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SEPTEMBER 2005

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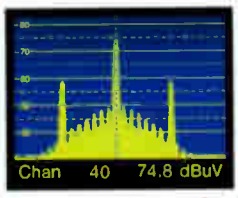

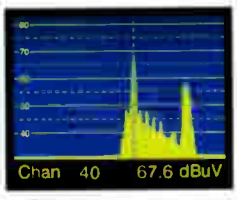

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SALES + SERVICE + CALIBRATION

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September 2005 **Vol. 55 No.11**

Editor
John A. Reddihough
TVeditor@highburybiz.com

Deputy Editor
Tessa Winford

Production Editor
Jane Massey

Production Executive
Dean Turner
01322 611206

Display Sales Executive
Reuben Gurunlian
01322 611 261
Fax 01322 616 339

Sales Manager
Paul Monaf
01322 611 262

Editorial Assistant
Katie Butler
01322 611 472

Managing Editor
Svetlana Josifovska
01322 611 250

Publishing Director
Tony Greville

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NEXUS
MEDIA COMMUNICATIONS

Will TV go broadband?

The question should perhaps be whether broadcasting will go broadband, since radio and other services can as well be distributed via the internet as TV. In fact internet radio is growing quite rapidly worldwide. The ultimate question however is whether radio and TV via the internet will eventually supersede other forms of distribution? It's at present impossible to answer the question. We just don't know what people will eventually find most convenient, and whether one mode of distribution will have such overwhelming advantages over the others that they simply fade away. Right now we are at the start of a period of experiment and change, with four basic modes of distribution – in practice they overlap to some extent. These are terrestrial off-air, satellite, cable, and internet via a broadband line. It's assumed of course that everything will be digital within a few years.

The advantage of the terrestrial off-air approach is that it's relatively cheap and cheerful for the user. The striking success of Freeview bears this out. Figures in Ofcom's recent report on digital radio, TV and communications in the UK show that more than 3·3m Freeview set-top boxes and integrated digital TV sets were sold during 2004. This brought the total up to 4·5m by the end of the year. Still less than BSkyB at 7·7m, but growing at a much faster rate. Freeview appeals because, for one thing, it is just that – free. And people are used to getting their TV free or, rather, for the cost of the licence fee. DTT has its limitations, for example the amount of interactivity possible, but who cares all that much about such add-ons provided you get a decent basic service? The other question with DTT is whether building all those transmitters to try to reach everyone is worthwhile when it can be more easily achieved via satellite. But for most of us DTT will probably continue to be the simplest solution for the time being – though the broadband alternative is looming up, and raising all sorts of questions.

Digital cable seems to have become somewhat marginalised. Being cable-based, it overlaps with internet distribution – the differences lie in the digital encoding and network arrangements. Cable TV provides a convenient way of getting all your needs via one provider – broadcasting and telecommunications, including the internet. Will the cable companies eventually go the whole way and simply adopt internet technology? At present the existing system is better for quality and reliability, but these advantages might not continue as internet technology advances. NTL has been conducting trials of HDTV via digital subscriber lines since March.

Satellite TV appears to have stalled, though BSkyB seems to be confident that it can reach its aim of 10m subscribers by 2010. The technology is tried and tested, and the company is expert at providing the programmes people want – and getting them to pay for the service. The great advantage from a distribution point of view is that the signals are easy to pick up almost anywhere within the service area.

Which brings us to broadband TV. As noted in our news pages, all broadcasters seem to be keen on trying out his new mode of distribution. It involves costs for the viewer, but for most people subscribing to an internet provider will be an unavoidable cost anyway, part of the modern data-based way of life. There has been quite a lot of hype about broadband TV, but not all forecasters agree. One recent report suggested that by 2010 six per cent of viewers in the UK and Germany will be using broadband TV. That's not a particularly significant number. It will probably depend on how good the technology becomes. At present it's easier for most viewers to connect their TV equipment up in one of the standard ways. But it's interesting that BT will from next year be selling a dual broadband/Freeview box. This could offer the best of both worlds – especially with the bonus of a built-in PVR.

Eventually most people might adopt broadband TV because of its versatility and the extraordinarily wide offerings it can provide. A recent report in the New Zealand trade magazine *SatFACTS* (June, 2005) says that Telecom NZ's Jetstream service, apparently one of the most advanced in the world, can among other things provide sixty live US channels and 66 live Russian channels at the click of a mouse. The report mentions more than 700 "public video streaming" sites, with several hundred more coming online each month. Radio too of course. The Ofcom report says that 19 per cent of adults with a web connection in the UK listen to radio online.

Broadband communication brings with it all sorts of possibilities. The NZ report mentions "radio bloggers" who can run a private radio station with worldwide distribution. No reason why we can't have TV blog stations too – there's already much video streaming. But there doesn't seem to be much profit in basic broadband provision at present. The Ofcom report noted that, because of accelerating price cuts, revenues grew by only 6·8 per cent last year despite the number of connections doubling.

What we don't know at present is the full potential of broadband technology. It is this that will determine how far broadcasting goes down the broadband trail.

Broadband developments

Ofcom reports that there are now more households with a broadband than a dial-up internet connection. 2005 is the year during which broadband has become a genuinely mainstream consumer product, says Ofcom. It's now present in almost thirty per cent of UK households and businesses and is being actively considered by many more. By the end of June there were over eight million connections, and by the end of the year 99·6 per cent of UK homes will be connected to a broadband-enabled exchange.

With the growth of broadband, more and more broadcasters and network providers are planning to offer IPTV (Internet Protocol TV) services via broadband links. The BBC put the first episode of the new comedy series *The Mighty Bosh* online before its terrestrial transmission, and plans to put more first-show programmes online. The BBC is also running a major trial of its interactive media player (iMP) this September. Some 5,000 households will be involved in the three-month trial. They will have a choice of 190 hours of TV and 310 hours of radio programmes.

Channel 4 is understood to be planning to put its programmes online by the end of the year, and BSkyB has announced plans for a broadband TV service by the end of 2005. Under the scheme, subscribers to the top-tier packages Sky Sports World, Sky Movies World and Sky World will be able to access broadband services. Sky Sports World viewers will be able to receive sports highlights, news and interviews; Sky Movies World subscribers will be given a choice of about 300 old and new films; and Sky World subscribers will be able to receive both packages.

Telewest has on trial a beta broadband service known as Blueyonder TV. Subscribers can access a number of programmes including sport, movies and community material.

BT, which plans to start an IPTV service next year, has announced that it will make available at £70 a set-top box with an 80GB hard drive for programme storage. It will be able to receive both Freeview and IPTV services and have a fourteen-day forward and seven-day backward electronic programme guide. A full-scale trial of the service will start next March.

Sharp's LCD technology

Two new LCD developments have been announced by Sharp. The first is a dual-vision LCD that enables two people to see different pictures simultaneously. It uses a 'parallax barrier' that acts as an optical filter, effectively splitting the screen into two. The accompanying photo shows the effect, while Fig. 1 illustrates the principle. One viewer could be watching a TV programme while the other one could be editing a video or accessing the internet. The barrier can be switched off for normal viewing. Sharp has demonstrated a 26in. prototype monitor and intends to start volume production immediately.

The second development is an LCD screen that can be switched between narrow- and wide-angle viewing. It works by covering a normal TFT LCD screen with a special liquid-crystal switching material that focuses the backlight so that, when brought into operation, it focuses the backlight to shine in front of the display and not at the sides. Fig. 2 illustrates the principle. The result is that only those positioned directly in front of the display get a clear image. Sharp plans to start mass-production of such screens this year, pointing out that that they will provide greater privacy for laptop PC users in public places.

Sharp has launched its 65in. LCD TV set (see CEATEC report, December) in Japan at a price equivalent to about £8,000. Model LC-65GE1 incorporates Sharp's QS (Quick Shoot) technology, which improves the response with moving objects, and a new four-wavelength backlight that adds crimson to blue, green and red to give faithful reproduction of pure red colours. Power consumption is quoted as 619W, which is less than that of similar-sized plasma models.

Sharp has launched the P50 range of LCD TV sets in the UK. The displays have a 960 x 540 resolution, which corresponds with standard PAL scanning. Previously, LCD sets have had either 640 x 480 (VGA) or 1,366 x 768 (WXGA) resolution, which are standards intended for PC use. With these, either some lines have to be dropped or extra lines have to be created by interpolation. Both processes can add noise to the video information. The panels used in P50 series sets incorporate Sharp's Advanced Super View technology, which enhances the brightness and contrast ratio. A simple down-conversion is provided to give good results with HDTV signals.

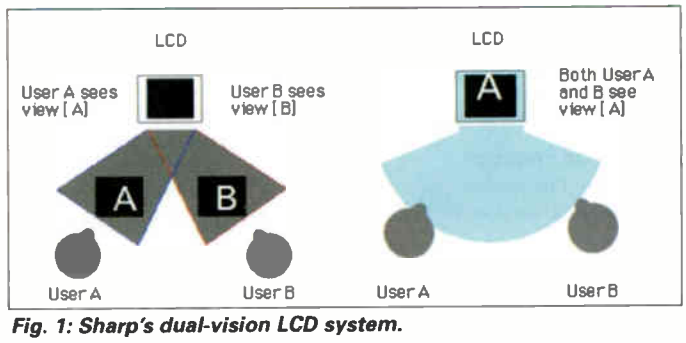


Fig. 1: Sharp's dual-vision LCD system.

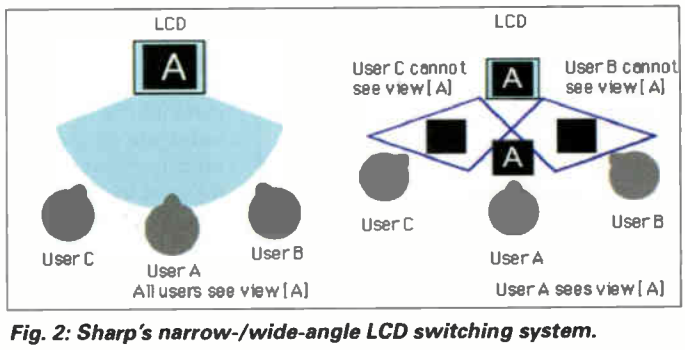


Fig. 2: Sharp's narrow-/wide-angle LCD switching system.

Sharp's dual-vision LCD screen.

LG's HDTV sets

LG Electronics has announced that it will launch the world's first plasma HDTV sets with an integrated HD digital video recorder in the UK early next year, following launch of the sets in Korea and North America last May. Available with 50 or 60in. screens, the PY2DR series has a 160GB hard drive that can store up to thirteen hours of HD programming or 63 hours of standard-definition programming. The new widescreen plasma-DVRs incorporate an automatic time-shift feature that records continuously in one-hour intervals. Other features include slow-motion rewind and forward capabilities, instant replay and an EPG.

The US versions have an ATSC tuner for HD DTT and unscrambled digital cable TV plus analogue broadcast and cable tuners. They also have an integrated 9-in-2 multi-memory card reader (Compact Flash, SmartMedia, MultiMediaCard, SD Memory Card, xD and several other Memory Stick versions), enabling still images to be viewed and digital music such as MP3 files to be listened to. Users can store digital photos or music from a digital camera or MP3 player on the hard drive via a memory card. The recorder is able to create a music-photo album, so that stored photos can be accompanied with music in a slide show. The sets have an HDMI input with HDCP; IEEE 1394 with DTV Link; and PIP (picture-in-picture), POP (picture-outside picture) and split-screen options.

The 50in. version has a 60,000-hour DoubleLife panel with a contrast ratio of 5,000:1 and a brightness of 1,000cd/m^2.

Blockbuster phases out VHS

Blockbuster, the leading video rental chain with some 720 outlets in the UK, has announced that it will cease stocking VHS films over the next few months. The move has come as DVD has taken over as the medium for movie distribution. Industry figures show that last year 111 million films on DVD were sold, compared with only 13 million in VHS form. Other retailers, including HMV and Dixons, are dropping VHS.

HD-DVD adopts AACS

The DVD Forum has announced that the new HD-DVD blue-laser discs will use the Advanced Access Content System developed by Intel, IBM, Microsoft, Panasonic, Sony, Toshiba, Disney and Warner to provide copyright protection. Players will store the decryption keys in flash memory.

Freeview aerials from One For All

One For All has introduced a range of two aerials for Freeview reception. Model SV9320 is a stylish indoor aerial that provides 20dB amplification and comes with a one metre coaxial lead for flexible positioning. Price is about £25. It has non-scratch, non-slip feet and can be set up horizontally or vertically. The outdoor Model SV9350 incorporates a Freeview receiver and 15dB amplifier, also interference filters, and comes with a 6m coaxial cable and mounting equipment. For further information check at www.oneforall-int.com

Ofcom news

Ofcom reports that over sixty per cent of UK households can now receive digital TV, with the number increasing by more than 250,000 a month. Seventy per cent of the growth last year was attributed to Freeview – by the end of the year some 4·6m households (almost twenty per cent) could receive Freeview transmissions.

Ofcom has increased the number of channels that are required to provide subtitling, signing and audio description by 2006. A total of 76 channels will have to provide these TV access service compared with 70 at present.

Cabinet recycling

Sharp has developed technology to recycle the non-halogen resins used in its Aquos LCD TV set cabinets. The new technology enables the plastic material that makes up the cabinet to be easily recycled. Sharp plans to establish technologies to recycle LCD TVs in anticipation of the EU WEEE directive. By the end of its 2006 trading year the company aims to have developed a new LCD TV cabinet material with high recyclability based on the new technology. Sharp has published "Guidelines for LCD Panel Recycling" which the company will be distributing to promote designs that allow ready processing of redundant LCD TV sets.

Silicon laser

Intel has announced the development of a silicon-based laser, which could lead to a dramatic reduction in the cost of lasers. The research team at Intel's Santa Clara, California headquarters produced the first CW silicon laser last Christmas Eve. One major problem that had to be overcome was "two-photon absorption", which caused blockages as free electrons absorbed the light passing through the silicon. The first use, in possibly three-five years' time, is expected to be in optical modulators. Other applications could be to provide short-distance optical interconnections in computers and for medical purposes.

Lead-free solder

It will soon be obligatory to change over to the use of non-toxic solder. This is likely to cause all sorts of problems.
Eugene Trundle sets out the pros and cons

Soldering has been in use since before there was any such thing as an electrical or electronics industry. The basic material is tin (Sn), an expensive and innocuous material that melts at 230°C. For practical purposes it is combined with other materials to improve its properties – silver, copper, lead and others. These determine the characteristics of the solder – the melting temperature, physical strength, 'wetting' and 'wicking'. The solder we have used over the years, with great success, has typically consisted of 63 per cent tin and 37 per cent lead, sometimes with a small admixture of copper.

Surface-mounted IC pin joints made with SAC lead-free solder.

The environmental aspects

There has been growing concern about the effects of lead (Pb) for many years, because it's a toxic metal that can attack the central nervous system. Manufacturers have been adopting alternative solders that don't contain lead and, from 1 July 2006, its use in manufacturing and reworking – that's where we come in – will, under the European RoHS (Restriction of Hazardous Substances) Directive, be illegal.

The manufacture, use and repair of products that contain lead do not present any real health problems. The risk arises when the equipment has been scrapped and discarded, as the lead can enter the atmosphere from an incinerator or leach into ground water from a landfill site. Lead has already been eliminated from paint, plumbing and petrol, no doubt with some benefit to the environment, but in certain quarters its mandatory removal from solder is seen as misguided and even harmful, creating more problems than it solves. It has been suggested that the risk of seepage from landfill is minimal; that alternative solder alloys are also toxic; that the higher process temperatures required with lead-free solder are wasteful of energy and contribute to global warming and atmospheric pollution; while at the same time production costs are increased.

It's certainly true that the lead in solder accounts for less than one per cent of that mined and used. Eighty per cent of the lead goes into lead-acid storage batteries for use in road vehicles and energy-storage systems. Substitutes for these are hard to find, and I've seen no suggestions of any plans to outlaw them, though there are very strict rules regarding their disposal at their end of life. Of that one percent of lead used in solder, if one joint in a hundred thousand needs to be repaired its contribution to the world consumption of lead is less than half of one ten-millionth of what's at large out there. But even so we have to change over to lead-free solder by next summer, or we will be committing a criminal offence.

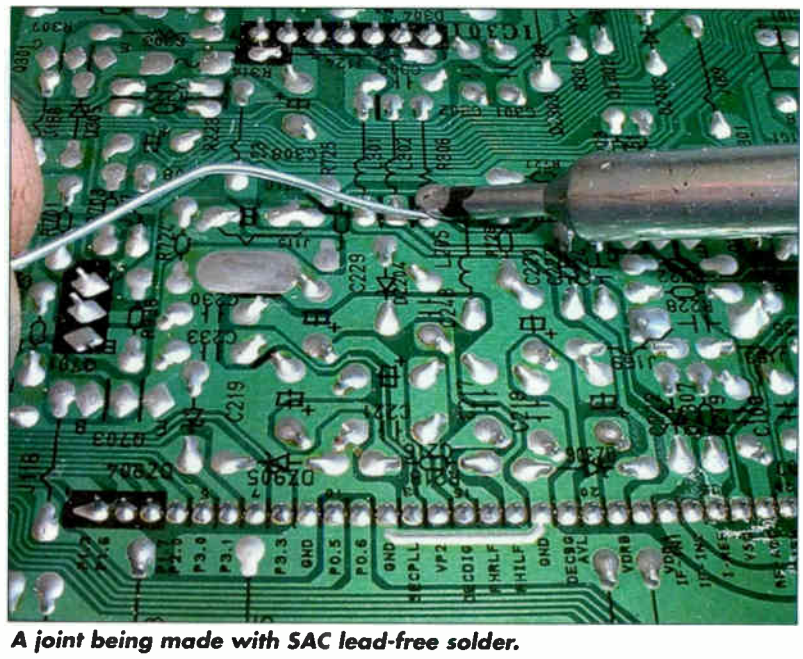
Traditional solder

Conventional solder that contains lead is relatively cheap but works very well. It melts very rapidly at about 183°C, is quick to wet the copper and tin surfaces with which it works, and readily forms a good bond between them. It flows well and 'wicks' very well – the latter is its capillary action, for example up and across copper wire and surfaces. Used with a good flux, either as a core in the solder or applied separately, it is easy to use and gives good and reliable results.

Lead-free solder

In comparison lead-free solder has several drawbacks. Because of its higher melting temperature (about 34°C higher), its use in factory assembly work has necessitated the reconfiguration of wave-flow soldering equipment and the redesign of some components that are vulnerable to physical cracking, such as multi-

layer ceramic capacitors. Plastics are more likely to melt or deform, while the slower wetting properties of lead-free solder and its high surface tension require care to avoid 'tombstoning', when small surface-mounted components such as resistors and capacitors jump upright as one end reaches the melting point before the other – most of those who have worked with surface-mounted components will be familiar with this. Other production problems are board and component warping and the risk of cracking in through-board plated holes. These are caused by the higher temperature used. Another potential problem, the formation of tin whiskers or 'dendrites', is caused by the combination of high-tin alloys and some flux materials: the whiskers can result in short-circuiting between adjacent conductors.



A joint being made with SAC lead-free solder.

Quality-control inspection of lead-free soldered PCBs. Note the rework equipment at the left.

A substitute

There is no 'drop-in' lead-free substitute for traditional solder: many alloys have been tried and tested, but all lead-free types involve compromises. Probably the best one at present for use in consumer electronics equipment, generally called Sn96·5/Ag3/Cu0·5, SAC or 7SC alloy, consists of 96·5 per cent tin, 3 per cent silver and 0·5 per cent copper. It melts at about 218°C, remains pasty over a relatively wide temperature range and cools slowly in comparison with tin/lead, making its joints more vulnerable to tension or movement for several seconds after the heat has been removed. Lead-free solder is more difficult to work with because it's less ready to wet board lands and component legs. And because it has high surface tension it's more likely to create a dome-shaped joint than a conical one.

Once the joint has been made and has cooled the appearance is coarser, duller and more granular than with leaded solder – its colour is more grey than silver. Judged by the old standards, these characteristics can give the impression of a bad joint. In fact, provided it has been made properly the joint is harder, stronger and more resistant to corrosion and abrasion than a leaded-solder one, and is better at withstanding thermal and mechanical stress. While these properties are important in some industries, none of them are very relevant to soldered joints in consumer electronics equipment – except, maybe, where hot-and-heavy components such as transformers, and 'stressy' ones like field output ICs, capacitors in line-scan circuits and plug/socket connections to a deflection yoke, are concerned. And most of these are disappearing as flat display devices take over from CRTs.

On the bench

The workshop changeover can be carried out at any time, because lead-free solder can be used safely on old PCBs and assemblies that were made with lead-based solder. It's available in the form of wire, with flux core if required, down to a diameter of 0·3mm/30 SWG for very fine work, and also as a paste for use with surface-mounted assemblies. It costs three times as much as conventional tin/lead solder, but even so it remains a very small percentage of the cost of a repair job.

The higher melting point calls for a higher temperature at the tip of the soldering iron: 370°C is about right. Soldering stations with temperature control can easily be set to this. Simpler, thermostatic irons may be adjustable to 370°C by replacing the tip.

An iron with high thermal capacity is best for lead-free work – it's equivalent to fast acceleration as opposed to high-speed capability in a car. This equates to high wattage and an ability to transfer heat quickly to the solder and joint. In fact it could be a good time to replace an old or inadequate iron! All soldering-iron manufacturers have suitable instruments for sale, as a look in the current CPC (for example) catalogue shows.

The higher temperatures associated with lead-free solder mean that more particles and gases are generated, for example aldehydes and isocyanates. Regular or prolonged exposure to these can lead to various symptoms and, in extreme cases, occupational asthma. You may, especially if you do a lot of soldering work, wish to implement or upgrade fume-filter and extraction systems. Again, many suitable products are listed in the CPC catalogue. ■

A wave-soldering station that uses lead-free solder.

The CAI 2005 Trade Fair

J. LeJeune reports on the latest Confederation of Aerial Industries annual trade show, held this time at Stoneleigh Park

The CAI Trade Fair is now a two-day event. It appears to have been a great success this year, with a large number of visitors present. The venue at Stoneleigh Park, the National Agricultural Centre, was ideal, with good parking and excellent facilities.

There is always a certain déjà vu feel with an event such as this, as many of the products may have been seen at road-shows earlier in the year or be tried and trusted ones being given another airing. There were nevertheless plenty of innovative products on display, designed to give better performance than their predecessors or enable the installer to achieve good results at less cost and with greater ease. They were of high quality, soundly engineered and some able to provide a real helping hand.

Cable identifier

An example is the Digitach cable identifier, a test instrument that enables up to twenty cables to be identified at one time. It also shows up short-circuits. The device is simple but cleverly thought out. Outgoing cables at the head-end are connected to a sender unit, with each output socket identified by a number. At the far end of the cable a portable receiver box is connected to the cable's screen, with a probe to touch the inner conductor. A sounder indicates that connection has been made and the display lights up with a number, identifying the cable. A label can then be attached to it to help with future servicing, avoiding the time-consuming business of cable tracing.

Software CD

Fracarro Industries, an established supplier to the signal-distribution trade, has produced a CD of software for planning audio and video reception and distribution systems. The software is user-friendly, flexible and the image quality is excellent with the use of vector graphics. The company was also showing its new AMP series of line amplifiers, Models AMP9762 and AMP9763. Both incorporate a 5-30MHz return path, and the AMP9763 adds satellite IF (950-2,400MHz). The ±2dB flatness means however that they are not really intended for cascaded use.

Multi-satellite dish

Force showed an ingenious multisatellite dish that can receive signals from satellites up to 46° apart by using a convex reflector on a 55 or 90cm offset dish. The company also showed its Promaster receivers for CATV headend use. These are single-channel satellite or terrestrial types in 19in. rack-mounting cases.

New products

Global Communications fielded a raft of new products including new styles of wallplates, a modular multiswitch range, home distribution equipment using CAT5e and some additions to the Professional range, including a VSAT 10MHz source and redundancy amplifier.

Labgear made a strong showing. The company's June 2005 catalogue, in A5 format, provides handy information on signal-level conversion, DTT transmitters, analogue transmitters, UHF aerial groups and much more. A comprehensive range of distribution equipment, from wallplates to amplifiers plus accessories for earth bonding, Tetra filters and IR remote-control extenders, occupies the majority of the catalogue's 22 pages.

A new name in the distribution field, Masterplug TradePro, made its debut. The company is well-known for its range of mains cable reels and power-surge protection equipment. It has now launched a range of equipment including mast-head amplifiers, cable, distribution units, outlet plates and multiswitches.

An interesting leaflet on the Johansson Profiler range of distri-

bution equipment caught my eye. The UK distributor is Martin Turner Direct, which was also showing some excellent cabinets by Redi-Build for distribution equipment or other uses such as CCTV, security, telephones etc. Johansson has taken a close look at the distribution of DTT signals alongside analogue ones and has come up with some good answers to this challenge.

The Teldis stand featured a new IRS (integrated reception system) launch amplifier with a meaty specification. This Spaun unit is for nine-line or split-launch five-line IRS systems. It contains ten amplifiers, eight for satellite channels, one for terrestrial UHF and a reverse path amplifier for future interactive services.

Eursosat showed the Manhattan range of flat-panel TV sets with 15, 17, 20, 23 and 30in. screen sizes. They come equipped for Nicam and Zweiton stereo sound. The receivers provide off-air PAL and Secam reception and some accept an NTSC input at video level.

The Spanish company Televés showed aerials benchmarked by the CAI for digital terrestrial reception in addition to test equipment and processing equipment for CATV

Test equipment

With the digital switchover in prospect, digital signal analysing instruments, signal-level meters, alignment equipment and DAB radio test equipment were much in evidence. The Alban Electronics stand featured a wide range of equipment, and a comprehensive range was displayed by RO.VE.R Labs Sp.A of Sirmioni, Italy.

Horizon Electronics of Enfield showed its limited but well-specified range of low-cost digital meters for satellite and terrestrial transmissions. The MiniSAT, with its small dimensions and two-hour battery life before a recharge is due, is an ideal companion on the roof or atop a ladder. In addition to indicating signal level the MiniSAT reads DC voltages up to 30V and current up to 1A, and will detect or generate a 22kHz tone as well as DiSEqC 1.0 and 1.1. It weighs 1lb 5oz (0·6kg). Ideal for spot checks and fault location with satellite receiving systems.

The busy and very accessible Swires Research stand highlighted the Annie 204 portable spectrum analyser, which incorporates all the facilities required to enable direct, meaningful measurements to be made with anything from a single aerial to a distribution system covering a multitude of dwellings. Carrier-to-noise ratio, BER, channel identification and a received picture can be seen simultaneously. Automatic identification and switching of analogue and digital signals further simplifies operation. Annie 204 has a 5·8in. colour LCD display and is powered by internal rechargeable cells.

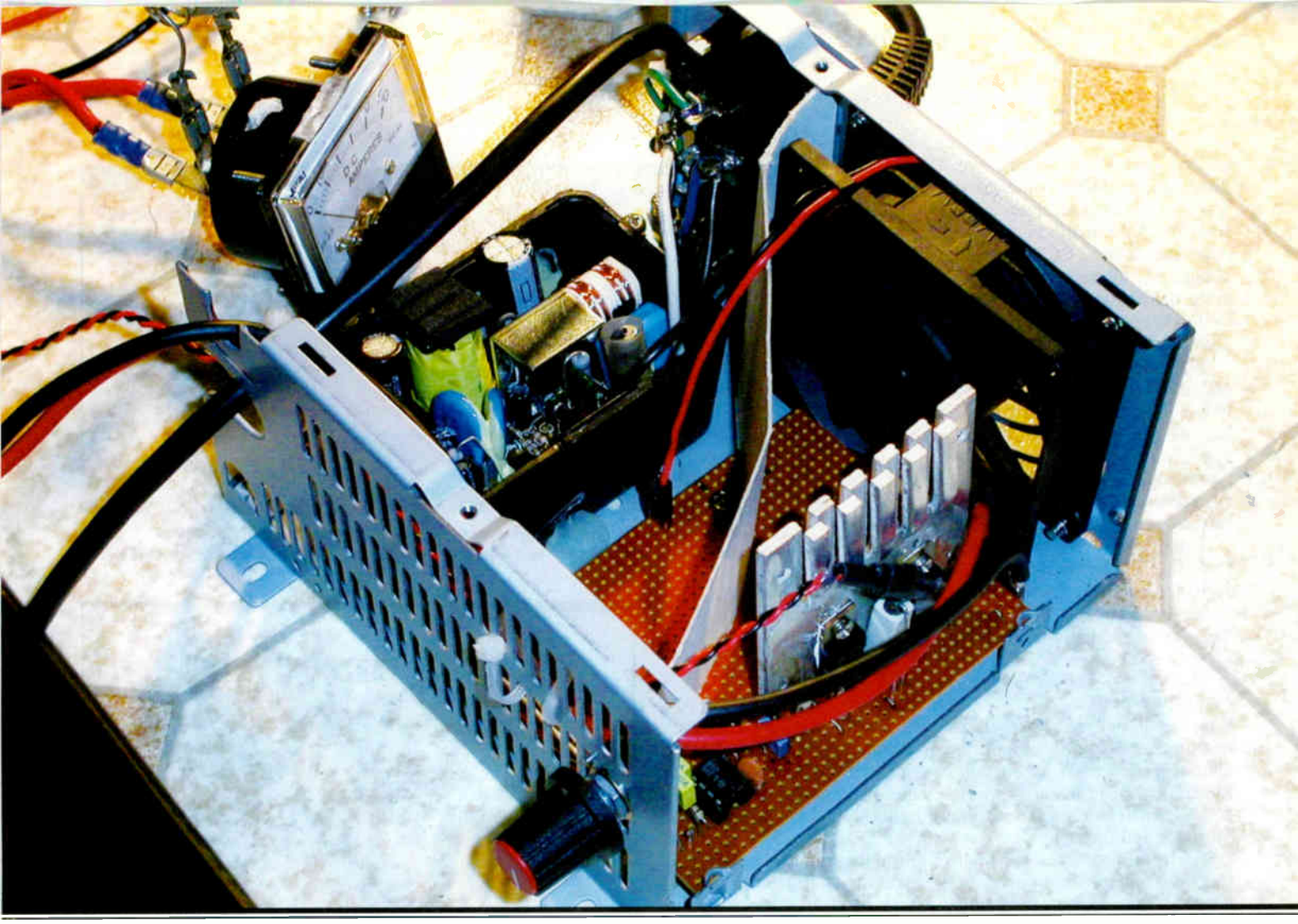
The Spanish company Televés showed aerials benchmarked by the CAI for digital terrestrial reception. Multimetter Model FSM500 provides BER measurement and decoding of QPSK, QAM and COFDM, and is thus suitable for cable, satellite and terrestrial system measurements. The decoder is MPEG-2, enabling pictures from DTT transmissions to be displayed. There is also the DataLogger that can download to a PC. Televés also supplies a comprehensive range of processing equipment for CATV headends. It includes transcoders, frequency converters, modulators, amplifiers and DVB-T gap-filler transmitters.

SCC Distribution showed a selection from its vast stock of items for the installer and also featured its services, which include training that covers installation techniques, the measurement of signal levels and quality, and the elements of CATV and VSAT technologies.

The CAI also provides a comprehensive range of training courses – on IRS systems; DTT installations from single point to MATV and SMAT; basic terrestrial radio, TV and satellite installations; and safe working at heights.

A Redi-Build cabinet for distribution equipment or other uses such as CCTV, security, telephones etc.

The busy Alban Electronics stand featured a wide range of test equipment.



A constant-current test load

Christopher Jones describes a unit that enables power supplies with output voltages from 1-30V to be checked at current values up to 25A. Variations to the design can be carried out to suit other requirements. Because of the components used, the build cost is small

Photo 1: Internal view of the prototype.

Whenever a power supply needs to be tested or repaired there's the problem of providing some sort of load across the output to ensure that it will deliver its rated output current. If a bank or banks of resistors are used it's difficult if not impossible to find the right value, and a smooth change in load is difficult to achieve because of the need to use a high-power variable resistor or rheostat, which would be very expensive. It's often necessary to be able to test a supply that provides 5V or less at a current of tens of amps. So the resistors used would need to be of low value with high current and power ratings. For example to test a 5V, 20A power supply a variable resistance with a value of 0·25Ω at a power rating of 100W would be required!

The unit described here enables power supplies with output voltages from 1-30V to be checked at current values up to 25A and powers up to 100W. The specification will vary depending on the components used. The cost of construction can be kept low by using inexpensive and possibly second-hand components. An outline of the design considerations is provided to enable variations to be worked out to suit particular needs.

The specification for the prototype unit was:

Load current adjustable from less than 100mA to up to 20A.

Voltage range from less than 1V to 30V.

Total continuous power capacity at least 100W (this can be exceeded but must be monitored).

Continuous operation at an air temperature of 25°C.

Constant current at all voltages within the range.

The circuit of the prototype unit is shown in Fig. 1. MOSFETs Q1 and Q2, connected in parallel, provide the load across the + and – terminals. A sensing resistor R1 is connected in series with them. This works with the operational amplifier U1A to control the MOSFETs. Cheap n-channel MOSFETs were chosen as the current-control elements.

Design considerations and options

The specification of the unit you decide to build will be determined mainly by the current-control device(s), for example IRL2203 or IRF540; the value and power rating of the sensing resistor; the opera-

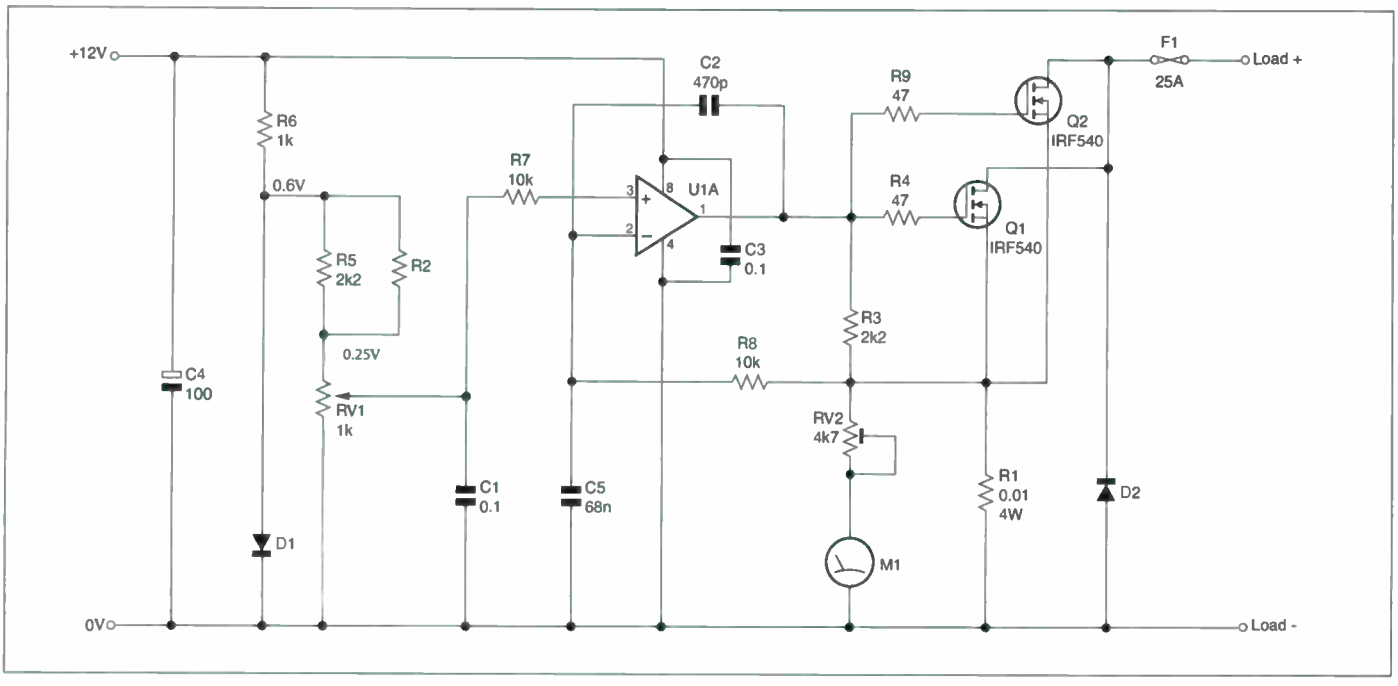


Fig. 1: Circuit diagram of the prototype unit. Specification 30V/20A/100W maximum. The value of R2 is selected on final test to set the maximum current at 20A.

Fig. 2: Factors that determine heatsink selection. TR1 is the junction-to-case thermal resistance, TR2 the case-to-heatsink thermal resistance and TR3 the heatsink-to-air thermal resistance.

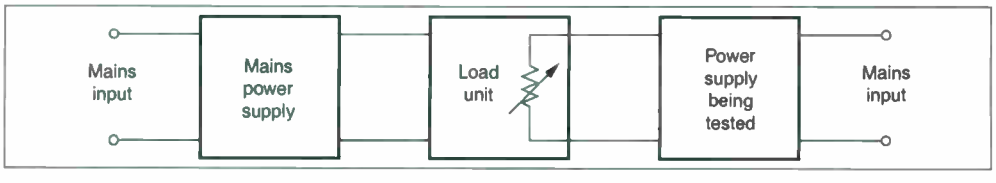


Fig. 3: Set-up for testing one power-supply output.

tional amplifier and its associated circuitry; and the heatsink and fan assembly.

The IRL2203 MOSFET is a 130W, 100A, 30V device (see the data sheet for further information). But note that with a TO220 package it can be difficult to use at powers much greater than 50W because of the small package's thermal resistance and the internal junction-to-case thermal resistance. With this package the maximum power rating becomes a pulse rating.

The IRF540 and IRF540N are 150W, 100V devices that are available from a number of manufacturers, with maximum current ratings of 25-30A.

The output devices can be connected in parallel to increase the power-handling capability of the unit. It's easier to operate MOSFETs than bipolar transistors in parallel: because they are essentially resistive in operation at low frequencies they don't need balancing resistors.

The lower the value of the sensing resistor, the smaller the feedback voltage and the power dissipation. Higher values are better for smaller currents and cheaper operational amplifiers. Low-value wirewound resistors are available from a number of component distributors, such as CPC, RS and Farnell.

CPC has available a 4W wirewound type with values between 0·01-0·051Ω. When you use such low values the wiring has to be carefully considered, otherwise the circuit won't function correctly. Resistor values as low as one milliohm (0·001Ω) can be obtained but, unless the circuit is very carefully constructed, the solder joints and wiring can form a significant proportion of the circuit resistance. A four-terminal device is desirable at these very low resistor values: it enables the sensing-voltage connection to be controlled and guaranteed by the resistor manufacturer. But such devices are very expensive, often costing £5-£15 each.

If an 0·051Ω, 4W resistor is used then, from Ohm's Law, the maximum current it can handle is 8·8A. Beyond this the power rating will be exceeded and the resistor will overheat. Use of an 0·01Ω resistor rated at 4W will enable 20A to pass before its power limit is reached. This value is also more convenient because it can be used as a meter shunt resistor, giving 10mV per ampere. A cheap 100μA moving-coil panel meter can be connected across this resistor value to provide an analogue current display. Alternatively a digital multimeter set to 200mV can be used.

For higher currents the use of resistors connected in parallel would need to be considered – unless higher-powered components can be found.

Now for the heatsink requirements. The maximum junction temperature of the MOSFET control device is 175°C. The ambient temperature is taken to be 25°C. Because of practical considerations the maximum power in the control device is 50W (may be higher).

Fig. 2 shows the factors that determine heatsink selection. TR1 (thermal resistance junction to case) is determined by the device

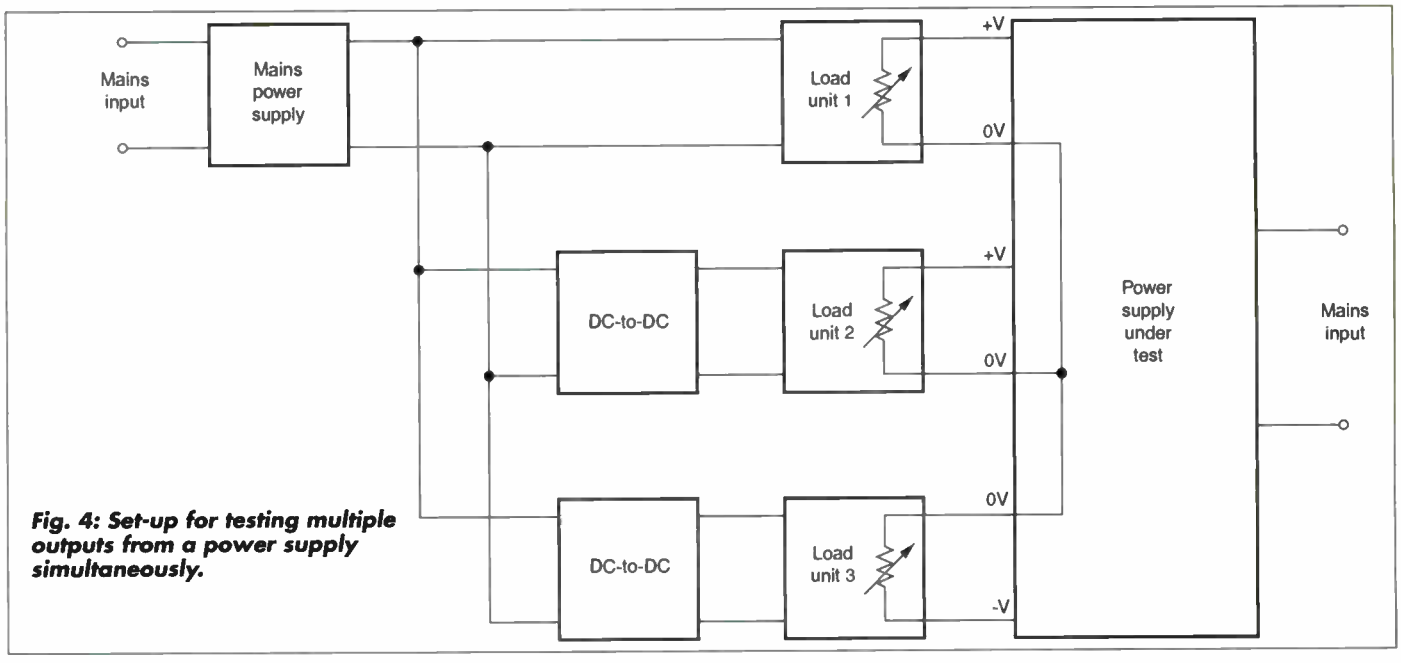


Fig. 4: Set-up for testing multiple outputs from a power supply simultaneously.

design (0·5°C/W here); TR2 (thermal resistance case to heatsink) is determined by the case size and thermal contact (add 1°C/W for any insulation); TR3 (thermal resistance heatsink to air) is determined by the heatsink size, material, design and air flow (about 0·6°C/W for the fan-assisted heatsink used).

Thermal considerations are critical in a unit such as this. For it to be useful, a high power dissipation is needed in a small space. So the design and construction of the unit can be quite tricky.

If insulation is required between the power MOSFETs and the heatsink, up to 1°C/W should be added to the thermal resistance of a TO220-cased device. This is unacceptable if 50W per device is to be dissipated.

Fan cooling is used to improve the efficiency of the heatsink assembly.

Finally, power supply considerations. The unit can be powered from a separate 12V power supply or from its own mains power pack. If several outputs from a power supply are to be tested simultaneously, separate load units will be required fed from different power supplies or DC-to-DC converters (see later).

Photo 2: The prototype unit on the bench with associated equipment.

Circuit description

Refer to Fig. 1, which shows the circuit diagram of the prototype unit. Any current that passes through the load unit will flow via the current-control MOSFETs Q1 and Q2 and the sensing resistor R1, which will develop across it 10mV per ampere of load current. This voltage is fed via R8 to the inverting input (pin 2) of the operational amplifier U1A, which compares it with the voltage tapped from RV1 at its non-inverting input (pin 3). Any difference in the two voltages will produce a change at its output (pin 1). This output drives the FETs and, as a result, the conduction of Q1/2 changes to compensate, eliminating the voltage change.

Silicon diode D1 provides a cheap but reasonably stable reference voltage source for pin 3 of U1. When it is forward-biased with a constant current the voltage across it will remain fairly constant.

The operational amplifier selected, type LM358, is a cheap and readily available type that's suitable for single supply operation. As a result its inputs can operate right down to 0V without problems. This is essential, because the input voltage is in the range 0-200mV above 0V. Other single-supply operational amplifiers would probably be suitable for use here.

The prototype

An old PC power supply was used to provide the case, fan and mains input connection. The accompanying photographs show how it was modified. The load circuit is built on stripboard but occupies only a part of this, leaving space for use by extra load circuits so that several outputs from a power supply can be checked at the same time.

Should this feature be implemented, it would probably be advisable to fit a 12V DC-to-DC isolated converter for each additional load circuit to avoid earth currents causing voltage differences. Negative output voltages can be tested simultaneously using this method.

The heatsink shown in the photographs was removed from the PC power unit. The photographs also show the internal cardboard baffle, which ensures that maximum airflow is directed at the heatsink. Insulating pads couldn't be used between the MOSFETs and the heatsink because of the degrading effect they would have on the thermal resistance, which is critical at maximum load power. This means that the heatsink must be isolated from any other voltages in the circuit.

The black plastic box at the side of the stripboard houses a 12V switch-mode power supply for the fan and the control circuit.

The adjustment potentiometer is mounted on part of the ventilation grill. There isn't much choice, because it is not a good idea to mount any wired component on the removable cover and the base metalwork is mostly for air intake (the grill area) and exhaust (the fan).

When the unit was first built problems were encountered at the maximum current setting because of voltage variations caused by the current flow along the stripboard tracks. The tracks need to be reinforced with tinned-copper wire and solder to lower their resistance and improve their current-handling capacity.

D2 is a protection diode to prevent damage should the load terminals be connected the wrong way round. A less sophisticated 6A rectifier could be used, or it can be omitted entirely, relying on the internal MOSFET diodes to pass the reverse current and blow fuse F1.

Testing

A thermal test was set up on the bench, using the largest 5V power supply available – an old Weir 150W switch-mode unit. A calibrated thermistor was attached to the heatsink midway between the power MOSFETs. The unit was initially tested at 5A, 5V (25W) until the heatsink's temperature stabilised, which took about five to ten minutes. This was done to establish the thermal resistance of the heatsink. With the heatsink shown in the photographs the thermal resistance was found to be 0·6°C/W with the fan running.

Another test consisted of measuring the temperature of one of the MOSFETs to check the thermal contact and the device's case temperature at maximum load power (100W). The case temperature rose to 171°C with an ambient air temperature of 20°C. The data sheet says that the junction to case thermal resistance is 0·5°C/W, which suggests that the internal junction would be at 196°C. The unit continued to operate correctly for thirty minutes without problems but, if it's likely to be used at maximum power for extended periods, it would be advisable to improve the heatsinking and/or airflow to reduce the thermal overload on the MOSFETs.

Testing multiple-output power supplies

Figs. 3 and 4 illustrate the extra complexity when multiple outputs are to be tested simultaneously.

It may be possible to avoid the extra cost and complication of the DC-to-DC converters if all outputs are positive and the earth connections are tied together with a substantial cable or busbar.

Any negative outputs must be tested with a DC-to-DC isolated load. ■

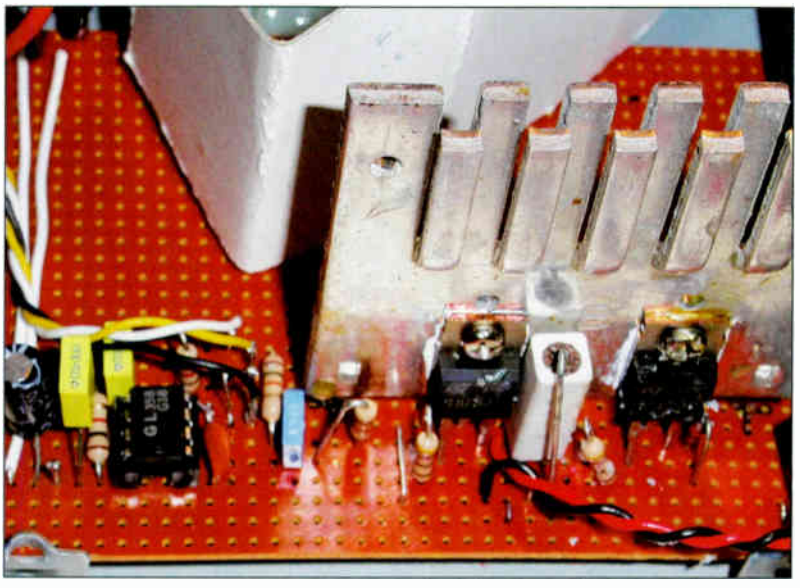


Photo 3: Internal view showing the component layout.

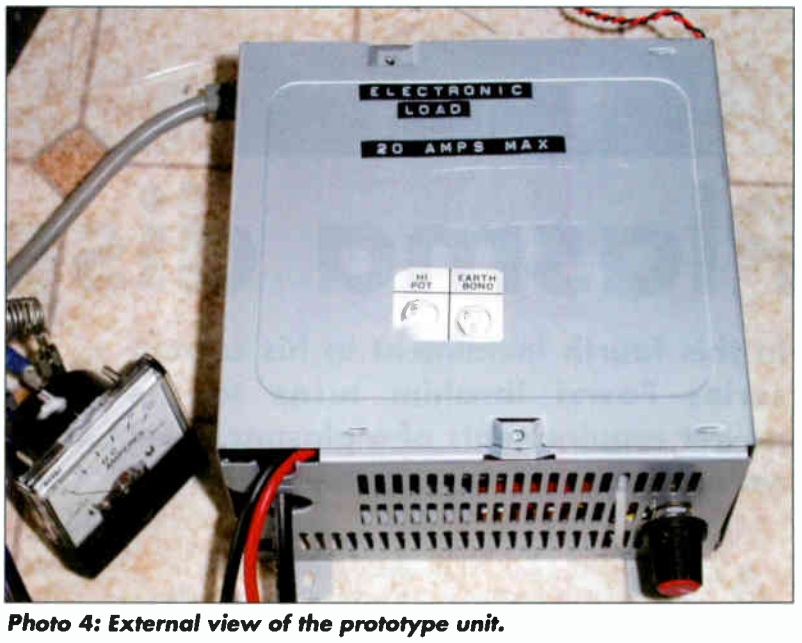


Photo 4: External view of the prototype unit.

Components list (prototype unit)

C1, 3	100nF	D1	1N4148
C2	470pF	D2	1.5KE100
C4	100µF, 16V		
C5	68nF	Q1, 2	IRF540
R1	0·01Ω, 4W	U1	LM358
R2	See Fig. 1		
R3, 5	2·2kΩ	F1	25A
R4, 9	47Ω	RV1	1kΩ
R6	1kΩ	RV2	4·7kΩ
R7, 8	10kΩ	M1	100µA, <200mV FSD

Plasma display technology

In this fourth instalment in his current series Fawzi Ibrahim turns to the power requirements of a plasma panel set and some of the circuitry used

A plasma display panel set generates a considerable amount of heat, because of the large current consumption of the panel itself and the fast switching in the power-supply circuitry. It's therefore essential to minimise the heat generated and maximise operational efficiency. In addition to high efficiency, PDP power supplies must have fast transient response, low noise and produce low EMI (electromagnetic interference).

The plasma TV receiver

The following supplies are required by a plasma TV receiver: LT supplies of say 3·3V, 5V, 12V and ±15V for the processing chips, audio amplifiers and other semiconductor devices used; a 70V address-electrode supply; and a 200V sustain and scan supply.

Fig. 1 shows a typical system in block diagram form. It consists of the following basic elements: a full-wave bridge rectifier for the mains supply; a mains supply line filter; power-factor correction (PFC); a multi-output 'chopper' circuit to feed the receiver circuitry etc.; a sustain power supply (Vs); and protection circuits (not shown – see later).

Power-factor correction reduces reactive power consumption and adds pre-regulation. The sustain power supply accounts for over 75 per cent of the entire power requirement of the set: to ensure high efficiency, low noise and low EMI, a soft-switching resonant converter circuit is used here.

Power-factor correction

The purpose of PFC is to reduce the reactive load, which is of no real value to the set. Only resistive power consumption is of any value as far as the set is concerned.

An entirely resistive load is said to have a power factor of one. Power factor is given by

$$K = \cos \theta$$

where θ is the phase difference between the current and voltage waveforms involved. Since the load current is in phase with the voltage when the load is resistive, it follows that $\theta = 0$ and $\cos \theta = 1$. Hence the power factor $K = 1$.

A power factor of one is the highest possible, when all the power consumed by the load is useful power. At the other extreme, with a purely reactive load, i.e. a pure inductor or a pure capacitor, the power factor is zero, since $\theta = 90°$ and $\cos \theta = 0$. In practice most loads, including a plasma TV set, are reactive to some degree, with a power factor between 0·5 and 0·7.

With a purely resistive load P (power) = V x I. With a reactive load however the power factor has to be taken into account and power is given by $P = V \times I \cos \theta$. Thus with a power factor ($\cos \theta$) of 0·5, only half the power supplied is useful power and the other half is completely wasted.

For this reason PFC is used to ensure that as little power as possible is wasted. PFC enables the power factor to be up to

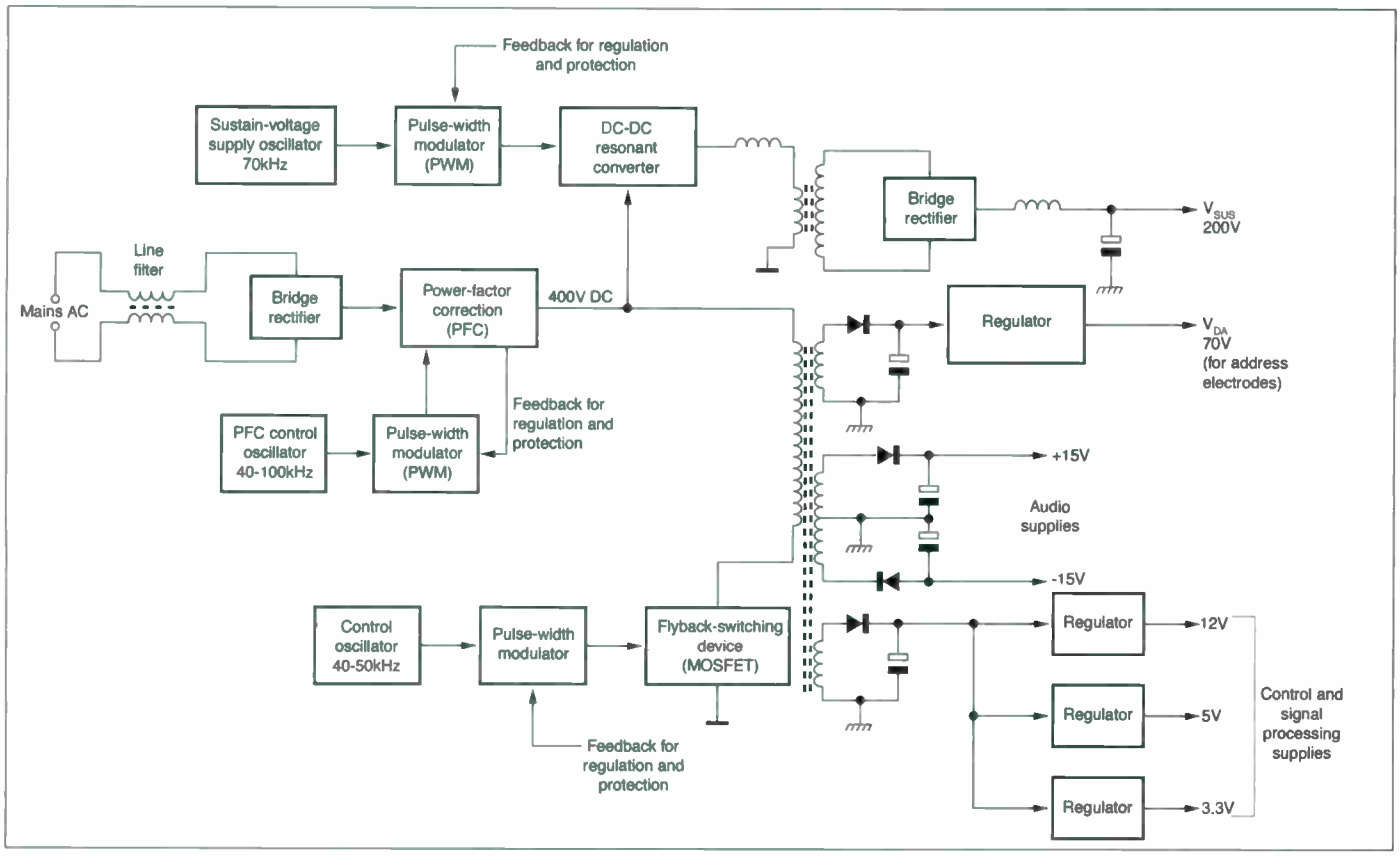


Fig. 1: Block diagram of a typical power supply arrangement for a plasma TV set.

0·9. In addition, under European law mains harmonics are restricted for items that consume 75W or more. PFC is therefore needed to ensure that the harmonics do not exceed the permitted level. A further reason for using PFC is to reduce the imbalance on a three-phase mains power supply caused by low power factors. This imbalance becomes noticeable with the high power requirements of equipment such as electric motors and plasma TV sets.

With the simple full-wave bridge rectifier circuit shown in Fig. 2 the diodes act as switches that conduct for a short period of time, depending on the charge across the reservoir capacitor and the load current. The current flows only when a pair of diodes conducts naturally, i.e. when they are forward biased during the period when the instantaneous mains voltage at their anodes exceeds the voltage across the reservoir capacitor. The current waveform is therefore not in phase with the voltage, resulting in a low power factor and loss of useful energy. This may be tolerated where the power requirement is low (tens of watts), but losses because of a low power factor must be avoided where the power consumption is high. The use of PFC circuitry enables this to be achieved. Instead of charging the reservoir capacitor once every half cycle, PFC provides a small but much more frequent (hundreds of times) current during each half cycle of the mains supply.

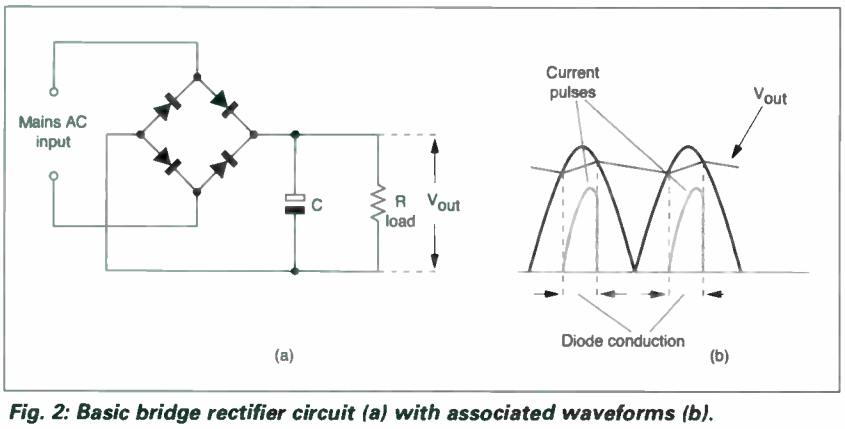


Fig. 2: Basic bridge rectifier circuit (a) with associated waveforms (b).

PFC operation

Fig. 3 shows the system outlined in Fig. 2 with the addition of PFC. When the bridge-rectifier diodes conduct and switch S is closed, current flows through coil L storing energy in it. When switch S is opened, the diode current ceases abruptly and the back-EMF generated across the coil forward biases diode D. The coil and the reservoir capacitor C then form a resonant circuit, charging the capacitor. What happens is that energy stored in the coil is transferred to the capacitor. When the capacitor has charged and the coil current has fallen to zero, diode D is reverse biased. At this moment switch S is closed and current flows through the coil again. The process is then repeated. The average current taken from the mains supply is now much reduced and follows the mains voltage, as the waveforms in Fig. 3 show. The power factor may be as high as 0·85 or even 0·9. The switching waveform for S, which is of course an electronic switch, is the pulse-width modulated waveform shown. Its frequency is usually in the range 40-100kHz.

Fig. 4 shows the main elements of a practical PFC circuit. The switching device is a power MOSFET, Q1, which is driven by the bipolar pnp transistor Q2. This is in turn driven by a pulse-width modulator, which has an input from the PFC oscillator and a feedback input. The duty-cycle of the pulse-width modulation is determined by the shape and amplitude of the mains-frequency sinewave input and the output voltage and current levels. In this way the PFC circuit acts as a voltage pre-regulator. See later.

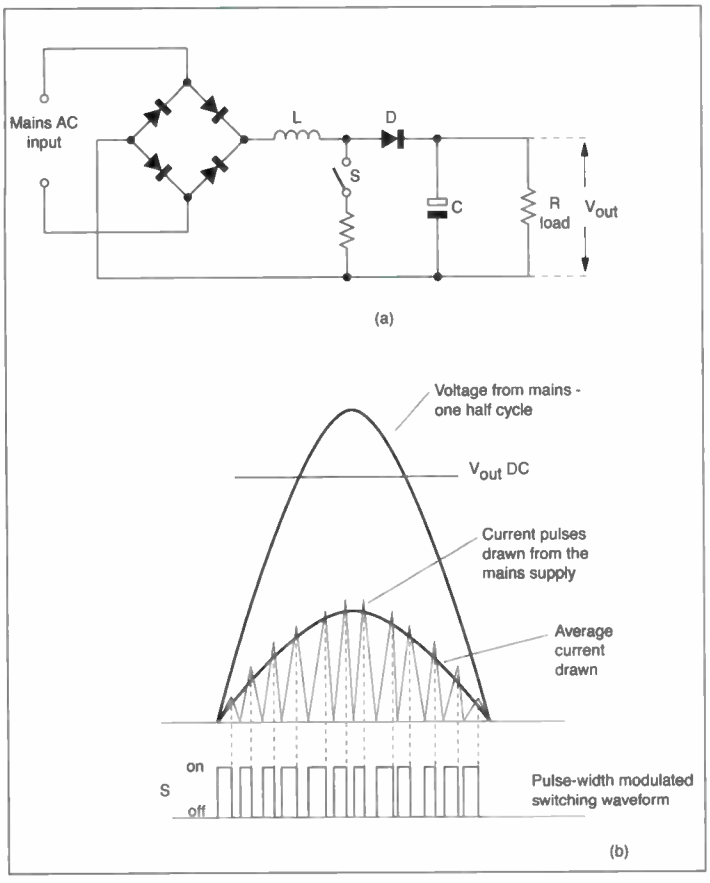


Fig. 3: Basic power-factor correction system: (a) circuit elements, (b) waveforms.

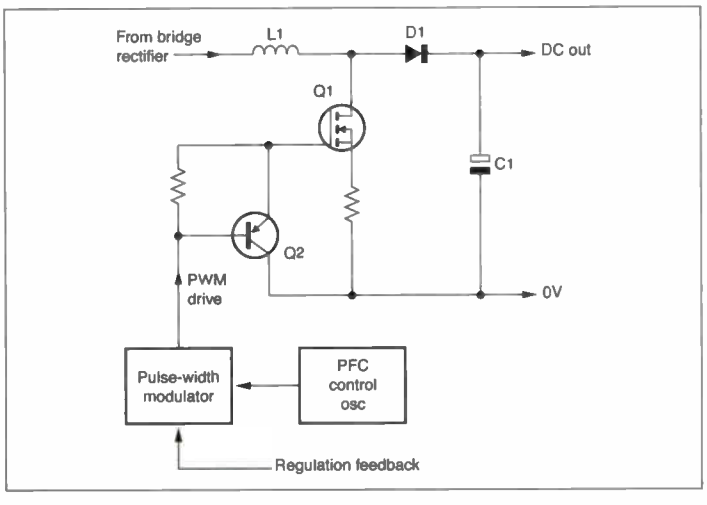


Fig. 4: Main elements of a practical PFC circuit.

Fig. 5 shows the main elements of a PFC circuit used by Panasonic. It employs two balanced MOSFETs for improved power-factor correction.

Power supply regulation

Because of the complex needs of a plasma TV set, several different power regulation systems may be employed. Referring back to Fig.1, you will see a basic 'chopper' supply (DC-DC flyback converter) fed from the PFC circuit, with linear regulators on the output side. In addition a soft-switching DC-DC resonant converter provides the sustain voltage supply.

A switch-mode ('chopper') power supply is more efficient than a linear regulator but has several limitations: high EMI, high stress levels with the switching devices, and limited switching speed – less than 100kHz. These limitations are mainly because of the need to run the 'chopper' device at high current and/or voltage levels. Such circuits thus came to be known as hard-switching converters. When operated at a high frequency, power dissipation is high and the harmonics generated by the quasi-square switching current and voltage waveforms result in high EMI.

In the late eighties soft-switching circuits started to come into use. Their advantages are reduced power loss, higher switching frequency and improved power density while maintaining high efficiency.

Soft-switching

Like the basic 'chopper' arrangement, soft-switching systems are DC-DC converters. DC from a rectifier is first converted to AC by the use of a switching device. This AC flows through the primary winding of a transformer that has a number of secondary windings to provide multiple outputs. These are rectified in the normal way to produce the required DC voltage levels.

The new feature with a resonant converter is that the switching occurs when the voltage across the switching device is zero, known as zero-voltage switching (ZVS), or when the current through it is zero, known as zero-current switching (ZCS). These conditions are achieved by using a resonant circuit: hence the alternative names resonant or quasi-resonant converter. The result is low switching power dissipation and reduced component stress, which in turn lead to increased power efficiency, reduced size and weight, faster responses and reduced EMI.

The reduced losses with ZV or ZC switching enable much higher switching frequencies to be used – hundreds of kHz or even a few MHz. And, since the size and weight of the magnetic components used (inductors and transformers) and the capacitors involved are inversely proportional to the switching frequency, the higher the frequency the smaller the size and weight of the power supply, improving its power density. A further advantage of soft-switching resonant converters is that, because of the high frequency, the leakage inductance of the transformer and the stray capacitance of the switching device can be used as part of the resonant circuit.

The principle of using a resonant circuit for soft switching is illustrated in Fig. 6. When an LC resonant circuit is fed with a step voltage, +10V in this example, it rings, with the capacitor charging up to 10V. At this point the current flow ceases, and the capacitor begins to discharge. Current then flows in the opposite direction, transferring energy to the inductor. This continues until the voltage across the capacitor falls to –10V, at which point the current flow ceases and reverses, as shown. If the circuit was not driven by a new step voltage, after the initial oscillation the amplitude of the resonant waveform would gradually decrease – because of circuit losses.

There is zero current at the peaks of the resonant waveform and, of course, the voltage is zero when the waveform crosses the 0V line. Resonant converters make use of this fact and are designed so that the switching occurs at one of these points.

Practical arrangements

Fig. 7 shows the basic elements of a ZCS resonant converter and Fig. 8 associated waveforms. In the steady state the load current IL2 is constant. The cycle starts when MOSFET Q1 is switched on by a control pulse at its gate, while D1 is also conductive. In this condition C1 is short-circuited by D1 and a current, IL1, flows via L1 and D1. IL1 increases linearly and, when IL1 = IL2, D1 is starved of current and switches off naturally. This is zero-current switching.

With D1 now open-circuit, L1 and C1 form a resonant circuit. IL1 increases in a sinusoidal manner to a peak then starts to decrease. When IL1 drops below IL2, the capacitor's current flow IC1 reverses and it starts to discharge, transferring energy to L2. When IL1 crosses the zero line, Q1 switches off naturally

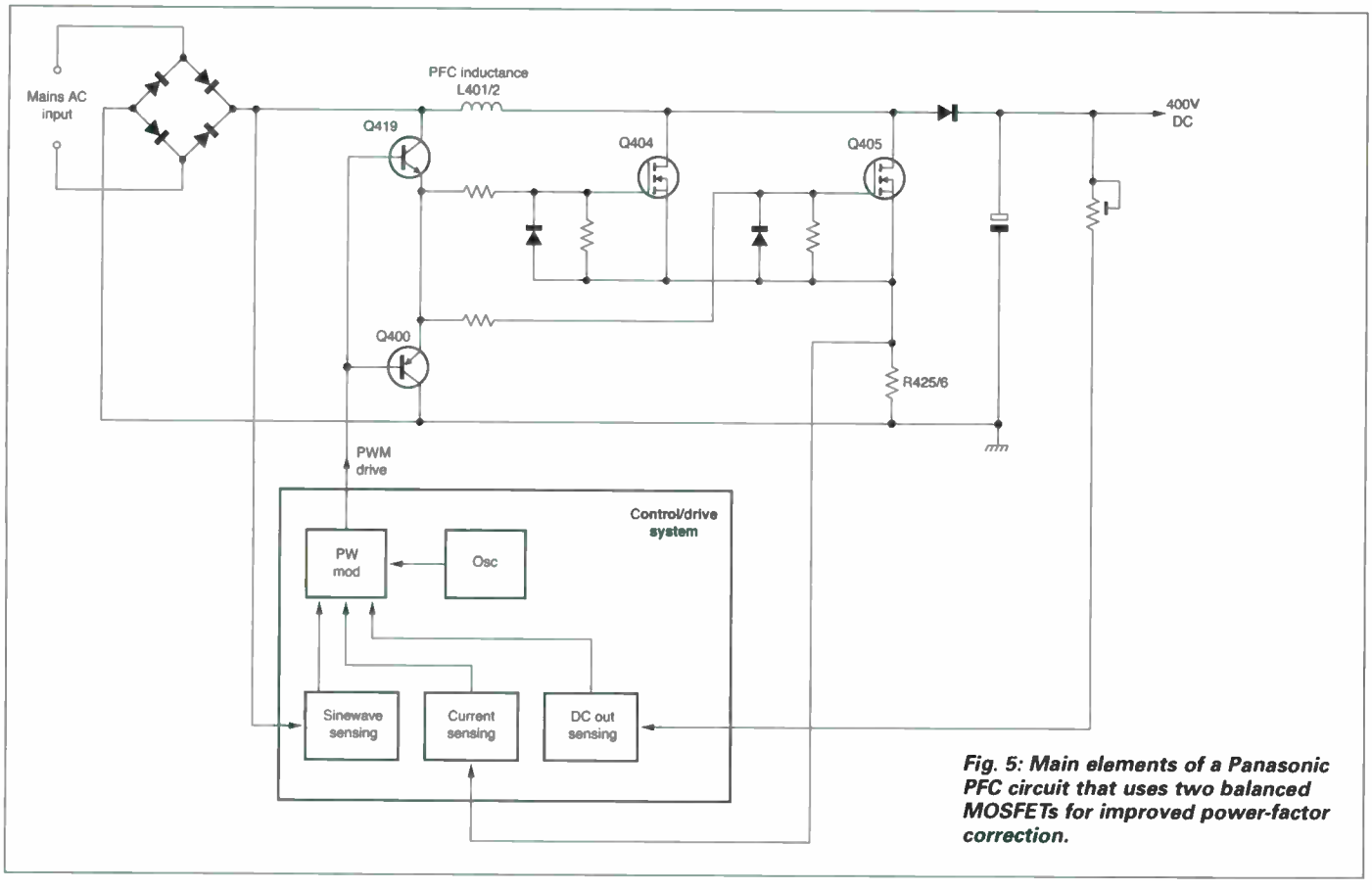


Fig. 5: Main elements of a Panasonic PFC circuit that uses two balanced MOSFETs for improved power-factor correction.

(ZCS), holding IL1 at zero until the start of the next cycle. C1 continues to discharge, via L2 and the load. When the voltage across it falls to zero, D1 switches on naturally (ZCS), short-circuiting C1. This condition continues until Q1 is switched on again by a control pulse and the next cycle of operation begins.

The period during which Q1 is conductive is fixed by the resonant frequency of L1 and C1, while the time during which it remains off is determined by the control pulses. The timing of the latter is varied as necessary to regulate the output voltage. Hence this type of resonant converter is known as 'fixed on time, varied off time'. For heavy loads, the resonant on time is made longer. The on period of the power MOSFET is the resonant period of L1/C1. The number of on times per second, i.e. the frequency of operation, is determined by the control pulses.

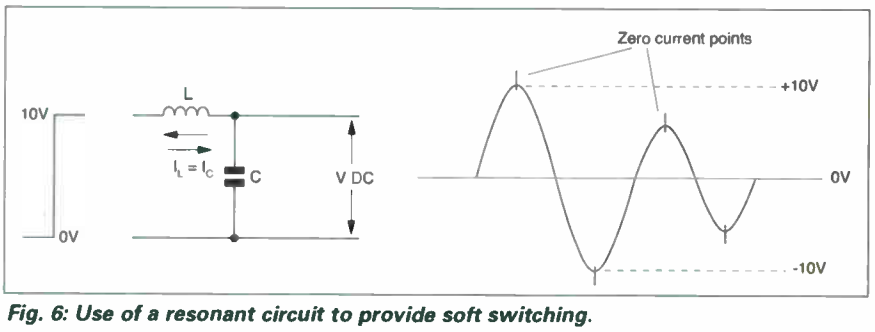


Fig. 6: Use of a resonant circuit to provide soft switching.

The equivalent zero-voltage switching (ZVS) circuit is shown in Fig. 9. This type is known as 'fixed off time, varied on time'.

In practice a full bridge resonant converter is normally used, for improved efficiency. The main elements of a full bridge clamped converter, as used by Panasonic, are shown in Fig. 10. The stray capacitances of the switching MOSFETs are used for resonance in conjunction with inductor L411.

A bipolar transistor, IGBT (insulated-gate bipolar transistor) or power MOSFET can be used for switching. Bipolar transistors are current driven, have high power consumption and medium to high switching losses. The IGBT is also current driven. It has minimal power consumption and low to medium switching losses. Power MOSFETs are voltage driven and have minimal power consumption and very low switching losses: they have obvious advantages over the alternatives.

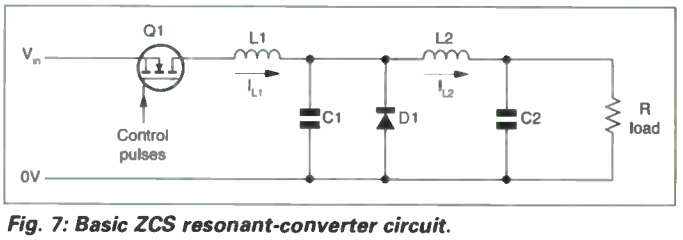


Fig. 7: Basic ZCS resonant-converter circuit.

Protection circuits

A number of protection circuits are used for the various power lines in a PDP set – drive protection, processing circuit protection and PFC protection. See Fig. 11. PCF protection is obviously carried out on the primary side of the power supply. The other protection systems are on the secondary side. Fig. 12 illustrates the drive and processing circuit protection arrangement. Samples of the sustain and drive voltages are fed to a comparator that sends an alert signal to a control IC should the voltages exceed a specified threshold. Processing circuit protection operates in the same way. When the control IC receives an alert input it sends a stop command to various parts of the set, including the power-supply regulators and the microcontroller IC.

The pulse-width modulator in the PFC section provides both protection and regulation, see Fig. 13. Regulation is achieved by varying the duty cycle of the PWM – Fig. 14 shows a typical waveform. The duty cycle varies with the DC output, the current

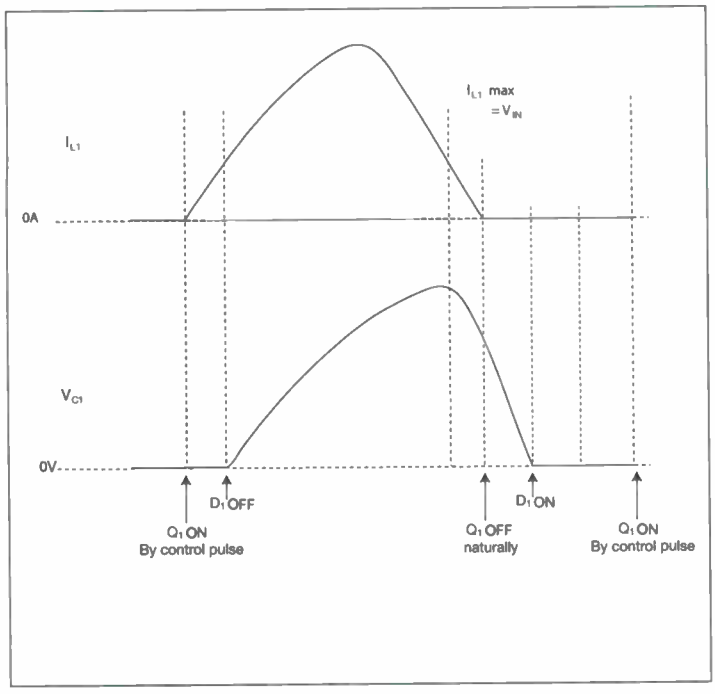


Fig. 8: Current and voltage waveforms for the resonant circuit (L1, C1) in Fig. 7.

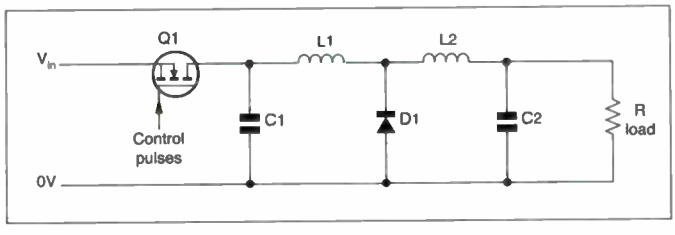


Fig. 9: Basic ZVS resonant-converter circuit.

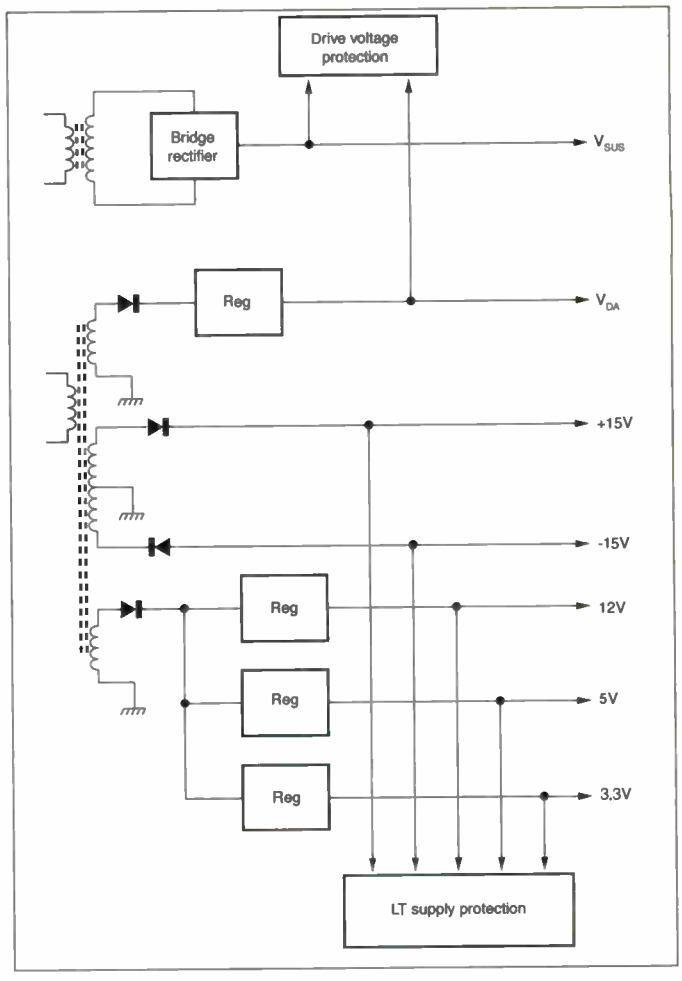


Fig. 11: Basic power supply protection arrangements.

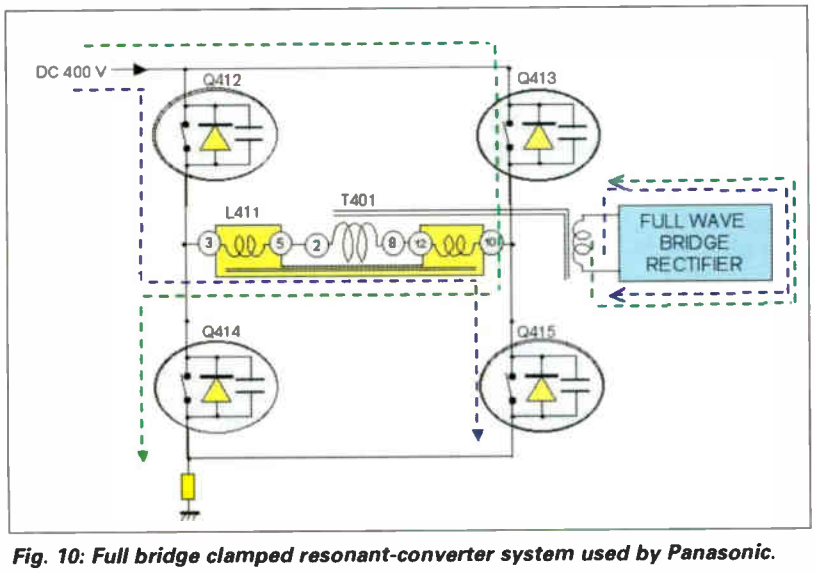


Fig. 10: Full bridge clamped resonant-converter system used by Panasonic.

taken and the shape and amplitude of the mains sinewave input. Protection is provided by using comparators to monitor the DC output and Vcc voltages. If these voltages exceed specified levels, or an alert is received, the over-voltage sensor operates. This is a transistor switch that switches off the PWM.

Energy recovery

The stray capacitance between the adjacent electrodes in a PDP consumes energy that cannot be used. Being of small value, stray capacitances consume negligible power that's normally ignored. But a PDP has a large number of pixels, each consisting of three cells, so the total stray capacitance is comparatively large. For example with a VGA-resolution PDP the number of stray capacitances is 852 x 480 x 3 = 1·23 million. With the high amplitude of the drive pulses, the power consumption of these stray capacitances is too large to be neglected. Hence the need to recover the energy stored in the stray capacitances for reuse. Most of the energy consumption is in the sustain drives, so the main energy recovery is carried out with these. Energy recovery may also be applied with the scan drives however.

The principle of energy recovery is to use an inductor to resonate with the stray capacitance. At the moment when the energy has been transferred from the stray capacitance to the inductor, resonance is terminated by means of a driven switching device, normally a MOSFET. Subsequently the energy stored in the inductor is transferred to a PFC storage capacitor.

Fig. 15 shows the principle of the energy-recovery system used with PDPs. Cs is the stray capacitance between electrodes E1 and E2, while C1 is the energy-recovery storage capacitor into which energy from the stray capacitance is deposited for use during the next discharge cycle. The sequence of events is as follows:

Stage 1. Switches S1 and S6 are closed and the sustain voltage Vs has a rising edge. L1 and Cs resonate, with Cs charging. Energy passes from C1 to Cs.

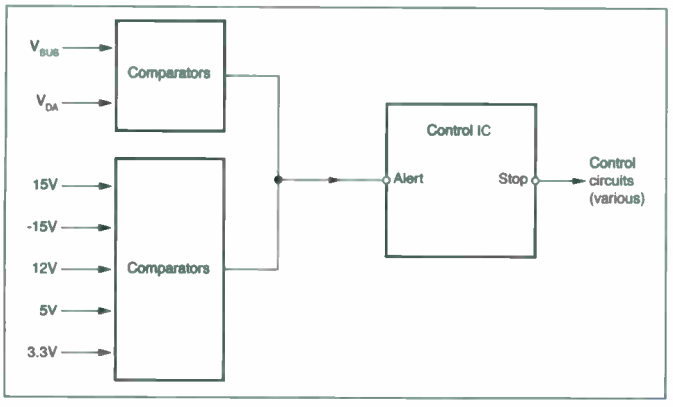


Fig. 12: Drive and processing voltage protection arrangement.

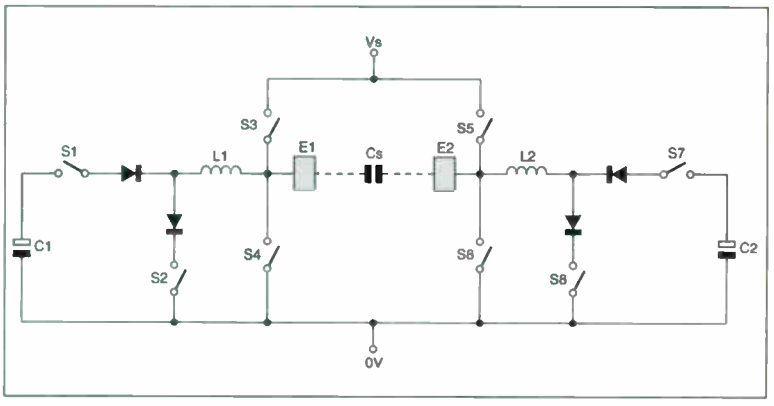


Fig. 15: Energy-recovery system for use with the stray capacitance in a PDP.

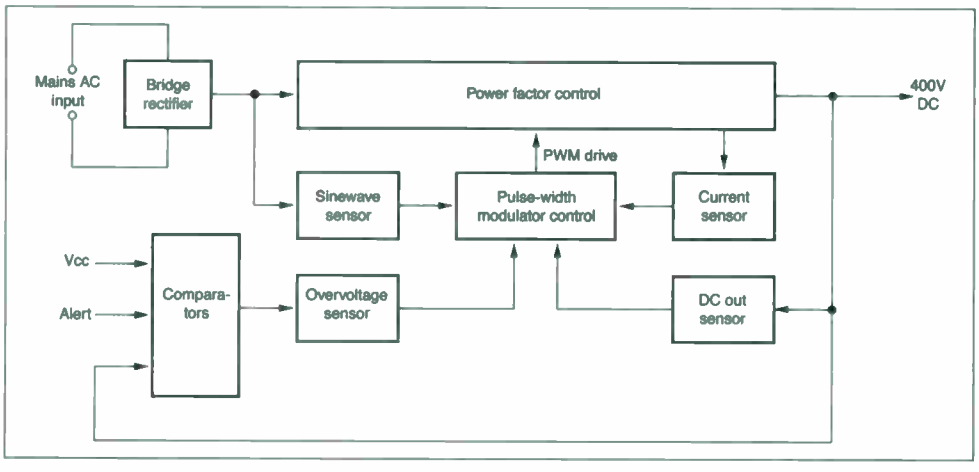


Fig. 13: PFC protection and regulation-control arrangements.

Stage 2. Switch S3 is closed, so Cs is clamped to Vs.

Stage 3. Switches S2 and S6 are closed and the sustain voltage Vs is falling. L1 and Cs resonate, with Cs discharging. Energy is transferred from Cs to L1.

Stage 4. Switches S1 and S4 are closed. Cs is clamped at 0V by S4. L1 and C1 resonate, with energy transferred from L1 to C1 (energy recovery).

Next month

The concluding instalment in this series deals with fault conditions, fault finding and PDP specifications.

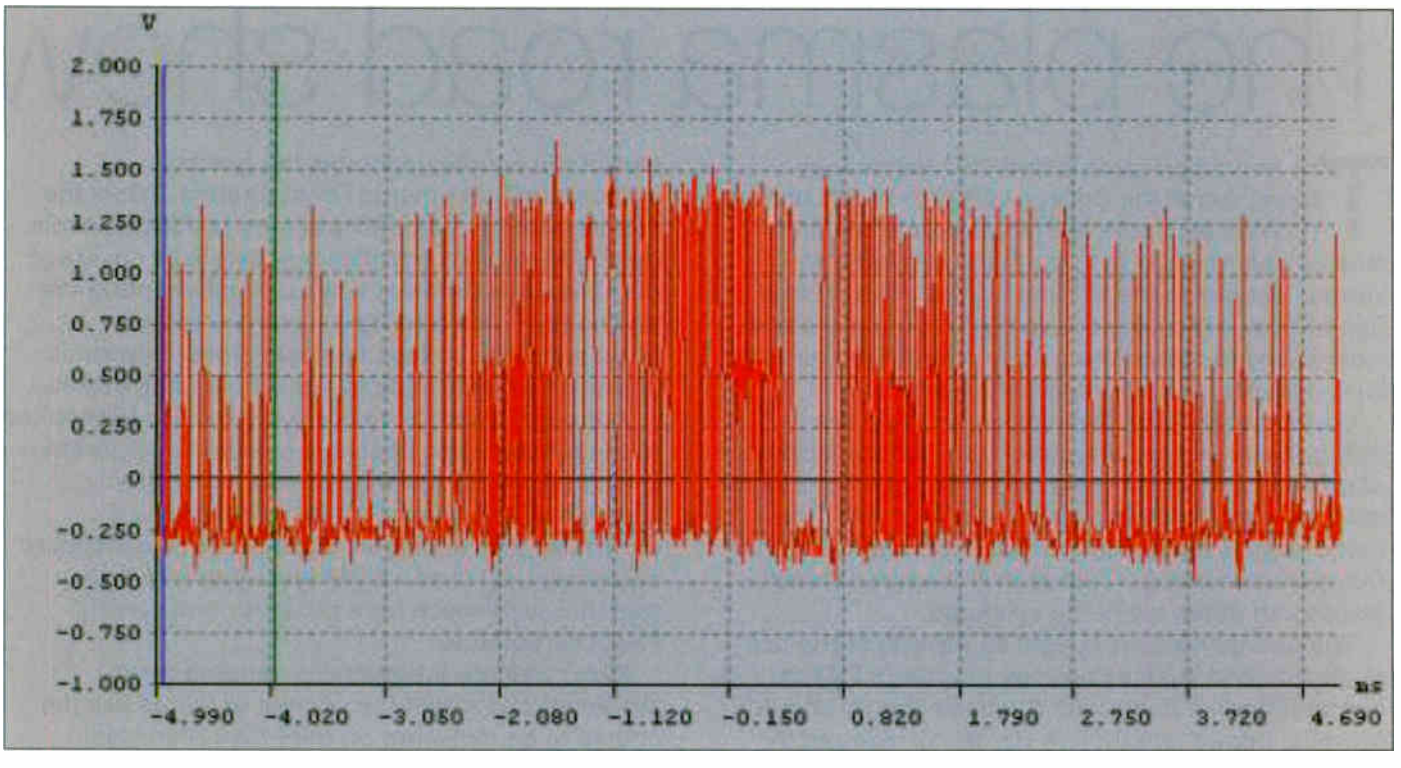
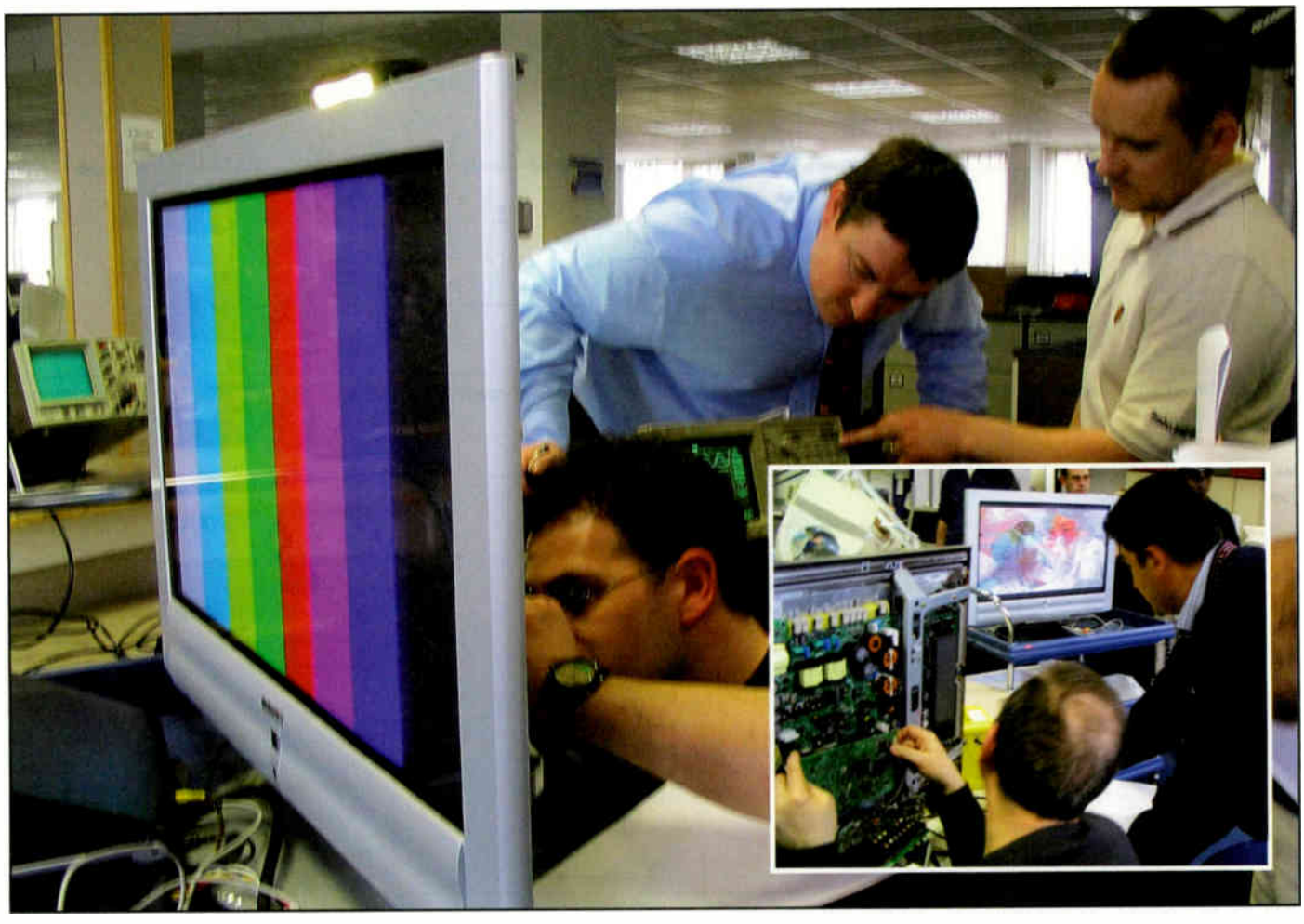


Fig. 14: Typical PFC circuit PWM drive waveform.

Fawzi Ibrahim is currently engaged in developing and running training courses on plasma and TFT/LCD at the College of North West London. He may be contacted by email at Fawzi.Ibrahim@cnwl.ac.uk or by phone on 07976 350724.



The plasma road show

The course on plasma and LCD technology being run at the College of North West London (CNWL) is to take to the road – and the first stop will be Malta. It is to be made available at various venues in the UK and abroad. The Plasma Road Show will make it possible for engineers and technicians to attend the course without the need for long-distance journeys and overnight stays.

Course tutor Fawzi Ibrahim reports that the college has received enquiries from different parts of the world, from as close as the Republic or Ireland to as far away as South Africa and Australia. The first overseas course will be held in Malta on 18/19 October, followed by Cyprus in November. Other places and dates are being arranged.

The two-day course covers all aspects of the use of plasma and LCD technology in today's TV sets and monitors. It deals with the basic theory and its practical implementation in chassis developed by manufacturers. Video and display processing are included, also testing and fault-finding.

"The feedback we have received from those attending the course indicates that the hands-on part of the course generates the greatest enthusiasm" comments Fawzi Ibrahim. While the courses run by manufacturers are product-specific, the CNWL course provides a generalised coverage of the various different ways of implementing the technology. This adds to its usefulness and popularity. The college has developed a dynamic approach to fault-finding, applicable to all makes.

Although local colleges are the venues best suited to the presentation of such a course, Fawzi Ibrahim is also hoping to run the courses at various companys' premises. "All that's needed is a workshop with a suitable large bench and standard equipment, such as a DVM and an oscilloscope, together with space for a projector and screen" Fawzi comments.

Firms that are interested in sending their employees to attend the course, or would like the course to be delivered on their own premises, maybe in conjunction with other firms, should get in touch with Fawzi Ibrahim. He can be contacted on 07976 350 724 or by email at Fawzi.Ibrahim@cnwl.ac.u

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AC Current: 200uA, 2mA, 20mA, 200mA, 2A, 10A
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Technical Specifications:

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AC Voltage: 200mV, 2V, 20V, 200V, 750V
DC Current:20uA,200uA,2mA,20mA,200mA,2A,10A
AC Current: 200uA, 2mA, 20mA, 200mA, 2A, 10A
Resistance: 200R, 2K, 20K, 200K, 2M, 20M, 200M
Capacitance: 2nF, 20nF, 200nF, 2uF, 20uF
Frequency: 2kHz, 20kHz

Order Code : METER03
Price : £ 17.00 + vat
Carriage charged at £ 3.00 + vat

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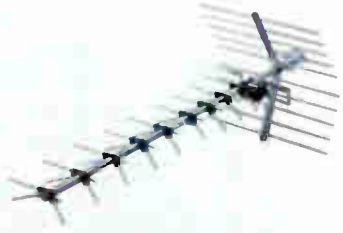
Aerial Installation Accessories

48 Element Digital Compatible Aerial



Receives both digital and analogue signals
For poor to weak strength signal areas
Robust design for low wind loading - 2 peices boom with aluminium wire rod elements
Supplied with F connector and clamp for horizontal and vertical (fits up to 57mm masts)
Ideal for areas with bad picture ghosting
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1 way UHF TV Masthead Amplifier - 26dB Gain
Order Code : 27831RPrice : £ 4.50 + vat

2 way UHF TV Masthead Amplifier - 10dB Gain
Order Code : 27837RPrice : £ 9.00 + vat

4 way UHF TV Masthead Amplfier - 10dB Gain
Order Code : 27838RPrice : £ 9.50 + vat

4 way UHF TV & FM Masthead Amp - 10dB Gain
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Masthead Amplifier Power Supply
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Main Operated , comes with full instructions

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2 way with Bypass	6dB	SLX2B	£ 9.25 + vat
4 way	12dB	SLX4	£ 13.00 + vat
4 way with Bypass	6dB	SLX4B	£ 14.00 + vat
6 way	12dB	SLX6	£ 18.00 + vat
6 way with Bypass	6dB	SLX6B	£ 19.00 + vat
8 way	12dB	SLX8	£ 18.50 + vat
8 way with Bypass	6dB	SLX8B	£ 20.00 + vat

Carriage charged at £ 2.00 + vat or £ 6.00 + vat for 2 or more

Universal Single LNB

Signal/noise ratio of 0.6dB.
Feedhorn: 40 mm
Input Frequency 10.7 - 12.75 GHz

Order Code : LNBSINGLE
Price : £ 5.00 + vat

Universal Twin LNB

Signal/noise ratio of 0.7dB.
Feedhorn: 40 mm
Input Frequency 10.7 - 12.75 GHz

Order Code : LNBTWIN
Price : £ 14.00 + vat

Universal Quad LNB

Signal/noise ratio of 0.7dB.
Feedhorn: 40 mm
Input Frequency 10.7 - 12.75 GHz

Order Code : LNBQUAD
Price : £ 25.00 + vat

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Feedhorn: 40 mm
Input Frequency 10.7 - 12.75 GHz

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Adjustable sensitivity adjustment
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Order Code : PLG51
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Bag of 100
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Price : £ 1.60 + vat
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Wireless technologies in CE products

In the third instalment in this series Graham Maynard takes a look at Bluetooth-enabled products that are currently available

A very large number of Bluetooth-enabled products are now on sale. Of the PAN (Personal Area Network) technologies, Bluetooth is easily the most advanced and, apart from mobile-phone technologies (WANs) such as GSM and possibly WLAN (802.11b etc.), is the most stable and established of the new wireless technologies covered in this series of articles. So I'm going to take an in-depth look at various types of Bluetooth products that are currently available, with some specific examples.

Photo 1: The D-Link DBT-900AP Bluetooth-to-LAN access point.

Access points

Access points are an obvious application for Bluetooth. Only its relatively low data rate in comparison with WLAN limits it for this purpose.

A good example is the D-Link DBT-900AP Bluetooth-to-LAN access point (see Photo 1), which is designed to extend LAN services to Bluetooth-enabled devices such as laptop computers and PDAs (Personal Digital Assistants, i.e. electronic diary/calendar devices). In this example the access point provides wireless connection for multiple users and devices in a Bluetooth network. It enables mobile users, using devices equipped with Bluetooth technology, to connect wirelessly to a local network (LAN) and the internet. D-Link is one of the better, more reliable manufacturers of Bluetooth and WLAN equipment.

This type of device can be used at home and in public areas such as offices, hotels, museums, airport lounges and even schools. It could be extremely handy if you are in a hotel and want access to the internet from different places inside the hotel or from your room. Another possible application is at a school, college or university to provide access to the internet from inside the campus.

The unit complies with Bluetooth specification v1.1 (PAN Profile) – see previous articles. It

connects to the Ethernet with DHCP (Dynamic Host Configuration Protocol) assignment (see http://www.dhcp.org/). There is plug-and-play installation, so no driver is required, and a security function for user access and authorisation/authentication. Up to seven Bluetooth users can have simultaneous internet/intranet access. The operating range is up to 20m, a very good Class 2 range. The unit works seamlessly with desktop/laptop PCs and PDAs. It sells for about £50-£70.

Other interesting access points, at prices ranging from £75-£225 depending on features, are the Axis Communications 9010, the Anycom Bluetooth AP-2002, Belkin's Bluetooth access point, the Sony PCGA-BM1 Bluetooth modem and the Possio Bluetooth-to-WLAN Gateway PX20, a Bluetooth to Wireless LAN gateway enhanced with OSGI.

As with all the devices mentioned in this article, you can use the internet and a search engine such as Google.com to find further information on the products.

Barcode scanners

For a little under £400 you can purchase a barcode scanner that transmits the scanned information to a remote device using Bluetooth instead of leads. The best known manufacturer of such devices is Baracoda, a French company.

A typical device, the BC2604 (see Photo 2), has many applications including point-of-sale terminals, shop inventory, warehousing and delivery tracking – I'm sure you can think of others. The devices are based on CCD technology that's similar to that used in camcorders. The BC2604 has a CCD scanning distance of 1–7in. (2·5-18cm) and a Bluetooth radio range up to 500ft/150m, so it's a true Class 1 device. For batch operation it can store up to about 3,000 bar codes. Power is from two AA NimH 1,800 mAh rechargeable batteries, the claimed battery life being greater than 3,000 scans. Dimensions are 143 x 78·8 x 154·5mm and the weight 180g.

Car kits and car navigation products

Because of legislation that forbids drivers using a mobile phone while driving, unless it's mounted in a fixed holder, this is one of the most popular applications of Bluetooth. There are various different versions, from the simplest hands-free devices such as headsets (see later) and clip-on wireless types that fix to your clothing to fully-fledged systems that integrate with the car electronics and provide voice dialling. With the latter the device stores a sample of the user's voice giving commands such as 'dial' or 'call' and saying the names of people in a phone directory. These systems allow other voice commands to configure the phone or the system, routeing calls through, muting in-car entertainment etc. while a call is in progress, and providing other features.

The most advanced supplier of these devices is another French company, Parrot, whose units, unlike some other products on the market, work with many different models from various phone suppliers and also BlackBerry-type PDA devices. A typical hands-free device is the Parrot DriveBlue+ (see Photo 3), which sells for about £60 and is available from many stores and on-line. The great thing about this device is that it is installation-free, simply plugging into the 12V cigarette lighter in your car.

With broad support for current and future phones, users are assured of the benefit of features such as one-touch handling of all calls and voice-recognition handling. There are additional features, but whether they can be used depends on the phone's capabilities. They include redial, dual call, caller ID, private mode, also the so-called DriveBlue menu on your phone display if it's able to provide this.

DriveBlue integrates advanced digital signal processing electronics and software. The driver's voice is processed to remove background noise and echo – noise- and echo-cancellation techniques are used – and as a result both the called and the caller get good-quality sound. But many Bluetooth hands-free units that are on the market have very poor noise- and echo-cancellation, and voice-dialling often doesn't work properly – especially if the voice samples have been taken in the quiet and the user dials with the engine running, or vice versa.

The Parrot CK3100 hands-free kit (see Photo 4) is a bit more advanced than the DriveBlue+. It can provide drivers with visual information and functions that they use with their mobile phones. Its display will show the phone book and caller ID information when a call is received – with compatible handsets. The unit mutes the in-car sound during calls and uses fitted car stereo speakers. So it has to be installed professionally, either as a retro-fit or when the car is being manufactured. It sells for about £100.

Photo 2: The Baracoda BC2604 Bluetooth barcode scanner.

Photo 3: The Parrot DriveBlue+ Bluetooth hands-free in-car phone system.

Photo 4: The Parrot CK3100 hands-free in-car kit provides visual information as well as routine mobile-phone functions.

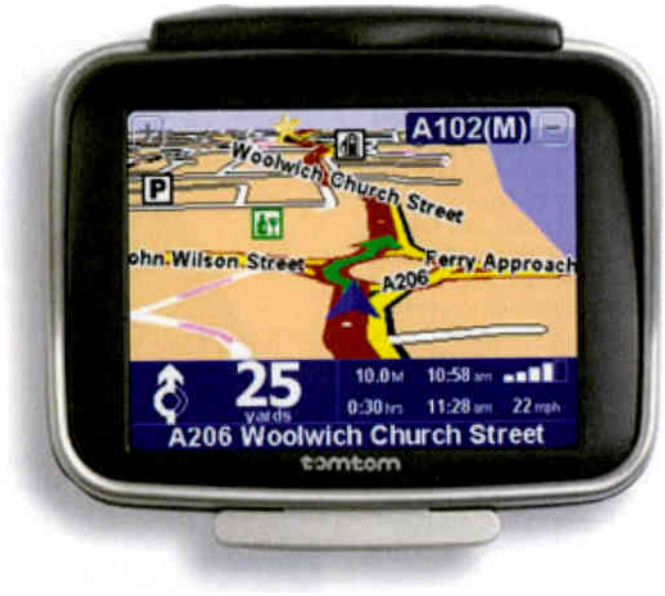

Photo 5: The Tom-Tom Model GO500 hands-free in-car satellite-navigation system.

Photo 6: The Belkin compact flash card with Bluetooth built in.

Photo 7: The Belkin combined PDA and PC Bluetooth adapter card.

Photo 8: The Anycom USB-240 adapter card for PCs.

An interesting variant and a far more complex beast, from Tom-Tom, incorporates the hands-free function into an in-car satellite-navigation system (see Photo 5). You can buy one of these great devices, Model GO500, for about £500. I recommend that you take a look at it by going to

http://www.blueunplugged.com/Products/TOMTOM_GO_500.aspx

It's certainly a fascinating approach and is an inexpensive way of getting a car satellite-navigation system without having to spend over £1,000 on integrated equipment or a retro-fit dashboard installation.

Computer cards, printer adapters and dongles

A variety of plug-in cards enable your PC, laptop etc. to send data to the outside world. Some computers have Bluetooth (and in many cases WLAN) built-in, so there is no need to expand your PC with these add-ons.

The most common type of adapter with Bluetooth is the PCMCIA card. There are compact flash cards that incorporate Bluetooth but these are less common – they are normally used in PDAs that don't already have Bluetooth built in. The most common way to add Bluetooth to your PC or other device is to use a Bluetooth USB adapter or 'USB dongle'. There are also RS232 dongles, but these are less common.

Belkin, one of the top makers of these devices, does a compact flash card with Bluetooth that sells for about £60 (see Photo 6). With this you can print, transfer files to/from your PDA and exchange cards, among other things, free of cables.

Be careful when buying this type of device – you may have to check that your PDA meets the system requirements specified by the manufacturer. For the Belkin device these are a genuine Intel StrongARM SA-1110 processor, a compact flash Type II slot, and Microsoft Pocket PC2000 or PC2002.

Also check that the profiles you need are provided. The Belkin cards are very good and typically have generic access, service discovery, a serial port, LAN access, dial-up networking, generic object exchange, object push, file transfer, and synchronisation. With this type of device – and any other PC/PDA adapter card – you get a CD-ROM with software to install, a user manual and a quick installation guide.

Belkin also produces a combined PDA and PC adapter card (see Photo 7). This basically consists of a compact flash card and PCMCIA adapter shell into which the compact flash card plugs to convert it to a PC adapter card.

Individual card-style PCMCIA adapters are also available, from firms like Belkin, BrainBoxes (a UK company based in Liverpool), TDK, Anycom and Socket.

A good example of a USB adaptor that simply plugs into the USB socket at the back of a PC (USB 1.1 or 2.0, check for compatibility) is the Anycom USB-240. It sells for about £30 – see Photo 8. It's easy to find cheaper products, but they don't all work as well or with as many devices and profiles. This USB adapter's range is also very good. Some of these adapters work up to only a few metres, but the USB-240 is a Class 1 device that works up to 100m. It uses

Widcomm software, which guarantees excellent compatibility with just about every device you could think of to use or pair it with. You will need to install software supplied with it unless you have a very recent PC with Windows XP software, in which case this device should work automatically.

There are many, many applications for these types of cards and adapters. Here are just a few:

(1) Synchronisation of your PDA or phone contacts etc.

(2) Internet access via your mobile phone, using GPRS or the newer 3G technology.

(3) Connection to a wireless keyboard or mouse.

(4) Sending images to/from a PDA or phone.

(5) Printing without cables in your home or office. Be careful – specific printing dongles that may work better for your application are available, for example the Anycom device mentioned below.

(6) Transferring files between your devices.

(7) PC voice applications, e.g. voice-command typing/operation.

(8) LAN access using an access point.

The Anycom PM-300 printer adapter (see Photo 9) adds Bluetooth capability to every standard printer that has the common USB interface, though maybe not 'all-in-one' printers. It's a Class 1 device with a range of up to 100m (330ft) and simply replaces the printer cable. It sells for about £65. The adapter uses the Bluetooth-specified HCRP (Hardcopy Cable Replacement Profile), which ensures use with a wide variety of devices and makes the printing itself reliable and fast. The standard SPP (Serial Port Profile) is also supported. Features include secure access and dedicated communication with password and device-specific PIN code, and 128-bit encryption, so no one outside can use your printer or steal the files you are printing out. As with all these Bluetooth adapter-type devices, the 2·4GHz band aerial is integral within it.

Indicators are also included – one LED for power status and one for printer-activity status. It's a Bluetooth 1.1 compliant device that has the approvals required for the US and Canada (FCC), Europe (CE) and major parts of Asia. This is important with all Bluetooth devices. Always check to see if these are listed in the instructions, otherwise the device may not be fully approved for use where you live!

Photo 9: The Anycom PM-300 Bluetooth printer adapter.

Bluetooth SD (Secure Digital) cards, such as those used in some digital cameras and modern mobile phones for storing images, are less readily available. An example is the Socket Bluetooth SDIO kit for Win CE. They are designed to perform specific functions, e.g. dial-up networking to access the internet with a handheld, mobile or PDA-type product. These are very interesting and sell for about £90. For further information check at

http://www.blueunplugged.com/products/Socket-Bluetooth-SDIO-kit-for-WIN-CE-3897.asp

Bluetooth headsets and mobile phones

By far the largest application for Bluetooth is with mobile phones and headsets. A whole book could be written on this subject, but suffice it to say here that a very large choice of mobile phones and headsets that incorporate Bluetooth is now available to give cable-free communication during calls. The headsets can be used in a car as a cheaper alternative to the more complex hands-free kits (see above) – as long as the phone is mounted in a fixed holder (in the UK, the regulations vary in other countries). If you want to ensure you get one that works with your phone, the following is a list of some of the more common and reliable manufacturers of headsets.

These companies have been active in the Bluetooth field for some years and know the pitfalls associated with the manufacture of such devices. They can therefore in general be trusted. The companies are Jabra (that's the brand name, the company is GN Netcom), Plantronics, Nokia, Sony Ericsson, Anycom and Motorola. Cheap

Photo 10: The Plantronics M2500 Bluetooth headset.

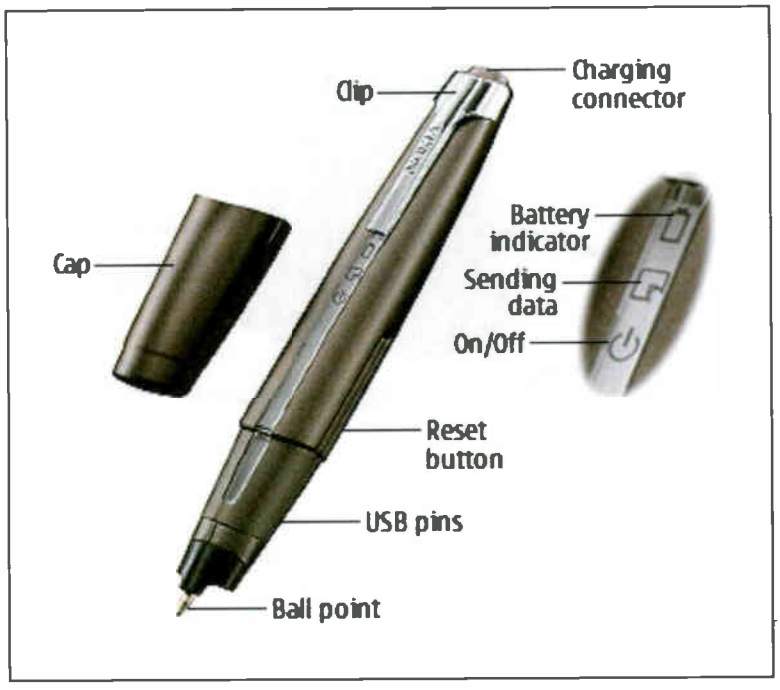

Photo 11: The Nokia SU-1B Bluetooth pen (or Chatpen).

products, especially those on sale at market stalls, may not be properly qualified for the Bluetooth specification and may work with only certain phones – or not at all! Steer clear of them: they are a false economy.

The Plantronics M2500 is a typical Bluetooth headset (see Photo 10). It provides about five hours of talk time (time engaged in calls) and up to 120 hours of standby time (time spent in the low-power mode waiting for either incoming or outgoing calls to commence). The headset fits over your ear and can be adjusted for comfort. It sells for about £30. Only three-four years ago such headsets were in their infancy, had very low battery life and sold for about £150 – as much as £300 in some cases. They were in effect a gimmick for the businessman with a good expenses budget! They now sell in supermarkets and are even in some cases given away at petrol stations.

The M2500 headset has Bluetooth v1.1 compliance (Class 2), i.e. a range of up to 10m. It supports headset and hands-free Bluetooth profiles, has the voice-dialling function, an LED indicator and a button for on/off and to receive/make calls. Plantronics headsets are of very good quality and work with almost every conceivable mobile phone. Once the headset has been paired with your phone it needs the minimum of effort, and clicks etc. to get voice calls, both incoming and outgoing, routed through the headset instead of the phone.

The Sony Ericsson T630 is a typical mobile phone that incorporates Bluetooth technology. It sells for about £75, typically on a SIM-free basis. Its many features are too numerous to list here. To find out more about Sony Ericsson mobile phone products, which are the best, most advanced, most stylish and reliable phones available by a considerable margin, check at the website www.sonyericsson.com

New headsets that provide more than just basic voice communication are now beginning to appear. These Bluetooth stereo headsets use advanced new profiles and are capable of producing stereo-music quality from CD players and other consumer products, such as the new iPod MP3 players. In addition Bluetooth-enabled stereo speakers are becoming available for use with your domestic hi-fi equipment.

Pens

The Bluetooth pen is an interesting device. Nokia produces one called the SU-1B (or Chatpen) that costs about £120 (see Photo 11). Basically it remembers what you are writing so that this can all be stored in your PC or other storage device. The data from the pen is transmitted wirelessly by Bluetooth.

The pen can remember up to 100 A5 sheets of text. Even the most prolific writers don't need to worry too much about running out of memory, because the pen connects smoothly with your PC where you can store your notes for further revision and distribution. Once properly paired, the Nokia Digital Pen also provides automatic connection to a compatible mobile phone, so you can send hand-written notes to compatible phones or email addresses via MMS (Multimedia Messaging Service).

The pen can be connected to a compatible PC via a USB cable. The battery provides up to two hours of writing time. There are three LED indicators and a vibration alert to indicate pen and send status. Changeable ink cartridges are used, and the pen works as a normal one with non-digital paper. When connected to a compatible Nokia charger or a compatible Nokia travel charger the pen charges in its stand.

Summary

As you can see from the above notes a large variety of CE and other products now feature Bluetooth technology. This article has only really scratched the surface. There are many more applications, particularly in the industrial, medical and other fields. Even some camcorders, videos, digital cameras, set-top boxes and other domestic brown-goods products are starting to use the technology. I will look at specific examples of one or two of them next month.

Zigbee is another up-and-coming wireless technology I'll start to look at next month. The name comes from the 'zigging' motion of the bumblebee. It is starting to be used in home-networking type applications where a lower data rate than Bluetooth is acceptable and very low power is required, particularly in light-switch arrangements. This technology is nowhere near as well established as Bluetooth. Its protocol stack has only recently been ratified to form a full point-to-multipoint specification, but there's no doubt that it is going to be a very important technology indeed. It will enable light switches to be fitted to walls wherever you want them, without having to channel through your walls for cables – and who needs that aggravation? ■

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DX and Satellite Reception

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SWAT teams converge on their suspect on a US highway. A live police chase seen via Eutelsat W1 (10°E).

There was continued Sporadic E reception into June, with several excellent openings though lulls of a few days in between. TVE (Spain) ch. E4 has been seen in the UK and in the Netherlands. This is good news: nice that Spanish Band I TV has continued into the 2005 season.

Here's a brief rundown of June's SpE reception through to the final week:

1/6/05	HRT (Croatia) ch. E4; LTV (Lithuania) ch. R2; RTL (Hungary) ch. R2; UT (Ukraine) ch. R2; ARD (Germany) ch. E2; C+ (Canal Plus, France) chs. L3, 4; SVT (Sweden) chs. E2, 3; RAI (Italy) chs. IA, B; TVE (Spain) chs. E2, 3; Syria chs. E2, 3; plus an unidentified Arabic ch. E2 transmission.
2/6/05	RAI IA, B; Tele-A (Italy) E2–; TVE E3; BTV (Belarus) R1.
3/6/05	TVE E3.
4/6/05	NRK (Norway) E2-4; Tele-A E2–; RAI IA, B; TVA (Italy) E3.
9/6/05	RAI IA, B; Tele-A E2–; C+ L3; TVE E2, 3.
10/6/05	RAI IA, B; Tele-A E2–; TVA E3; ARD E2; TVE E2-4; C+ L2, 3; BTV R1; RTP (Portugal) E2, 3.
11/6/05	RAI IA, B; HRT E4; UT R3; TVE E2, 3; RTP E3; Antenna-Tre (Italy) E3.
12/6/05	RAI IB; Tele-A E2–; TVE E3.
15/6/05	NRK E2-4; SVT E2, 4.
17/6/05	Tele-A E2–.
18/6/05	RTP E3; TVE E3.
19/6/05	TVE E2, 3; RAI IB; BTV R1; RTP E2, 3.

Exciting news from Hugh Cocks in the Algarve (Portugal). On 31 May between 1930-2030 hours BST Hugh received RCTV Venezuela ch. A2 at good strength, with soap opera and commercials. The signal started to fade at 2030 and was gone by 2115. A check on the vision carrier frequency showed that it was 55·2496MHz. At the same time a 50MHz amateur radio operator, 9Y4AT, in Tobago was in touch with Portuguese amateurs. On 5 June Hugh again received transatlantic signals, this time NBC chs. A2 and A3 with the French Tennis Open Final plus US commentary at 1630-1645 BST.

Michele Dolci (Northern Italy), a name from the old DX days, has been in touch. He says that there are no complete channel listings for both RAI and the private commercial stations on the internet. However you can go to
http://welcome.to/dellerba
and click on LISTE, which will produce a map of Italy. Select the main city in each region and a local TV station listing appears.

Satellite sightings

BBC outside broadcast feeds continue via Atlantic Bird 1 (12·5°W). The best time to check the 11-11·2GHz V slot is between 1800-1900 hours, when the BBC regional services are transmitting their early evening magazine programmes. On 23 June for example BBC Plymouth at 11·061GHz reported from a sunny beach, Scopus-NET-TE at 11·067GHz was reporting from the dried-up bed of a reservoir near Rugby, noting that there could be water restrictions soon, while UKI-1153 at 11·100GHz was at an undisclosed site – it remained on colour bars! These and other transmissions used the normal BBC symbol rate of 4,226 with 5/6 FEC and vertical polarisation. Note that MPEG-2 and 4:2:2 are both used for the downlinks. Depending on your MPEG-2 receiver, partial picture lockup may occur though the audio should be OK. UKI-827 Newcastle is another regular, at 11·061GHz, using MPEG-2. BBC foreign news feeds may well appear in this slot. For example on 20 June BBSC was reporting live from Beirut, Lebanon on the elections, for BBC World and BBC 24.

There have been several elections in the Middle East, none so dramatic perhaps as Iran which went to the polls on 17 June. While checking Telstar 12 (15°W) on the 16th, in the evening, I came across the Iranian TV channel multiplex at 11·497GHz V

(17,468, 3/4) whose content seems to have increased in recent times. In total ten channels are available, with video quality that varies from fair to really poor. I'm not sure for whom the multiplex is intended – US cable networks perhaps? The channel listing is Appadana, Pars, NITV, Gunaz TV, Channel One, Lahse, Your TV, Rang a Rang, Payam TV and Marrom TV, the latter with only colour bars. They operate as Iranian Media Alliance and are transmitted via Globecomm TV. As received, the digital parameters are SR 17,468 and FEC 3/4, though one channel clearly captioned the parameters as 19,279 and 2/3. When I checked all the channels other than Pars carried party political broadcasting, phone-ins, talking to camera etc. The content of Pars is decidedly dramatic, and is continuously repeated. President Bush was seen speaking for several seconds, with Arabic subtitles, followed by revolutionary singing. The scene changed to a large group, into which blindfolded prisoners (hostages?) were dragged. They were each shot several times. The scene then changed to the bodies being beheaded by a man with a very blunt machete. He waved a head in the air before placing it on the torso. The audio was grim. Onlookers cheered as the man hacked away noisily, the floor awash with blood. The poor VHS video quality did little to dilute the real horror of this brutality.

The main political news in Europe concerned the Brussels EU budget, which dragged on for many days during June. There was a regular hook-up via Eutelsat W2 (16°E) at 12·525GHz H (5,632, 3/4), used by Sky News and others – courtesy UKI-818 SISLink.

Another long-running drama unfolded via the Eutelsat W1 (10°E) UP4 feeder (10·972GHz V, 4,167, 5/6) with the Michael Jackson trial and the verdicts. Of more interest technically was the drive by Jackson to the courthouse to hear the verdict announcements. This was covered from the moment he left his house, the procession of four black limousines being followed all the way to the courthouse by an 'eye in the sky'. From the fading and signal dropouts the sky-to-ground link was clearly analogue and not digital.

There was eye in the sky drama via UP4 on 14 June, with a heli-cam hovering over New York's East River. A small helicopter had flipped over and crashed into the water. Rescuers scrambled to help, and all those in the helicopter were rescued. The latter was left submerged, tied to a pontoon to prevent it drifting in the strong current. Three days later another chopper crashed into the East River, on a pleasure flight. Another well-rehearsed rescue, with all surviving. The pictures were received via UP4, using the WABC-7 heli-cam.

Another live drama via UP4 unfolded on June 7. This time SWAT teams had pinned a criminal in his people carrier against a motorway wall, blocking all escape. There was a stand-off for over an hour, then a tear-gas grenade was fired into the vehicle. The suspect opened the door and a police dog leaped inside, pulling him out. SWAT members then 'subdued' him – he was eventually carried away by stretcher. The heli-cam had circled at the lowest permitted height of 2,000 feet. The live police chases I've seen via Atlantic circuits have always been just as we see them in the movies.

June, hot weather, no downpours so far and it's Wimbledon again. An encrypted OB multiplex via Eutelsat W2, at 11·140GHz H (22,218, 5/6), was established for the duration of the event. Interesting that the various courts had their own channels in the multiplex – catalogued as 'Ch2 Centre Court', 'Ch3 Court 1', 'Ch4 Court 2', 'Ch5 Court 3' and 'Ch6 court 6'. There was an internal identification, 'Digital OU mux'.

Another sports multiplex, for basketball action, has been established by the NBA via the little-used Intelsat 901 (18°W). It had previously been carried by Atlantic Bird 1 (12·5°W). The new service is encrypted and uses up to three channels, depending on the content required by European broadcasters. There are NBA TV Europe at 11·664GHz, NBA Path 2 English at 11·672GHz and NBA Finals at 11·680GHz – all with horizontal polarisation, SR 5,632 and 3/4 FEC.

Finally in mid-June Sky News used Europe*Star 1 (45°E) for several live Johannesburg-Isleworth newsfeeds. They were transmitted by GlobeCast Africa at 11·522GHz V (6,109, 3/4).

A Bahrain radio promotional slide, seen via Arabsat at 26°E.

Tetra interference

Tetra is being rolled out across the UK. Most police forces are now using 380-385MHz (mobiles) and 390-395MHz (base stations) instead of the old 450-454MHz analogue band. There are specific 'direct-mode' channels in a two by six frequency block between 380·0125-380·1375MHz and 390·0125-390·1375MHz. The transmissions are all in an encrypted digital form, so your Radioshack scanner will hear only curious sharp buzzes in this band.

But Tetra can cause interference to TV reception, particularly when a wideband aerial amplifier or domestic distribution amplifier is in use near a Tetra installation. Appropriate UHF bandpass filtering or bandstop/notch filtering must be used to eliminate the breakthrough.

Broadcast news

Solent TV: The Isle of Wight RSL TV station (ch. 54 H) has opted for Astra digital satellite space, where it joins Sky at the end of the year. The cost of electronic programme guide access has fallen and, with its analogue RSL licence running out at the end of 2007, Solent TV has decided that it must go digital with satellite delivery. This will increase its coverage of course. Once its programming is on Sky, Solent TV hopes to provide greater tourist publicity.

France: The EU has confirmed that it will provide financing for a news channel, Chaine Francaise d'information Internationale, to be largely run by TFI and France Television. The aim of the channel is to present the French viewpoint to overseas viewers. The channel is required to "apply market conditions to all commercial operations", which suggests that it will carry advertising, though profits have to be put back into public-service tasks.

Malaysia: A third TV channel, to provide general entertainment, news and educational programming, is to be launched in September 2006. The existing RTM1 and 2 networks are to start digital operation on a test basis.

Afghanistan: UNESCO is funding the Kabul Educational Radio/TV Centre, which has been running on a test basis since last year. Several programmes and 'social marketing' promotions have already been broadcast via the national TV service. The Japanese government financed the rebuilding and equipping of the main Kabul TV tower, with NHK providing technical assistance.

South Korea: The government is to fund a TV channel that will broadcast the proceedings in parliament, provide details of new

A BBC feed from Beirut to London via Atlantic Bird 1 (12·5°W).

legislation and update viewers on emergency procedures. The new service will start in the southern Seoul region this December.

Syria: The state broadcasting monopoly is to be loosened, with the possibility of independent radio and TV stations opening in the near future.

Australia: The trade organisation Commercial Radio Australia is pushing for digital radio using the Eureka 147 system in L band, with a ten-year dual analogue/digital period initially. Tests of the system are being carried out in Paris.

Spain: The 50MHz amateur radio band has been widened to 50-51MHz across the country, with permitted power increased to 100W. Since there are still TV transmissions in Band I, amateurs have to apply for regional permission to go on-air.

Cuba: Because of inter-departmental arguments in Washington about funds, purchase of a C130 aircraft to transmit US material to Cuba, as part of the Radio and TV Marti project, has been delayed. Broadcasts continue from a tethered blimp moored at Key West, Florida.

Satellite news

Intelsat has confirmed the successful launch of its IA-8 satellite which, at 89°W, will provide coverage from the Americas out as far as Hawaii. It's the first Intelsat craft to have Ka as well as C and Ku band capacity. IA-8 will be providing broadcast, HDTV, OB and broadband data-transmission services.

The new satellite Apstar V1 came into operation in mid June, taking over services via the ageing Apstar 1A at the 134°E slot. It carries C and Ku band TV transmissions and telecommunications traffic across the Asia/Pacific region.

It's fifty years since the Baikonur Cosmodrome opened. The first Sputnik was launched two years later, in 1957. On 2 June the Kazakh government held an official celebration which was attended by the president and also President Putin. A 24-hour news channel is being prepared to be broadcast across the US, Europe, Russia and SE Asia. To avoid a 'Russian bias', a group is being set up to monitor editorial policy.

A four-channel Bulgarian multiplex is to be set up incorporating the commercial channels Nova TV and BTV plus the state TV Bulgaria Satellite (BNT) and a music channel. There will also be several radio stations. The service will be encrypted, and the satellite to be used has still to be announced. Coverage is to include Europe, West Russia, North Africa and North America. The service will operate around the clock on a three eight-hour segment basis.

Look out for KDN appearing on test cards now that Kenya Data Networks has opened a telecommunications gateway near Nairobi using Intelsat and NSS satellites. It went on air on 23 May.

Transpolar propagation

An article in *Six News*, the magazine for 6m (50MHz) band radio amateurs, refers to transpolar propagation (F2 layer DX) during the sunspot peak in the winter of 2001-2. Transpolar signal propagation had previously been experienced at 28MHz, but became evident on many occasions at 50MHz during this period. Mainly, Finnish and Swedish amateurs were in contact with amateurs in British Columbia (Canada) and the mid-to-west US states – Oregon, Montana and the Dakotas. Reception generally occurred at about 2000 GMT. Those involved comment that signal quality varied from normal to having an auroral/rough tone.

As solar outrages are more likely during a high sunspot period, it's possible that the propagation included an auroral element. Tromso observatory noted that strong Auroral E (E layer) and Spread F was evident during the time of several though not all the reception reports. The signal distances are greater than a single hop, which makes me wonder whether a degree of auroral ducting was involved. A check on the path plots shows a remarkably narrow 'opportunity angle' between the clusters.

There were no reports from the UK but on 30 October 2003, during an aurora that was visible here in the south of the UK, a check on the ch. A2-4 video carrier frequencies with an R7000 scanner plus Mutak preamplifier revealed a multiplicity of low-level signals. This suggests that AR propagation, although at low level, was present between the Americas and the UK, and could be received with a narrow-band tuner. For further information check http://home.planet.nl/~pa1six.htm

Historical matters

There's been quite a lot on wavefront tilt since I first mentioned the subject in the April issue. While looking through some back copies I found glowing testimonials for the four-element wavefront-tilted Telerection Maximus aerial in the February 1951 issue. The Cornish viewer quoted was, I assume, receiving ch. B5 from Wenvoe. Telerection ended its days at Weymouth as part of the Thorn Electrical group, being closed down despite a full order book for the UK and export markets. One of its final triumphs was a short back-fire UHF aerial. This was a high-gain, wideband system that was probably costly to produce because of its complex construction.

Mention of J-Beam last month brought a recollection from a reader of one of the company's most extraordinary aerials, a "folding double-beam" type for Bands I and III. This had a skeleton-slot for Band III, with a single dual-band output from a common termination at the Band I dipole. There were dual, parallel director/reflector assemblies for Band III, while the Band I section had three elements. J-Beam went on to produce skeleton-slot aerials for UHF TV, UHF telecomms and 435MHz amateur band use.

While going through early issues I came across an advertisement in October 1958 for what must have been the first 'satellite TV' receiver, the infamous ex-government R208. This six-valve single superhet covered 10-60MHz, i.e. much of Band I but also, as it went down past 20MHz, the bleeper beacon in the Sputnik satellites. The 19·995-20·010MHz band signal could be easily received during each satellite pass.

Worth reading

Austin Uden, a noted researcher on weather-related tropospheric signal propagation and reception, tells me that copies of his two booklets on tropospheric DXing are still available. They are not theoretical texts but accounts of conditions that have been experienced, with hints on forecasting the weather and possible signal paths. A descriptive leaflet is available – please send a stamped, addressed envelope with requests. The books are available at £8 for the two including postage from A. Uden, 12 Hampden Close, Aylesbury, Bucks, HP21 8NS. I think they are very worthwhile reference works to have.

HELP WANTED

The help wanted column is primarily intended to assist readers who require a part, circuit etc. that's difficult to obtain. Requests are published at the discretion of the editor. Send them to the editorial department – do not write to or phone the advertisement department. If you have access to email they can be sent to t.winford@nexusmedia.com

Wanted: Original remote-control unit for the Sony Model SL-C9 VCR. Any condition. Pleease phone Malcolm on 01279 813 727 or email malcolm.george@tesco.net

Wanted: A channel-change knob for the VHF tuner in the Sobell Model ST197DS. It's a dual-standard set that dates from 1964/5. The knob has VHF radio in three positions. A circuit diagram would be useful, also a scrap chassis if anyone has such a thing. Can collect locally (thirty miles). Jim Littler, 363 Atherton Road, Hindley Green, Wigan, Lancs, WN2 3XD. Phone 079 9096 3918.

Wanted: (1) A service manual or circuit diagram for the Sony C969 MP3 audio player. (2) The full service manual (not just the circuit diagram) for the Telequipment oscilloscope Model D65. A photocopy may be OK if legible. Cash settlement or will exchange for a different original manual that I may have and you may want. (3) An Advance P3 signal generator Mk1-2 with US octal valves or a Mk3 with B9G valves, dating from the late 1950s. It need not be in working order but must be reasonably complete for renovation and reuse. Phone Alan Williams on 01745 812 642.

Wanted: Quad 33, 34 or 44 preamplifiers, 405 power amplifiers and FM2, FM3 or FM4 tuners for spares. Also boards and modules for these. Contact Mike on 01758 613 790.

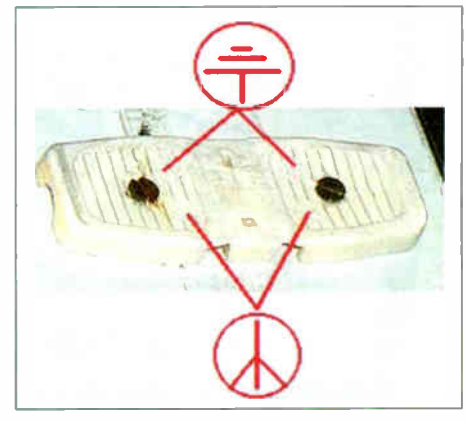
Wanted: Could someone let me know the value of item Z463 (circuit reference number) which is in series with the collector of Q460 in the Toshiba widescreen TV Model 28ZD26P? Please phone Brian on 020 8845 5123 or email BrianBattams@aol.com

For disposal: A Pye valve radiogram dating from approximately 1952. Free to a collector/enthusiast. It's in working order and the dark oak cabinet is in good condition. Must be collected unless local. Phone R. Weston on 0121 453 3786 (Rubery, Birmingham).

Wanted: Old half-inch diameter ferrite rods. Must be six inches or more long. Will pay very good money for them. Peter Tankard, 16A Birkendale Road, Sheffield, S6 3NL. Phone 0114 231 6321 between 9 a.m. and 10 p.m.

For sale: Various Sanyo Betamax VCRs in the VTC5000-VTC5100 range. There are six in total plus some cassettes. All were in working order when stowed away a few years ago but present condition not known. £25 each, and they would have to be collected from Denbigh in North Wales. Phone Alan Williams on 01745 812 642.

Wanted: Older type combined aerial/earth connector plugs of the type that were available in the UK in the late 1970s to early 1980s. The accompanying photo shows the connector. Please email James Eubanks at JME3@connect.net



Ultra Coronation Twin

Malcolm Burrell turns his attention to a mains/battery portable receiver that dates from about 1953. It required both electronic and cabinet renovation

Appearance of the Ultra Coronation Twin receiver after attention to the cabinet and tuning scale.

The Ultra Model R786 Coronation Twin, which has a four-valve plus metal rectifier line-up, is fairly well known amongst collectors of older radio receivers. It was released in 1953 as a mains-battery portable and provides long and medium waveband coverage. The Bakelite case was built to house a 7·5V valve filament battery (filaments in series) with HT supplied by an 85V battery. Mains operation is selected automatically by a changeover switch when the mains-input connector is inserted. Generally today only mains operation is practical.

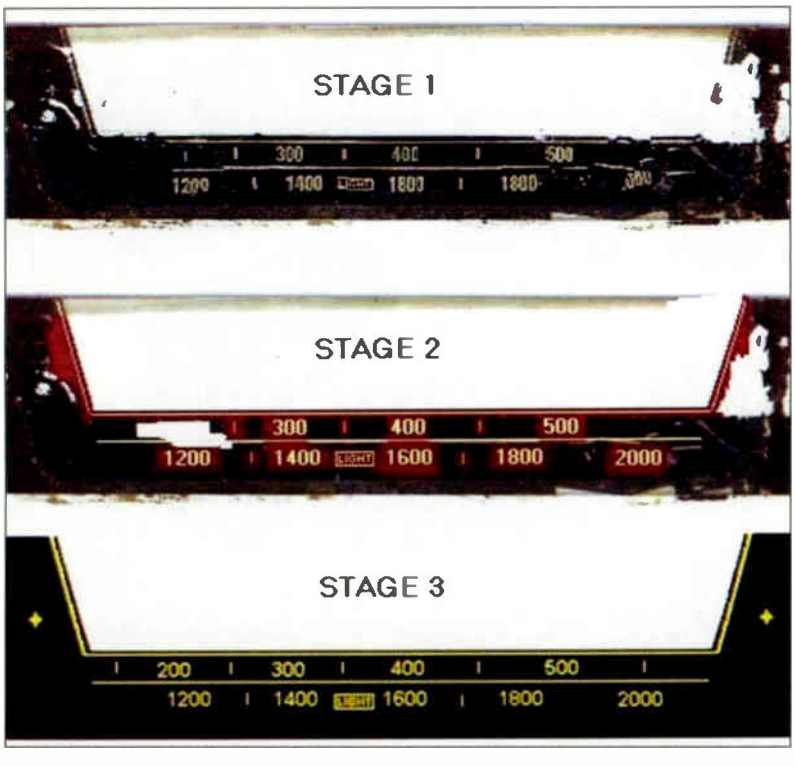


Fig. 1: Stages in the reconstruction of the tuning scale.

For those who are unfamiliar with valves, it's worth noting that most types made for battery operation are directly heated, i.e. the heater is also the cathode. There is no perceptible glow, and the warm-up time is typically only about one-two seconds! While conventional valve terminology refers to a heater and a cathode, with directly-heated valves the term filament is used.

I received a request to brighten the cabinet of one of these sets, which had resided in a shed for a considerable time. A total restoration was not envisaged, the idea being simply to preserve the set in a reasonable condition.

I found that it didn't function, despite the suggestion that it had done so recently. Investigation revealed that the smoothing capacitors were in doubtful condition. This was confirmed by a loud hum when power was supplied – because of loss of capacitance. There were no signals, and some essential components had been replaced during an earlier overhaul. The hum was surprising, as half the tapped filament of the DL94 output valve was open-circuit!

Confident of being able to obtain a replacement DL94 valve eventually, I turned my attention to the presentation.

Cabinet and tuning scale

The tuning scale in this model is in two sections: a cream metal plate that bears most station names is attached to the chassis while a transfer, that indicates the wavelengths for both MW and LW, is applied to the lower part of the glass window. In addition to the cabi-

net being jaded, the tuning-scale transfer was flaking, with its legends identifiable but cracked and misplaced.

Lest further damage should occur, before dismantling the receiver I placed it on the table of a computer scanner to record its state for reference. The glass tuning-scale window was eventually removed and also scanned, with a view to replication. I saved the image as a JPEG file, then retrieved it in Microsoft 'Paint'. After that it was fairly simple to redefine the relevant lines. I replaced the numerical legends, using 8-point Sans Serif type.

The smaller boxed type that identifies the LW Light Programme position needed careful attention. The word 'light' was generated conventionally and reduced in size appropriately, despite the essential shape of the letters being partly lost as a result of pixelation. The missing portions were restored as single pixels, finished with a box surrounding the word. It was then copied to the main drawing where, surprisingly, it resembled the original! The background was then coloured in an appropriate shade.

When it was printed the image required slight reduction in size. This was achieved with a little experimentation. The final artwork was produced on glossy photo paper. A thin layer of varnish was applied to the reverse side to provide additional support and discourage absorption of moisture likely to result in distortion when placed inside the receiver. It was then trimmed and fixed loosely behind the original glass, from which the flaking paint had been removed. A dab of resin secured the paper at its lower centre once the glass had been fitted within the cabinet. Edge fixing depended on new plastic pads fitted beneath the original sprung clamps in the cabinet. This allowed some freedom to adjust the new artwork in the unlikely event of warp. Fig. 1 shows the stages of the tuning scale reconstruction.

The cabinet was then scoured carefully with a motor vehicle rubbing compound and polished.

The electronics

Fig. 2 shows the circuit diagram of the Coronation Twin Model R786. For mains operation the selenium plate rectifier MR1, in conjunction with its reservoir capacitor C24, supplies DC to the HT line via the tapped dropper resistor R22 and smoothing resistor R21. C23 is the smoothing capacitor. Being directly heated, the valve filaments require a DC supply in order to avoid severe hum. For mains operation the filaments are supplied from the HT line via another dropper resistor, R20.

The dropper resistors had been neatly and adequately replaced with RS sections. MR1 had been replaced with a BY127 silicon rectifier with transient suppression. Other critical components, such as the audio coupling capacitors C17 and C20 and the filament bypass capacitors C6 and C21, had also been replaced.

Once a new DL94 had been fitted there was severe instability, 'hum' and merely a hint of any RF reception. Smoke suddenly appeared, with a fizz, from the vicinity of the mains filter capacitor C25. I immediately replaced it with a modern type rate at 250V AC – ageing paper dielectric capacitors don't appreciate being woken up after prolonged inactivity!

Subsequently both sections of the smoothing block C23/4 were replaced with separate 47μF, 450V capacitors. Surprisingly, this corrected all remaining faults and restored very good RF reception! I thought it prudent however, based on experience, to replace any capacitors of a dubious type. This included C3, C10, C19 and C22 – the originals were of a brown 'lozenge' construction, with values indicated by coloured stripes.

The end result was a sensitive and attractive little radio capable of more than adequate sound output!

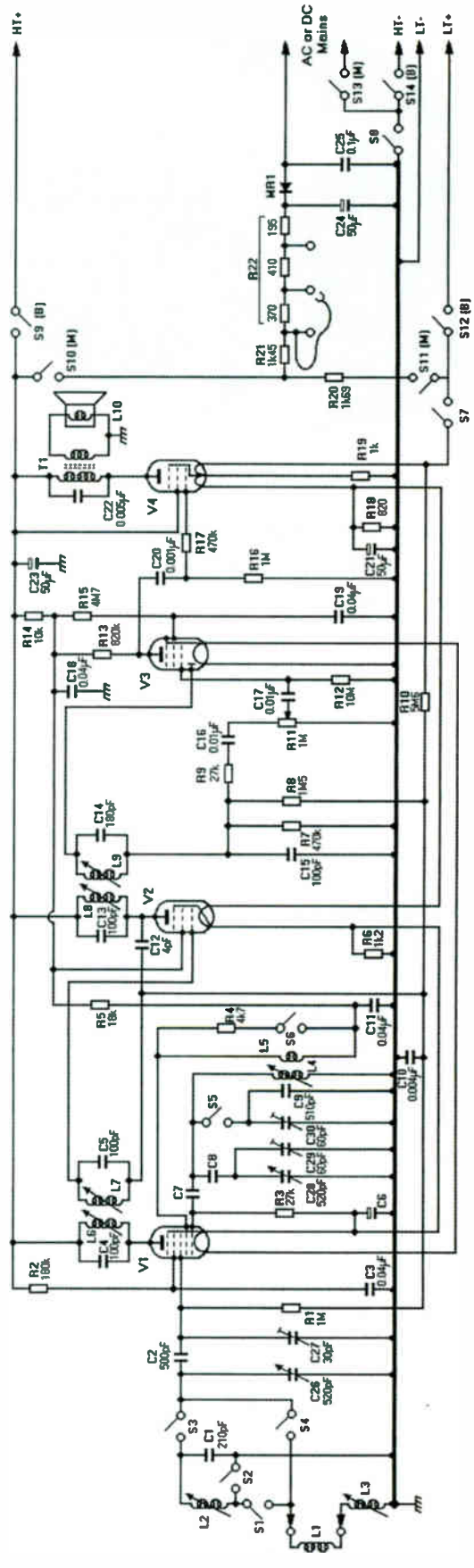


Fig. 2: Circuit diagram of the Ultra Coronation Twin Model R786. S7/8 is the on/off switch ganged with the volume control R11. S9-14 are the mains-battery changeover switches (M closed for mains operation, B closed for battery operation). S1-6 are the waveband switches: S2, 4 and 6 are closed for MW operation, S1, 3 and 5 are closed for LW operation.

JVC's latest hard-disk camcorders

The JVC Everio hard-disk camcorder Model GZ-MG30.

JVC has pioneered the use of hard-disk recording for camcorders. The latest Everio range uses a 1·8in. hard-disk drive. George Cole reports on the technology and the new range

In 2004 JVC launched a new series of camcorders under the Everio name. The initial C series models stood out from other camcorders in using a hard-disk recording system instead of tape or a DVD disc. They use MPEG-2 video compression, with the digital video stored on a removable Microdrive that provides a storage capacity of up to 4Gbytes. This September JVC is launching a second generation of Everio camcorders, the G series, which have a number of new features.

The technology

JVC points out that we are living in a post-tape age, as audio and video systems move from tape to disc-based mechanisms. In the personal-audio world, consumers first adopted the compact disc instead of the compact cassette, and are now moving to hard-disk and solid-state systems, exemplified by the success of Apple's iPod digital music player. In the video world the VHS recorder is being superseded by DVD recorders and Personal Video Recorders (such as the Sky+) that use optical-disc or hard-disk technology. Tape is still the main recording medium in the camcorder market, because of its high-density capacity and relatively low cost. But tape is already being challenged by DVD camcorders. JVC believes that the next step will be to the use of hard-disk technology and, possibly, solid-state recording – if costs can be greatly reduced and storage capacity greatly increased.

The six key benefits of hard-disk technology listed by JVC are as follows:

(1) High storage capacity – far greater than that provided by a tape or DVD camcorder.

(2) Random access for fast retrieval of specific scenes or images.

(3) High-quality pictures exceeding, in the highest-quality recording mode, that provided by DVD camcorders.

(4) High-quality still images and the ability to store many thousands of them.

(5) Computer editing via a USB 2.0 link.

(6) Convenience, because of the massive storage capacity.

Reception of the first-generation Everio camcorders was, according to JVC, positive though sales were not up to expectations. The company attributes much of this to their high price, at about £1,000 each. The new G series starts at about £600. JVC adds that suggestions from retailers also played a part in the development of the G series camcorders, including the need for longer recording times.

The 4GB Microdrives used in the C series models provide recording times that vary from one hour in the ultra-fine mode (recording data rate 8·5Mbits/sec) to five hours in the Eco mode (recording data rate 1·5Mbits/sec). Although larger-capacity Microdrives are expected to become available quite soon – an 8GB version is promised by the end of the year – their high cost is somewhat prohibitive.

As a result, JVC considered the various alternatives, as follows:

(1) MiniDV tape. This has a large storage capacity, maximum 11GB, but the size is large.

(2) 8cm DVD. Again the size is large and in addition the storage capacity is limited to 1·4GB.

(3) The SD card. This is small but has a limited capacity (1GB maximum) and is expensive.

(4) Microdrive. This is small with good storage capacity (4GB maximum) – larger versions are expensive.

(5) PC card. These have a large capacity (10GB) but the size is large.

(6) The 1·8in. hard-disk drive (HDD). The storage capacity is large at 20-40GB and the size relatively small.

(7) The 2·5in. HDD. The storage capacity is very large at 120GB, but so is the size.

JVC selected the 1·8in. hard-disk drive as offering the best possible combination of size, storage

capacity and cost. Unlike a Microdrive, the disk is embedded rather than being removable. This is less flexible in some ways, but the upside is that up to 37 hours of video can be stored on a 30GB HDD. Table 1 lists the various recording modes.

Another approach to extending the recording time would have been to use a more efficient video-compression format than MPEG-2, which was developed in the 1990s. More powerful compression algorithms have since been developed, such as MPEG-4. JVC considered the use of MPEG-4 but came to the conclusion that it was not quite good enough to use as a replacement for MPEG-2. It's likely that future-generation Everio camcorders will use MPEG-4 however. One thing to note is that in the higher-quality recording modes Everio camcorders use a constant bit-rate rather than a variable bit-rate, thus maintaining the highest possible picture quality. DVD camcorders use variable bit-rate recording.

Unlike many companies in the video field JVC has gone from tape to hard-disk technology rather than DVD. The company says that there are disadvantages with the DVD, including relatively short recording times and the fact that many blank discs would be needed to store the same amount of video as a hard disk, an inconvenience to the user. In this respect JVC quoted as an analogy the Apple iPod, which can store at least 1,000 songs, in comparison with someone carrying the same number of songs around on CDs. Other factors include the time taken for the camcorder to start up before recording can commence; the limited capacity, which means the possibility of having to change discs part way through a recording; and the fact that discs have to be finalised before they can be played by a DVD player. The Everio models are also being promoted for their convenience, with the ability to connect the camcorder to a TV set, VCR, DVD recorder or a PC.

The G series Everios

Three new Everio camcorders are being launched in September, Models GZ-MG20, GZ-MG30 and GZ-MG50. A fourth, the GX-MG70, is planned for October. Features of the MG20 include an 800k pixel CCD image sensor, 25x optical zoom and a 20GB hard drive that provides a maximum recording time of 25 hours. Model MG30 has a 30GB hard-drive that provides a maximum recording time of 37 hours. Model MG50 has a 1·33 Megapixel CCD image sensor, an f1.2 Superbright lens and 15x optical zoom.

Still images can be recorded on the HDD or a removable SD Memory Card. Dimensions are 67 x 70 x 109mm (w x h x d), while the weight is approximately 380g. Models were passed around for us to examine during the presentation. The Everio is certainly a compact camcorder, but it's not what you would call pocketable, like a digital camera.

The camcorders have some very useful features, such as a data battery that tells you how much recording time remains on the hard drive. You don't have to switch the camcorder on – just press a button on it and the information is displayed on the LCD screen. You also get a hard-disk graphic that shows the remaining space. This is similar to what you get when you go into My Computer with a Windows PC and right-click a hard-drive icon. A remote-control handset is provided, and users can locate recordings by the date they were made – useful when you think how many recordings you can accumulate on a large hard drive!

Protection

Camcorders have to withstand some pretty rough handling, which is why many have image-stabilisation systems. When it comes to hard-disk technology, additional protective measures are needed. The read/write head normally floats above the hard-disk platter. If the two 'crash' or come into contact, at best some of the data will be corrupted or at worst the disk would be severely damaged. Not much fun if you've got 37 hours of video stored on the disk!

Two systems are used to protect the disk. First, polymer shock absorbers dampen vibrations, using a floating suspension system. Secondly a g-sensor system monitors and calculates the gravitational velocity in three dimensions (height, width and depth), sensing when the camcorder is in free fall. Power is then switched off automatically and immediately, and the recording head is pulled away from the platter to protect it. During the presentation an Everio camcorder was tossed across the room with no ill effects. Notebook computers use a similar protection system. But the system won't protect the camcorder if it is dropped on to a floor.

JVC suggests that in the event of a hard disk crashing much of the data could probably be retrieved, though how much this service would cost the user is not known.

Playback and editing

The fact that the G series Everio camcorders use an integrated hard disk means that users have to connect the camcorder to another device via a wired connection for display, playback or editing. For straightforward video playback, composite video or S video outputs can be connected to a TV set, monitor, VHS recorder or DVD recorder.

A USB 2.0 connection is used for video editing (a cable is supplied with the camcorder). Recordings are stored as files, so users can drag-and-drop them from the camcorder to a PC at approximately four times speed.

The JVC Everio hard-disk camcorder Model GZ-MG50.

Digital still images can be printed directly from the camcorder via a PictBright interface. This is an industry-standard interface that enables digital prints to be made without a computer – the camcorder is liked directly to a PictBright-compatible printer.

An SD Memory Card with stored still images can be removed and inserted into an SD-compatible playback device.

JVC also provides editing and manipulation software for both Windows and Macintosh computers. PC users are provided with CyberLink DVD Solution for producing home-made DVDs. This includes a non-linear editing facility that can be used with a variety of formats including DV-AMI, MPEG-1, MPEG-2, Windows Media Video and RealVideo.

Table 1: Recording modes and times with Everio G series camcorders

Mode	MG50/MG30	MG20	Image	Video bit rate	Audio bit rate
Ultra (DVD Movie)	7hr 10min	4hr 50min	720 x 576, 50i PAL	8·5Mbits/sec	384kbits/sec
Fine (DVD)	10hr 40min	7hr 10min	720 x 576, 50i PAL	5·5Mbits/sec	384kbits/sec
Norm (TV)	14hr 10min	9hr 30min	720 x 576, 50i PAL	4·2Mbits/sec	256kbits/sec
Eco (internet)	37hr 30min	25hr	352 x 288, 25p PAL	1·5Mbits/sec	128kbits/sec

The recording times are approximate, with continuous shooting.
With NTSC recordings the number of lines is 480, with 60 interlaced fields per second, except in the Eco mode where there are 240 lines with 30 progressively-scanned fields per second.
The video bit rate is constant in the Ultra and Fine modes, variable in the Norm and Eco modes.

Future plans

JVC has lots of plans for its Everio camcorders and hopes that they will become in the video market what the iPod has become in the digital music market. There are plans for MP3 compatibility with future models, so that users could carry thousands of music files around in their camcorders.

There's no reason why Everio could not be used as a portable hard drive, with files transferred from a PC to the Everio and then downloaded on to another computer. The stumbling block at present is EU rules which impose additional tariffs on video devices that include a video-in connection. This is why the USB link in current Everio models is one-way only, from camcorder to PC.

As mentioned earlier, MPEG-4 compression is likely to be included in future models. There will also be a high-definition version at some stage. It is also safe to predict that future models will have even larger-capacity hard drives – and shrink in size.

Conclusion

Everio is an interesting system with some strong features, including the ability to store more than a day's worth of video on a hard drive. At present JVC is the only company that's decided to bypass DVD technology and opt for hard-disk technology instead. More and more consumer products are using hard-disk technology, for example personal video recorders and digital music players, so HDD camcorders seem to be a logical development. But with so many other companies promoting DVD camcorders, JVC will have to work hard to promote Everio.

JVC says that today's hard-disk drives are robust and reliable, and points out that tape-based camcorders can tangle the tape while DVD discs can easily be scratched. The company adds that it is more than happy with the number of first-generation Everio camcorders that required some form of service attention.

It's too early of course to say how well these new Everio camcorders will fare in a very competitive market. With a handful of tape-based formats, several DVD formats and now hard-disk drive models, camcorder users are certainly not short of choices! ■

Test Case 513

Despite digital TV, flat-panel screens and microprocessor control, it's mainly the same old circuits and components that give rise to faults. For every digital chip failure there are dozens of breakdowns in conventional power supplies, and faults with CRTs and their drive and scanning circuits outnumber those associated with flat screens many times over. Indeed with LCD-type displays it's the hot-and-hairy projection lamps, fluorescent backlights and mechanical bits such as cooling fans that are most likely to give rise to trouble. Many faults can arise in a perfectly conventional seven-year old TV set fitted with a CRT, but none of them should be difficult to find and fix. This particular one took a little while longer however.

The set concerned was a Ferguson Model V51NB, which is fitted with the Thomson TX91G chassis. It was a rental set that had been collected and brought into the workshop, the complaint being that the picture was too green. Once it had been hoisted on to Real Technician's bench and powered, the symptom was immediately apparent. Faces looked sickly indeed, while the background areas, for instance the snowy raster displayed when the aerial was disconnected, seemed to be lacking in green. The lads hooked it up to the workshop test-card generator, whose pattern showed that the green colour bar was excessively bright – to the point where it was smearing and spreading to the right. Near black level however there was a lack of green: dark greys had taken on a magenta colour.

Did Real Technician give these symptoms sufficient thought? Not really. If he had, might he have gone straight to the cause? Probably. What he actually did was to tap the neck of the CRT (with no effect) then jump to the conclusion that the RGB output IC was responsible. He found the right type of chip, a TEA5101B, in the component stores and straight away fitted it. Now how did you guess? The fault was still present in exactly the same form! So the IC was not to blame. But the tube could still possibly be defective in some way – not every internal fault reveals its nature with a tap on the glass. RT's next step therefore was to swap over the drives to the green and red cathodes (pins 6 and 8). He wanted to see a green picture, so that he could condemn the set and be rid of it. But this was not to be. The red parts of the test pattern, now containing 'green' information, came up bright and flared badly, while lowlights in the display took on a cyan hue. This indicated that the cause of the fault was somewhere in the green-drive circuit, most of which is buried inside the multi-legged IC that had already been replaced.

The next test was a comparison between the low-level RGB signals that arrive at the CRT base panel via connector HT01. They proved to be identical with a black-and-white picture. But the waveform that drove the green cathode (the original connections had been restored) of the now exonerated tube was grossly different from the red and blue drives. There followed some desultory testing, with an ohmmeter, of the diodes associated with the green output stage, and also some of the low-value resistors between the IC and the tube. This failed to turn anything up. But the cause of the fault was finally located and rectified. What was it? Turn to page 699 for the solution to this one.

Adrian Gardiner describes a simple I²C interface for use with EEPROM chips and some recent servicing problems

Bench Notes

I²C interface

In my article on workshop equipment (July, page 554) I mentioned that we routinely keep copies of known good EEPROM programs in our workshop PC. I subsequently received an email from Douglas Russell asking where an I²C interface for use with a PC can be bought.

A simple interface can be built from a handful of parts that you probably have lying around. Fig. 1 shows the basic circuit we use. Pin 7 of the EEPROM (U1) is shown with a pull-up resistor and a jumper link to connect it to 0V. In our interface we simply connect pin 7 to 0V, which enables the EEPROM to read/write. When pin 7 is high, the EEPROM is in the read-only condition. Inclusion of the jumper enables us to test this facility. The interface connects to a standard PC parallel port.

Construction is straightforward. Almost any npn transistor can be used in positions Q1 and Q2. If a BC847 surface-mounted type is used the entire circuit, minus the EEPROM, will fit inside a standard parallel plug shell.

The software we use is an excellent program called PonyProg. It can be used with a wide range of EEPROMs, and provides saving to multiple data formats. Best of all, it's free! The software can be downloaded from http://www.LancOS.com which also contains a lot of useful information and other interface circuits.

The Vestel 11AK45 chassis

A large number of inexpensive sets, all fitted with the Vestel 11AK45 chassis, have come in recently. They bear various brand names, mainly JVC, Hitachi and Bush, and tend to suffer from a common fault, EEPROM failure – perfect for the I²C interface! Model AV28GT1SJF is a typical JVC example. Hitachi sets include Models C28W460 and C28WF560N. The Bush sets have various model numbers, including RF6683 which is fitted with a super-flat CRT and RF6694 which includes a Freeview DTT decoder.

A few bytes in the EEPROM seem to fail, corrupting the contents. Symptoms include geometry errors, particularly in the 4:3 mode, returning to standby on certain channels and complete failure to operate.

Repair is simply a matter of replacing the EEPROM (type 24C16), loaded with the appropriate software. Although the EEPROMs come preprogrammed when ordered from the manufacturers, only JVC ones seem to work without any further setting up. If you have a copy of the program for each model stored in your PC however setting up is eliminated: you simply load the settings into the new EEPROM before installation. This also enables inexpensive black EEPROMs to be used for out-of-guarantee sets. Note that although the above models are all fitted with the same chassis it's not possible to interchange the manufacturers' data, as this is customised for each model.

Another common problem with the 11AK45 chassis is failure of the STV9379FA field output chip. This is nearly always caused by a corrupt EEPROM. It sends the picture off the bottom of the screen, overloading the field IC. So be sure to replace the EEPROM as well as the field output chip, and make sure that you fit one which has the suffix FA. Type STV9379 is not suitable!

An interesting Panasonic

A Panasonic TV/VCR combi set, Model TX21GV1, arrived on my bench recently. The complaint was that it reverted to standby intermittently. When the fault occurred it was not possible to turn the set on again using the remote-control unit. You had to switch the set itself off then switch it on again.

The on/off switch is of the 'soft' type, which doesn't disconnect the mains supply. When it's used to switch the set off, you can't use the remote-control unit to switch the set back on again. But in the fault condition it was still possible to insert or eject a videocassette.

It's not easy to dismantle the unit. Once you have taken the back off, the power supply/deflection PCB has to be removed from the top of the chassis. The next step is to dismantle the screening metalwork, then remove the deck. After that the main PCB can be extracted from the plastic shell.

After doing this I gave the PCB a thorough visual inspection. The on/off switch, which is mounted on this panel, was dry-jointed at one side. Resoldering, followed by reassembly, cleared the fault condition.

The Hitachi A7 chassis

This chassis used to be straightforward to repair. Normally all we had to do was to attend to dry-joints at the regulators and the field output IC. Just recently however we seem to have been getting all sorts of other nasty faults with these sets.

The complaint with a large 32in. set, Model C32W410, was simply "dead". When I removed the back my heart sank on seeing the shattered remains of what had been a fuse. But it was a nice easy job for a change, as replacement of the fuse and the four mains bridge rectifier diodes brought the set back to life. One of the diodes had gone short-circuit. When this happens I prefer to replace all four diodes – in case the others have been subjected to stress.

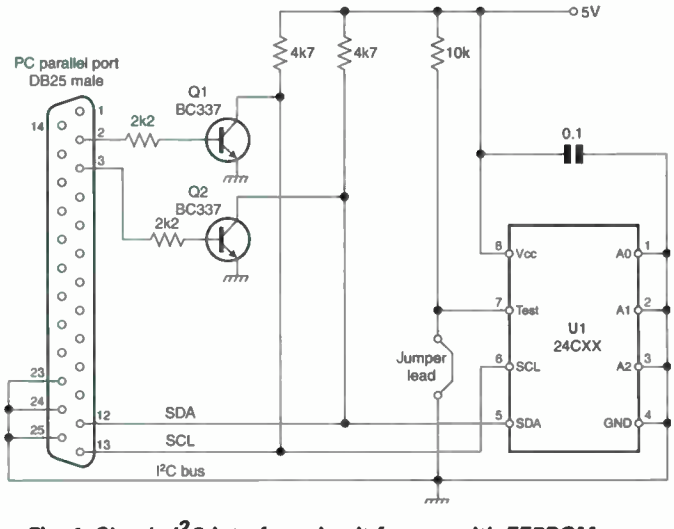


Fig. 1: Simple I²C interface circuit for use with EEPROMs.

AUDIO FAULTS

Reports from
Chris Bowers
Geoff Darby
and
Philip Rosbottom

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

Reports can be sent by post to:

Television Magazine Fault Reports,
Nexus Media Communications,
Media House,
Azalea Drive, Swanley,
Kent BR8 8HU

or e-mailed to:
t.winford@highburybiz.com

Sony ZS-D55

This portable unit would stop playing a disc after five minutes. Inspection of the CD mechanism assembly revealed the cause of the trouble – the flexible PC link (358) at the optical pickup. A replacement, part no. 1-660-965-11, restored normal operation. **C.B.**

Sony TA-VE25

This unit's power button had been pushed in and broken. Inspection inside revealed that the button is part of the plastic front assembly. The complete front panel, part no. A-472-283-7A, had to be replaced to restore normal power-on operation. **C.B.**

Sony MDS-JE520

This unit would flash error C013 in the display while trying to record. Checks inside revealed that the KMS260A optical pickup was defective. A replacement restored normal operation. Make sure that you connect the flexible PCB before removing the ESD protection jumper. **C.B.**

Sony STR-DE495

This is an AM/FM receiver. The sound from the amplifiers would cut out after five minutes, but the audio output relays remained in the same state. The cause of the trouble turned out to be the direct function select chip IC201 on side B of the main board. It had not been fitted and soldered correctly. All that was required to restore normal operation was to resolder this IC. **C.B.**

Sonic Link DM20

For various reasons that I won't go into here, other than to say that as usual family were involved, this was another of those 'must-fix' jobs. It's apparently part of a karaoke system, and is described on the rear panel as a 'dual mono amplifier'. I would have said that it's a normal stereo amplifier myself, with volume and balance controls as well as input and push-button selectors for tape, video, radio, CD and phono. The complaint was that the output from the left channel was distorted, and had defied all attempts at repair elsewhere.

When I opened it up I was confronted with a large toroidal transformer and a single fibreglass PCB with a fairly conventional-looking amplifier on it. The only slightly worrying thing was a silk-screened legend that said "Audio Kits".

Initial tests were inconclusive. The voltages in the bad channel were certainly wrong, but not hugely so. Scope checks however showed that only one half of the signal waveform was being amplified, hence the horrendous distortion. Then followed the inevitable slip of the meter probe . . . One pile of dead transistors later I had nothing at all from the left channel, but still wrong voltages in the early stages. At least nothing was burning however!

There's a 5mm LED in each channel back in the driver stages. I've never been very happy about this practice, though it seems to be quite common. Basically it's a way of obtaining a stable reference voltage – the forward voltage drop across the LED. The voltage is very prone to tolerance spreads however, and the exact characteristics of the LED. It's also not particularly stable with temperature change. In the good channel there was about 2V across the LED, which seemed reasonable for a red type. In the bad channel the voltage reading was 10V, which indicated that the device was open-circuit. I didn't have any 5mm red LEDs, so I fitted a 3mm one. As its efficiency was somewhat better than the original type, it actually lit up.

I now had correct voltages and normal-looking drive right up to the output transistors, but still no output from the left channel. This final problem was a leftover from the blow-up I had caused: there were open-circuit 1Ω resistors by the output transistors.

To keep everything balanced, I also replaced the 5mm LED in the right channel, using the same 3mm type I had fitted in the left channel. When the amplifier was reassembled and tested there was remarkably good audio from both channels. **G.D.**

JVC CA-MXGT91R

There were several complaints with this hi-fi unit, including intermittent failure to play CDs, failure of the CD drawers to open and sticking tape decks. When I tried it the mechanical operation of the CD deck was erratic to say the least. Trays would sometimes eject all the way and sometimes not at all. At other times the deck seemed to be confused mechanically.

A lift cam at the left side of the deck moves the tray loading gear up and down to engage with the requested tray. A mode switch reminiscent of the type used with VCR decks is beneath this lift cam. At the right side of the deck there are six little lever switches that sense the in/out positions of the three trays.

I decided that a good initial move would be to clean all these switches. The cam gear was easily removed after teasing off the retaining cut washer. The mode switch was then given a good scrub round, with some switch cleaner/lubricant injected. Vigorous operation of the lever switches,

again with cleaner injected, saw to these. When the deck was refitted it performed faultlessly, apart from poor playability. This was corrected by cleaning the dust off the laser lens.

The final problem, with the tape decks, was cured by replacing both main drive belts. It's a very common problem with all the tape-deck variations fitted in different JVC models. **G.D.**

Sony TA-H3600

This amplifier, which is part of a four-piece system, produced normal audio from the headphone socket but not from the speakers. The immediately apparent reason for this was that the output protection relays didn't close. It was easy to get at the terminal pins of the relays, so I applied my scope to each of the four output channels (two bass, two mid/high frequency) and found normal-looking audio with no DC offset. Having established that there was nothing that might potentially damage the speakers, I momentarily shorted across the relay contacts for each channel in turn. This produced normal audio. So I turned attention to the protection sense and drive circuitry, which is centred around IC701, on the power amplifier board.

Voltage checks at the pins of the IC were inconclusive. They were not correct compared with the readings shown in the service manual, but except for pin 6 they weren't far enough out to lead to any immediately suspect components. The voltage at pin 6, the drive pin for the relay coils, was completely wrong of course.

I began to suspect the IC itself. A hunt through the scrap box produced a board that had one on it, so I set about removing the power amplifier board to get to the IC to replace it. Once the board was out however I spotted telltale signs of electrolyte leakage on the reverse side, close to IC701. The nearest capacitor is C702 (220μF, 10V), and there was a strong smell of fuming electrolyte when it was unsoldered. Curiously however it didn't look as though it had been leaking, and ESR and capacitance checks proved that it was OK.

I cleaned up around the area and fitted a replacement anyway, but the results were the same. I then replaced the other two electrolytics in the vicinity, C706 and C707, though once again the old ones checked OK.

One or two clues suggested that someone might have been here before me looking for the cause of the fault, and I began to suspect that they had replaced the leaky capacitor without cleaning up the board. I have to say however that the components and the soldering looked original.

This time when I refitted the board the speaker relays closed at the right time and there was normal audio – briefly. After about five seconds both relays dropped back out. Once I had removed the board again I examined the area of the leakage in minute detail. I found that the PCB holes for R705 were blackened around the edges. So I replaced the resistor and reflowed every joint in the area. This time when the unit was reassembled and powered the relays closed at the appropriate time and, thankfully, remained closed! **G.D.**

Pioneer XC-L5

Thanks are due once again to the nice man at Pioneer, without whose suggestion the problem would probably have taken a lot longer than it did to solve. Basically, the whole system worked all right except that the output protection relay kept cycling on and off at regular intervals of about three seconds. When it was on there was normal audio from both channels, with no measurable DC offset.

The cause of the problem was a defective fan. Apparently the protection circuitry checks the current drawn by the fan to see if it's working. If not, it cycles the relay to warn the user that there's a problem.

When I removed the fan it was tight. It was easily freed with a little oil in the bearing, but still wouldn't run. So damage had presumably occurred to its windings as a result of it being stalled, despite it being an electronically commutated type. These are normally impedance protected. All was well once a new fan had been fitted. **G.D.**

Proton AA1150

This large power amplifier would blow the mains fuse on the rear panel because there was a short-circuit across the input. It's a very prestigious item (the amplifier, not the fuse) from the late Eighties, with the incredible short-term power capability of 280W at 8Ω or 600W at 2Ω, but is essentially a 50W RMS stereo amplifier. Anyway back to the fault, eh?

Someone had looked at it before. It seems that they may have disconnected the mains wiring to fault-find then connected it up wrongly, as one transformer (dual mono) was open-circuit (excess-temperature sensors open-circuit) while the other one was fine. One of the bridge

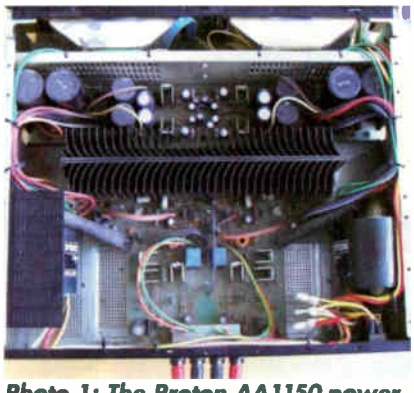


Photo 1: The Proton AA1150 power amplifier.

rectifiers was missing from the channel with the faulty transformer. I suspect that it had gone short-circuit and fried the transformer. There are approximately four windings on the secondary side of the transformers, arranged to provide 64-33-0-33-64V.

I connected the good transformer to the two channels to see if they would power up and found that they worked fine. Now I have to decide whether it would be worthwhile having the transformer rewound. **P.R.**

B&O 3000 receiver

This unit looked as if it wasn't powered up: the power switch, with 'off' over it, is 'on' when it's up, indicating 'off'. I'm confused already!

The cause of the problem – FM drifting through the stations (the unit is varicap-diode tuned) and the left-right channels not working – turned out to be the switchbank. The lever switches are on an interlinked assembly. Either the lubricant had dried up (the unit dates from 1969) or the contacts were corroded. A couple of soaks with WD40 equivalent were required along the whole length. This, followed by constant operation of all the switches for a length of time, eventually got them working again. **P.R.**

Photo 2: The B&O 3000 receiver.

LETTERS

Send letters to "Television", Nexus Media Communications, Media House, Azalea Drive, Swanley, Kent, BR8 8HU or e-mail t.winford@nexusmedia.com using subject heading 'Television Letters'.

Please send plain text messages. Do NOT send attachments. Be sure to type your full name, address, postcode, telephone and e-mail address (if any).
Your address and telephone number will not be published but your e-mail address will unless you state otherwise.

Diversifying

Oh dear, Elaine is feeling sorry for herself (the answer is diversify, July)! We all feel a bit despondent about the state of our trade from time to time – but take in a lodger? This time of the year is traditionally quiet. As usual, conditions will improve again.

It's a good time to consider your advertising. When was the last time you did a local leaflet drop? A few spare hours a week can be beneficially used going round the new local housing estates with a fist full of them.

What about your skills? If it hasn't already happened, plasma and LCD sets will soon appear on your bench, also DVD recorders. Are you ready for them? Now is a good time to look into such matters and prepare yourself. It's often thought that we will all become redundant as new technology takes over, with manufacturers taking servicing in house. The reality is that manufacturers will be happy for local companies to handle it when – and only when – engineers have updated their skills.

Elaine is right on one point. Diversifying is good, but shelf stacking at the local supermarket? Come on, we're professionals! Diversify into other products. As repair engineers, our skills can easily be adapted. Now is a good time of the year to service portable air conditioners. You may not be able to tackle the refrigeration side, but most faults concern straightforward fan or control failure. As a worst-case scenario you can turn to more mundane repairs such as vacuum cleaners – they are straightforward and moneymakers. Having expanded your service activities and with it your customer base, you will find that recommendations bring in TV sets when they break down.

Now stop feeling sorry for yourself and go make some money!

Adrian Gardiner,
Dereham, Norfolk.

Vintage audio

The technology moves on relentlessly, with the humble cassette having been superseded by the CD, DVD, MP3 and a multitude of other digital formats. I still have many old tapes however. Although I listen to them only rarely, I wouldn't want to be without them.

So the other day I attempted to get my trusty old Aiwa ADF-640, which hadn't been used for about a year, to play an old comedy tape. It was the first proper piece of hi-fi equipment I bought, in the late Eighties, and is an excellent machine, with three heads, dual capstans, fine bias control and Dolby B/C/HX Pro. Not up to the standards of the best Denons and Nakimichis of course, but still capable of superb recordings.

One surprising oversight with this machine is the provision of a headphone jack with no way of controlling the volume, especially as the default volume is so high it can be painful. But it's not too difficult to add a little volume control, adjustable, at the back of the device.

When I first had the unit it developed a temperature-related fault after about six months' use. The logic would become wonky – lights flashing, suddenly going into the record mode etc.– but only when the machine was cold. It was completely reliable once it had warmed up. I returned it for attention but no one could find the cause of this intermittent trouble. I eventually traced the cause to the oscillator can associated with the microcontroller chip. After careful removal a barely visible solder blob was seen, between the inside of the can and one of the pins. The temperature change must have been enough to produce either a short or not. It has worked flawlessly since then – until the other day, that is.

It didn't play that old tape. The drive belts seem to have stretched and now slip on the motor. Does anyone know if replacements can be obtained and, if so, where?

Nick Smith
nick@smithnet.ods.org

The Pansonic Euro-4 chassis

Test Case 511 (July) related to a faulty widescreen tube in a Panasonic set fitted with the Euro-4 chassis. The tubes are of Philips manufacture however, at least the ones I've come across have been, with a Panasonic label smartly stuck on top. Carefully peeling the Panasonic label back will reveal this. In our neck of the woods the problem is becoming quite common with two-three year old sets, making an otherwise very reliable set uneconomic to repair. I understand that Philips had a problem with widescreen tubes for a time.

While on the subject of the Euro-4 chassis, when resoldering the STRF6654 chopper chip IC801 ensure that the mains bridge rectifier's reservoir capacitor C811 is fully discharged, as the IC can be damaged if the charge remains – as I've found out.

Ray Dunleavy,
Raphoe, Ireland.

BS cheques and Leak amplifiers

In the August letters page Michael Dranfield mentions Building Society cheques being as good as cash. At one time they were stolen in large quantities, though I don't know if this is still the case. A stolen one is still worthless, no matter how well it's filled in

On the subject of Leak amplifiers, I worked for the company as a lad. If anyone wonders how they got the wires so straight, it was me! I took a three-foot length from a reel, put one end in a vice and gripped the other with a pair of pliers. By pulling it steadily the wire would give and stretch a fraction, making it straight as a die. The wiring staff then cut off lengths to suit, adding right-angle bends as required.

Brian Gilbert,
Hampton, Middlesex.

ESR measurement – and radiograms

In his review of the Peak Atlas ESR meter in the June issue Eugene Trundle makes the point that "it would be good to have had ESR readings up to 20Ω, to take into account low-value, high-voltage capacitors such as the 1μF and 2·2μF, 100-400V types typically found in the 'kick-start' circuit in a chopper power supply – they often fail".

The Peak Atlas ESR tester's upper reading is 10Ω. The ESR of a good 1μF, 450V capacitor is typically 15Ω which, as

Eugene points out, is outside the range of the tester. There's a simple solution to this however – the range of the meter can be extended to measure from 10-100Ω.

The unit's test leads are terminated by miniature crocodile clips. Eugene made some needle-pointed test probes to connect to these clips to make in-situ tests easier. If a 10Ω resistor is connected between the clips when we need to test these out-of-range capacitors, the tester will read the parallel combination of the 10Ω resistor and the ESR of the capacitor. A good 15Ω ESR 1μF, 450V capacitor then reads 6Ω, while a capacitor with an ESR of 50Ω will read about 8Ω. The upper limit that can be measured is about 100Ω, which will give a reading of about 9Ω.

The formula for two resistors in parallel is R total = (R1 x R2)/(R1 + R2). In our case the effective ESR reading will be (10 x ESR)/(10 + ESR).

There's a case for having a resistor of say 20Ω always connected across the test leads. It will have little effect on the readings that mainly concerned us, but increases the upper range. In general we are interested in capacitors that normally read less than 1Ω, which is marginal for a 47μF capacitor. In the main the presence of a 20Ω resistor will have little effect on the usual tests but will log out the higher readings, making them readable.

If a 20Ω resistor is wired in permanently, a capacitor with an ESR of 15Ω will read 8·5Ω. This is within the range of the Peak Atlas tester. If the resistor is a 3W wirewound type it will help in the discharge of any charged capacitors. From the specification listed, the abuse voltage tolerated across capacitors over 10μF is 40V. The main reservoir capacitor in a TV set is well above this restriction when charged. It is of course this very capacitor that does the damage to ESR meters.

Remember that ESR is an in-phase component, and can thus be considered as a resistor.

On a different topic, Philip Bearman writes in the August issue about his first attempt to reduce the volume, to solve a nuisance problem, produced by a radiogram (what's a radiogram do I hear some of you say?). He fitted a 10Ω potentiometer across the loudspeaker and adjusted it for an acceptable sound level. I think it should be pointed out to younger readers that a valve output stage requires a transformer to match the high impedance at the anode of the valve(s) to the low impedance of the loudspeaker. A valve output stage is quite happy with a short across the loudspeaker connections – it just damps the primary winding. If there is an open-circuit however the audio output transformer will be quite distressed. The opposite is the case with solid-state audio output stages: an open-circuit will not normally do any damage, but a reduced load will.

Alan Willcox,
Cardiff.

Colwyn Bay Wireless College

As an Old Boy of Colwyn Bay Wireless College I was interested to see the letter and photograph from Alun Rawson-Williams (May, page 442). I feel however that he is mistaken in dating the view of the "wireless service engineers training department" as being in the Thirties.

I don't know when Alun first used an AVO Model 7, but I would be surprised if it was as early as that. I never saw an Avometer until after the war – certainly not at Colwyn Bay, where the equipment was famed for its antiquity!

When I attended Colwyn Bay in 1941-2 and again in 1948 it was entirely devoted to training marine radio officers. The only test equipment I recall was a voltmeter encased in a small wooden box about 3-4in. square and 2-3in. deep. Three wires with crocodile clips enabled you to measure voltages on two scales – both, if I remember correctly, DC. For many years this was a standard item of equipment, ashore and at sea.

The equipment on which we trained consisted of a Marconi 0·5kW CW/ICW marine transmitter, type 381; a Marconi type 352A marine receiver; an 0·25kW quenched-gap spark transmitter, type 341, a type M automatic alarm; and a type 359 direction finder. To simulate radio signals on which to take bearings a second goniometer, contained in a biscuit tin, was mounted above a door. It was generally referred to as "the goniometer over the door" to distinguish it from the one in the DF receiver.

Many are the tales told about the exploits of Colwyn Bay students, far too many (and nefarious) to mention here. But after the war we had an Indian student called Ram Rao who disappeared at intervals to fly his plane down to the Riviera. It seems that he was a rajah who, unfortunately, died an early death after his return to India.

As for the Wireless College itself, it fell victim to progress, being demolished to make way for a new road.

Richard Shaw,
Dunstable.

Editorial note: An advertisement in our copy of the *Trader Year Book* for 1939 shows an AVO Model 7 that certainly looks like the meter in the photograph we reproduced.

Electronic microscope

Failing eyesight comes with increasing age, especially for close-up work which, of course, is what our trade needs. Unfortunately, unlike other problems associated with those of us in our fifth decade, they haven't yet come up with a little blue pill to fix the problem!

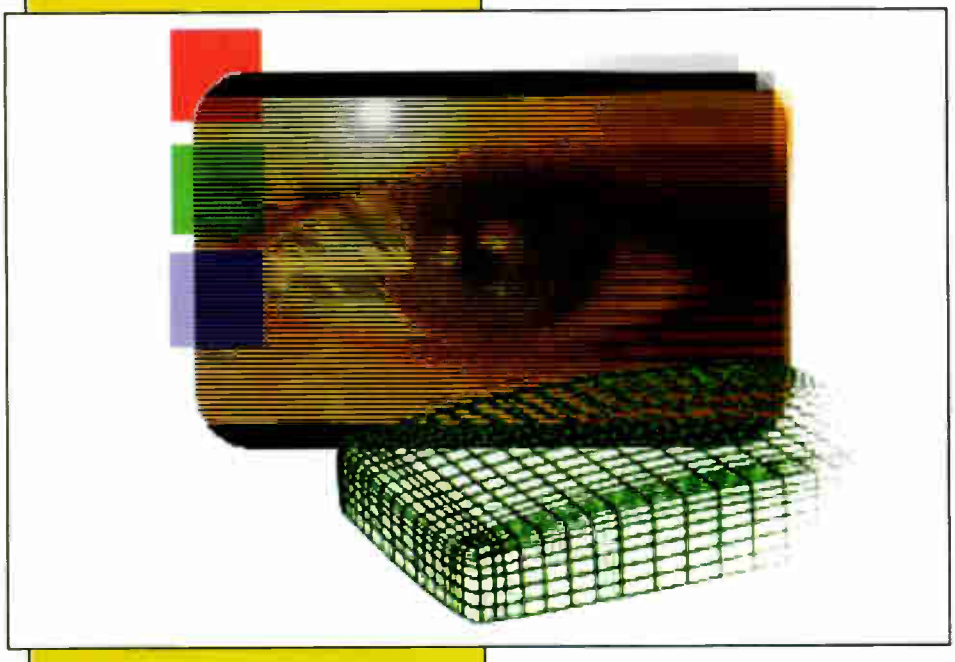
For the past few years we have been using a small electronic microscope made by C2D attached by USB to the bench PC. This microscope has its own built-in light source and can be freely moved across a PCB to look for track damage, identify components, etc. It has been very useful: the magnification can be altered from 10 to 220 – the lowest magnification is usually enough – and it beats an illuminated bench magnifier hands down.

Last month the bench PC gave up the ghost. So we attached the microscope to the USB socket of a new laptop computer. Unfortunately we then found that the device wouldn't work without the installation CD that came with it several years ago. And here lies our problem. The installation CD has been lost and, while there's an internet site from which to download a copy, the link is dead and emails to the manufacturer have brought no reply.

I am therefore wondering whether any reader has a compatible microscope installation and driver CD? I would be happy either to copy it and return it immediately or perhaps it could be emailed to me for a small fee? The microscope, of C2D manufacture, is made of dark-blue plastic with light-blue controls and is described as a microscope/camera. The only identification on the side is a small logo that says "C2D Microscope", with "C2D Camera" at the front and "Made in China" on the base. It seems that it's no longer a current model.

Perhaps this is a lesson for the future: when buying unusual computer peripherals, the driver CDs should be kept in a very safe place!

Robert Philpot,
philpot@clara.co.uk



TV FAULT FINDING

Reports from
Philip Salkeld
Eugene Trundle
Dave Husband
L. Gare
Uel Harte
Charles Ritchie
Richard Lewis
David Ingrey
Bob Longhurst and
Glyn Dickinson

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

Reports can be sent by post to:

Television Magazine Fault Reports,
Nexus Media Communications,
Media House,
Azalea Drive, Swanley,
Kent BR8 8HU

or e-mailed to:
t.winford@highburybiz.com

Sharp 28LF92H (11AK45B chassis)

These sets are coming in with various fault symptoms, for example failure to come out of standby, blanking out when selecting picture size modes, and intermittent cutting out. The faults are caused by the same component, the EPROM IC502. The part no. is V20144774. After fitting the replacement you will have to set up the picture formats. **P.S.**

Sony KD32DX51U (FE2D chassis)

This analogue/digital set came in as a stock set, which means that it had been returned by the customer as faulty. The fault slip indicated that you couldn't record digital stations. When I tried, it recorded the digital sound with the analogue picture or, sometimes, a blank raster. Time for the Aspirin or, better still, a phone call to Sony technical.

The nice man told me he had heard from other dealers that the soldering to the surface-mounted transistor Q4608 on board A1 was poor. This is the small board next to the main one, so it was easily removed. When I examined it under the magnifier I saw that one of Q4608's pins had no solder at all. To my relief, resoldering it put matters right. **P.S.**

Philips 21PT4458/02 (SL01.2E chassis)

This set was dead apart from a faint tripping noise. I soon found that the BUT11APX line output transistor (part no. 9340 5632 1127) was short-circuit. But when a replacement was fitted the line output transformer started to arc. A new transformer (part no. 4822 1401 0669) plus another BUT11APX transistor completed the repair. **P.S.**

Panasonic TH-42PA20

This plasma set would switch to standby after ten minutes. Use of freezer and the hairdryer brought me to IC551, which is on the top centre panel. Panasonic technical confirmed that this could well be the cause of the trouble. So I ordered and subsequently fitted a replacement, part no. C5HABZZ00123. A long soak test then confirmed that the set was OK. **P.S.**

Toshiba 28ZT29B

This digital set came in because the picture was breaking up with a green cast. After a few minutes the analogue picture would cut off then appear again. The digital board is in an aluminium screening can to the right of the chassis. At present it's not a repairable item. The procedure is to order a replacement, part no. P237B7656, and return the faulty one to Toshiba. **P.S.**

Beko 284248WNS (14.2 chassis)

The customer complained that the picture had moved over – part of the Sky logo was missing. I found my service remote-control unit to adjust it but, to my horror, it refused to select the service menu. A quick phone call to Beko provided the answer. Use the customer remote-control unit to select the main menu, punch in 9301, then use ± volume to select horizontal shift (HSHT) and ± channel to alter the setting. Press 0 to exit and store settings. My thanks to Beko. **P.S.**

Philips L01.1E chassis

Poor EHT regulation is an uncommon fault these days. This set's picture ballooned with brightness changes, settling down only at very low levels. When checked, the HT reservoir capacitor C2561 (47μF, 160V) was found to have a high ESR. A replacement cured the problem. **E.T.**

Panasonic TX21M2T/B

The sound and picture disappeared intermittently, being replaced by a squealing noise. I found dry-joints at three pins of the line driver transformer T351. It was fortunate that the line output transistor had survived in this situation. **E.T.**

Tatung B chassis

The initial problem with this set was field

collapse with R451 overheating. This was cured by replacing the TDA3654 field output chip IC402 and its flyback-boost components C425 and D402. We then had a wide picture with pincushion distortion. TR405 (BC557) in the EW circuit was leaky. **E.T.**

Toshiba 21S23B

At switch on the picture was fine. After about five minutes however the field scan progressively decreased, to the point where there was just a bright band about an inch deep across the screen. Replacement of the field timebase chip IC401 didn't help. We eventually found that C412 (47nF), which is connected to pin 7 of the IC, was faulty – leaky in fact. **E.T.**

Decca D32W4415

This big widescreen set didn't work at all. The user reported that he had noticed a burning smell before the final failure. It had come from the line output transformer. All was well once we had fitted a replacement, type FBT40824 from SEME. **E.T.**

Philips 28PW6332/05 (MD1.2E chassis)

The problem with this set was intermittent line scan collapse. It was caused by a dry and burning soldered joint at the little connection PCB on the scan-coil assembly. The EW drive FET Tr7480 had been wrecked as a result. **E.T.**

Goodmans W322NS (F19 chassis)

There was no sign of life until the 2A mains fuse had been replaced. We then got sound but no picture. Several dry-joints were found in the line output stage and, in addition, C72 (1μF, 250V) had dried up, C73 (680nF, 250V) was open-circuit and resistors R82 and R83 (both 15kΩ) were burnt. The effect of C73 being open-circuit was excessive width. **E.T.**

Samsung CS6226Z

When this set was switched on there was severe and continuous sparking: the insulation of the line output transformer had broken down. Repair was not sanctioned, because of the high cost of a replacement transformer. It then emerged that this set had been bought in Saudi Arabia. **E.T.**

Toshiba 15V11B

It's the first time I've seen one of these portables, so I was thankful that it is included on Toshiba's service manual CD SMCD005. The problem was that the HT would start to decrease after about ten minutes, with the result that any increase in beam current reduced the width and caused field foldover.

Much use of freezer and the hairdryer pinpointed Q502 (KRC111SRTK), a surface-mounted transistor that's located close to the optocoupler. It seems to be used to shut down the power supply in an excess-current condition. To my surprise it read open-circuit when removed. **D.H.**

Amstrad TVR1

The TV sound was very distorted but it was OK when playing videotapes. Off-air sound is routed via Q2301. Checks here revealed that the base bias was only 0·03V instead of 5V. The cause was R2304 (100kΩ), which was open-circuit. **L.G.**

B&O L2800 (type 3726)

When this set was switched out of standby there was a sound like very rough line drive, then it reverted to standby. The lower EW modulator diode D34 was short-circuit and the line output transformer was faulty. Once these items had been replaced the set produced a picture with reduced width and heat came from diode D37 (BA159) which was leaky. All was well once this diode had been replaced. **L.G.**

Minato T1401 (PT92 chassis)

This set had been bought from Tesco. It was dead because the start-up resistor RP06 (3·9MΩ) was open-circuit. **L.G.**

Amstrad STV20

The picture was very poor with terrestrial TV reception but satellite reception was fine. Scope checks around the LA7952 video switching chip IC501 showed that the output waveform at pin 1 looked very much worse than the terrestrial TV that went in at pin 4. In fact C503 (470μF, 16V) was short-circuit. **L.G.**

Daewoo GB14C3BL

This fluorescent-purple coloured 14in. portable was dead. Fortunately power-supply output voltages are marked on the PCB. They were all present though the 12V supply was low at 9·8V. As there was HT at the collector of the line output transistor I decided to check the DC conditions at the line driver transistor. There was no collector voltage because the driver transformer was open-circuit. A replacement, from a scrap CP380 chassis, cured the fault. **U.H.**

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

The reported fault was dead with a clicking sound. Expecting to find a short-circuit line output transistor, I was surprised to discover that the relay, circuit reference 1400, used to switch for panorama viewing was clattering continuously. A replacement line output transformer restored normal operation. **U.H.**

Daewoo DWX-28W5GB (CP885 chassis)

This dead set had been elsewhere. The mains fuse was missing and the STR-F6654 chopper chip I801 had either been resoldered or replaced. Whatever had been done there was a short between pin 4 (VCC) and chassis. After removing the IC I decided to check other components and found that R855 (3·3MΩ) and R804 (0·22Ω) were both open-circuit. As a precaution I decided to replace the optocoupler chip I804 as well. Once the replacements had been fitted the set produced an excellent picture. **U.H.**

Matsui 2109NS

The set was dead. I am not familiar with this chassis but soon found that the chopper FET drive was not being biased on. The cause was the 2·2MΩ start-up resistor RP506 which was open-circuit. **U.H.**

Grundig ST55-934 (CUC2121 chassis)

The fault symptom was line collapse. The burning smell that was present quickly took me to C53006 (330nF) and R30012 (10kΩ) which were both open-circuit. Replacements restored normal operation. Note that the value of these components can vary depending on the type of tube fitted. **U.H.**

LG KI-14V38

This set was dead with the mains fuse blown. The usual culprit, the degaussing posistor, was this time intact. Before condemning the expensive STR-S6707 chopper chip IC1801 check the blue disc-type capacitor C807 (1nF, 1kV) which may be leaky or short-circuit. **U.H.**

Philips 25PT4103/07 (L6.2 chassis)

The fault symptoms with this set were field cramping and flyback lines at the top of the picture. Once C2904 (100μF, 25V) and C2905 (220μF, 25V) had been replaced the field scanning was correct. **C.R.**

Bush WS6680SIL (Beko 14.2 chassis)

The job card said "no picture". I had the set on soak test for several days but the fault never put in an appearance. When I phoned the customer he told me that the fault was intermittent and that when it occurred the picture slowly faded off and

on, with the sound remaining. This immediately suggested a problem with the CRT's heater supply, which proved to be the case. The ballast resistor (value depends on CRT type and size) was dry-jointed. **C.R.**

Roadstar CTV5501

This 5·5in. colour portable had a very defocused picture. The old glue that supports the base socket on the neck of the CRT had become conductive. Cleaning it off cleared the fault.

But the base socket then didn't fit tightly against the CRT neck, and there was the possibility that with normal handling it might fall off. I used a few drops of hot-melt glue to support it and avoided applying this to the high-voltage pins, i.e. focus and A1/G2. **C.R.**

Muruyama PHL14T (Philips CTT-H AA chassis)

This set appeared to be dead. I repair a lot of these sets, so I expected to find that the blue disc-type ceramic capacitor C2524 (1nF, 1kV) in the power supply was faulty or that the line output transformer was faulty with shorted turns. But not on this occasion. R3444 (5·6kΩ) in the HT feed to the line driver stage was open-circuit. A replacement restored normal operation. **C.R.**

Nokia 6355UKSFN (Stereo Plus chassis)

The S2000AF line output transistor VK50 in this set was short-circuit. I removed it and connected a 60W bulb between pin 1 of the line output transformer and chassis. This proved that the HT was correct, at 150V. Before fitting a replacement transistor I carried out a visual inspection and found a dry-joint at capacitor CK51 in the EW diode modulator circuit. This had probably been the reason for VK50's failure. As a precaution I also replaced the BC337-25 line driver transistor VK22 and CK22 (2·2μF, 100V) in its collector damping network. This brought the set back to life, with a surprisingly good picture for its age. **C.R.**

Daewoo GB21C6NTS

This set was tripping with the front LED flashing. An in-circuit test suggested that the line output transistor was short-circuit, but it proved to be OK when tested out-of-circuit. The faulty component wasn't far away – D403, type BY228. **C.R.**

Schneider STV1500

This elderly set had no sound output. The usual components that cause this are Q602 (2SD468) and Q608 (2SB562) in the audio output stage. But both were OK this time. Further checks revealed that the 16Ω, 1W speaker was open-circuit. Luckily I found a replacement in my pile of salvaged speakers.

Transistor type BD131 is a suitable replacement for the 2SD468 and type BD132 for the 2SB562. **C.R.**

Hitachi AE7 chassis

For no sound, picture OK, the sound can obtained by restoring the set to the factory mode. To enter this mode select menu, hold and the vol+ and vol– buttons together and press for about five seconds. Install, service and exit then appear. Select the factory mode: this will reset the EPROM to the default settings. Then select exit. You may find that you need to adjust the picture settings, but you would have to do this anyway if you replaced the EPROM.

I've done this many times. No problems so far. **R.L.**

Goodmans GTV69W3VPL (Vestel 11AK37 chassis)

We've had three of these sets in recent weeks with an EW fault. In each case the cause was C622 (12nF, 630V) in the EW diode modulator circuit. **D.I.**

Mitsubishi CT29A6STX

The complaint with this set was bowing at the top and bottom of the picture. It was not noticed when a full-screen picture was being transmitted. None of the controls on the NS panel had any effect. Correct operation was restored by replacing Q4009 (2SA950). **D.I.**

Philips 28PW6816/05

The fault symptom with this set was a line-tearing effect. The sub-PCB on which the infamous Painter chip is mounted is also the home of a TDA9171T chip, IC7405. This was the cause of the trouble. **B.L.**

Goodmans TVC201T

This TV/VCR combi unit produced a very bright raster with flyback lines. Checks on the CRT base PCB revealed that R916 was open-circuit. Its coloured bands were scorched beyond recognition. With no circuit diagram, and no technical assistance being available from Comet, I decided to measure from both ends of the resistor to the centre point in an attempt to establish its value. 100Ω seemed likely. But the replacement resistor went up in a puff of smoke, the cause being the TDA6107G RGB output chip IC901. The **Alba** version, obtained from CHS, is an upgraded TDA6108VF which cured the fault. I assume that a CRT flashover had seen off the original IC and resistor. **B.L.**

Matsui TVR2080T

This set produced a very dark picture. A check on the first anode voltage showed that it was low at 250V, and couldn't be increased by adjustment of the control on the LOPT. The cause was on the CRT base PCB, where C819 was reducing the voltage when under load. **B.L.**

Sony KV14M1U (BE4 chassis)

This set was dead and I soon found that the 2SC2055N line output transistor Q802 was short-circuit. I removed it to measure the HT voltage and found that this was missing. Checks in the power supply revealed that R615 (0·47Ω fusible, CHS code 25005RA) in the feed to the STR-S5706 chopper chip IC601 was open-circuit. After replacing R615 and IC601 the HT was present at about 125V. Not knowing in what order these components had failed, I decided to remove and check the line output transformer. It turned out to be OK and, once Q802 had been replaced, the set powered up and was fine. **B.L.**

Goodmans W282NS (F19 16:9 chassis)

There was slightly reduced width with a little EW distortion. As usual with these symptoms, capacitor inspection paid off – C68 (15nF, 1·6kV) was looking very sorry for itself. But the fault was still present after fitting a replacement! The EW driver FET TR12 had also been damaged. A similar one is used in the 11AK19 chassis. **G.D.**

Sony KV28LS60U (AE6B chassis)

This set was tripping with three flashes from the LED. It didn't take long to establish that the 2SC5696 line output transistor Q8804 was short-circuit. I replaced it, along with the Slovenian-made LOPT T8800, only to be rewarded with four-flash tripping! This was not too serious: the two fusible resistors in the HT feed, R8895 and R8896 (both 0·47Ω, 1/16W fusible), had failed.

Replacement of these produced a terrible picture – the digital noise reduction was on!

Fortunately this set is much easier to work on than most modern Sonys. **G.D.**

DVD

Fault reports from Amrith Ramjewan Chris Bowers and Geoff Darby

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Samsung DVD909K

This DVD player's standby light came on but when the standby button was pressed it went off briefly then came on again. After replacing the three 330µF capacitors on the secondary side of the power supply everything worked normally. **A.R.**

Wharfedale DVD60ST

There was no sound from this DVD player. Checks around the microcontroller chip showed that there was no voltage at the SCL and SDA output pins 38 and 39, which are connected to the volume control IC. In fact the resistance to chassis at these pins was 5Ω. A new microcontroller chip restored normal operation. **A.R.**

Sony HCD-S800

There was an RDS display problem with this unit: when the RDS information changed, parts of the previous display remained visible. Oscilloscope and meter checks around the microcontroller chip showed that the cause was IC901 (type uPD703033A YGF-M27). I discovered from Sony technical that a modification, using the S500 IC kit (V113) assembly, part no. X-4954-876-1, is required. Once this had been installed the RDS display was normal. **C.B.**

Sony HCD-S800

There was an intermittent fall in the output from the front left-hand column speaker. Checks inside the unit revealed a dry-joint at L401 on side B of the amplifier PCB. A quick resolder here cured the problem. **C.B.**

Sony HCD-SB100

This unit would power up then, after ten minutes, suddenly power off. The fault was caused by IC901, part no. 9-719-947-79. When a replacement is fitted a zener diode, ZD955, should be added across C907. Connect its cathode to the positive side of the capacitor and its anode to the negative side. The part no. is 9-719-947-79. **C.B.**

Sony HCD-SC8

There were playback problems with specific DVD discs – the picture would sometimes freeze or start to skip. There's a firmware upgrade to deal with this problem. Installing it cleared the problem. **C.B.**

Samsung HT-DB120

This home cinema unit provided a useful object lesson in not allowing complacency to override proper fault finding. It came in with a request for urgent surgery to remove its owner's rental disc while the delivery person waited. The disc was easily removed, and the chap went on his way. While it was in bits on the bench I thought I might as well dive in and see if I could fix it.

When it was switched on it almost immediately went into a display-indicated 'protection' mode. In such cases one generally suspects the output stages. All six in this model consist of discrete components rather than ICs however – in general I've found that these are more robust and proof against customer-amuse than IC types.

A good examination of the main PCB revealed a slight bulge at the top of C30 (470µF. 16V). It's not particularly close to the power supply (linear) or anything hot, but I checked it and the nearby C31 with my trusty ESR meter. With both capacitors the digital display showed a nice low reading of just under 0·2Ω. The table on the meter's front panel suggested that it was a reasonable reading for a capacitor of this value. So I moved on and spent some time poking around in the output stages, to no avail.

Eventually I decided to replace the slightly bulged capacitor. When I switched the unit on again I was surprised to see that 'hello' came up on the display followed by a full normal power up. I rechecked the replaced capacitor, which still read good. Then it dawned on me. Checking again, but this time with an AVO meter, I found that the capacitor had an 0·19Ω DC short – not ESR goodness! **G.D.**

Sony DVP-NS355

A nice easy one for a change. The reason for this player's failure to read discs was that one of the flexiprints from the deck was displaced in its connector, at the board end. Once it had been reinserted correctly the unit worked normally. **G.D.**

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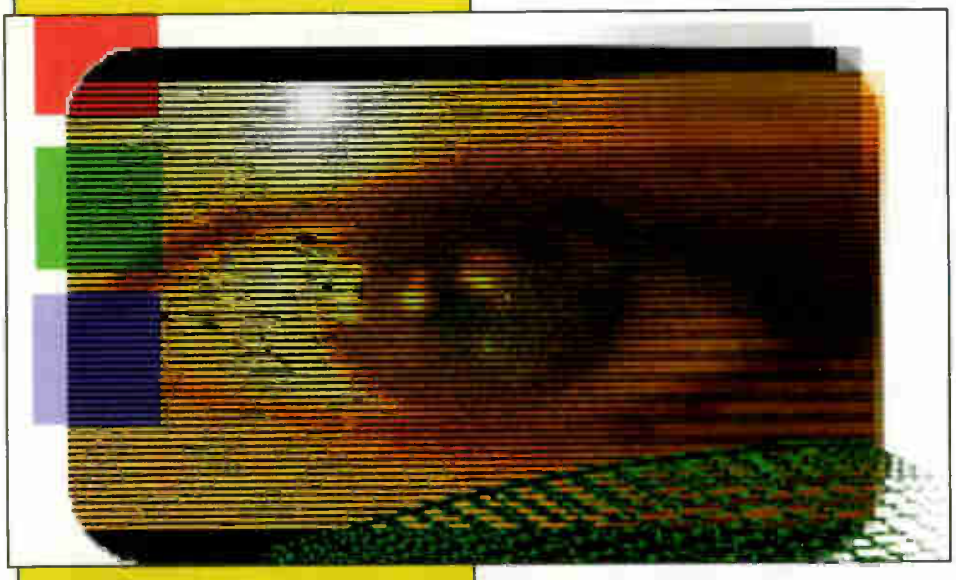


Extended Reports

Reports on complex or tricky TV fault conditions are sometimes too long for inclusion in our basic fault-finding section. We've put a few of them together in this extended fault report feature

Reports from
Arthur Jackson
Steve Hague
Charles Ritchie
Glyn Dickinson and
Les Mainstone

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

Reports can be sent by post to:

Television Magazine Fault Reports,
Nexus Media Communications,
Media House,
Azalea Drive, Swanley,
Kent BR8 8HU

or e-mailed to:
t.winford@highburybiz.com

Fault

Samsung SP42W4HBX/XEU

The complaint with this 42in. rear-projection set was poor picture quality – the effect was very unusual, to some extent resembling the symptoms of a soft tube in a standard TV set. The picture was generally dull, and parts of the images in it had a large halo effect around them. All three primary colours were present, but closer examination revealed that the halo effect was prominent on green images.

As a check I decided to run each tube separately, by sliding off the base sockets. With the red and blue tubes run individually clear and focused red and blue pictures were displayed. But when the green tube only was driven there was a totally unfocused green display. As the cables were long enough I tried connecting the blue base to the green tube, which now produced a clear and focused green picture. So at least all three tubes were good.

Close examination of the green base socket revealed corrosion on the focus pin and evidence of liquid around the socket. Cleaning off any liquid and fitting a new tube-base socket restored perfect pictures.

I was very concerned that the source of the liquid might have been leakage of the coolant fluid from the face of the tube, as on a couple of occasions I've seen this destroy a set when the coolant ran into the chassis. Fortunately a close examination here and a long soak test proved that all was well.

The very unusual picture was obviously because the red and blue tubes had perfect focus while the green tube had none. These symptoms could be displayed only by a rear-projection model. **A.J.**

Sanyo CBP2876A (EDO-28 chassis)

This elderly set had been in use for about twelve years on a high shelf in a bar. Its first fault had now developed: the complaint was about switching to standby quite frequently. When I removed the rear cover, the amount of nicotine, dust and cobwebs had to be seen to be believed, not to mention the smell. Every ventilation slot was clogged. So a thorough clean out was required before any checks could be made.

After that the set came on with sound and a picture when tried, but switched back to standby after about twenty seconds. Movement of the main PCB almost anywhere enabled the set to restart and run however, so a dry-joint somewhere seemed the likely cause.

The main reason for the trouble was very dry connections at all pins of regulator chip IC850, which is on the secondary side of the power supply. It provides the 5V standby and 12V outputs. There were dry-joints elsewhere, particularly at the scan-coil connecting socket on the PCB. Once these areas had been resoldered the set came on and ran permanently, but a couple of other problems that hadn't been mentioned were now evident. These were teletext lines visible down the screen (slow field flyback) and poor EW geometry.

The field output stage problem was caused by the flyback boost capacitor C703 (100μF, 35V), which was open-circuit and leaking badly. The EW problem was also caused by an open-circuit capacitor, in this case C750 (2·2μF, 50V) in the EW amplifier stage. Replacement of these two capacitors cleared the final problems and, once a thick brown scum (probably caused by years of passive smoking) had been cleaned off the screen, the picture was perfect. In fact I'm surprised I didn't get a complaint about it now being too bright! **A.J.**

Panasonic TX28DK2 (Euro-4 chassis)

The complaint with this modern widescreen set was no sound. When I switched it on however I thought that the fault report must be wrong: there was a very loud squeal from the power supply, and I suspected an overload in the line output stage. But just as I went to switch the set off a picture appeared, with the squeal still present.

I don't have the manual for this model, but found enough information in the manual for another model fitted with the Euro-4 chassis. This showed a module known as the C board. It contains the output devices for the centre and surround (left plus right) loudspeakers. When plug C1 on this PCB was removed, disabling the 300V DC input to it, the overload cleared and the set produced a picture plus very good sound from the internal loudspeakers.

The cause of the problem was found to be two short-circuit diodes, D2714 and D2715 (type 1SS133T-77), that are associ-

ated with the TDA2030AV centre loudspeaker output chip IC2703. They are connected across the ±18V supplies, for protection. There were no other problems with the set. We advised the customer to check the cable runs and connections to all the external loudspeakers: he subsequently confirmed that there had been a problem in this area. **A.J.**

Hitachi C28W440N (11AK33 chassis)

There was extensive damage to the switch-mode power supply in this set. The most obvious item was the chopper FET Q102 (STP8NC70ZPF) which had blown apart. The two BA159 diodes D140 and D141, which are in series with its source, were short-circuit, and the 1kΩ surface-mounted resistor R155 which is between its gate and source was open-circuit. I decided to replace the MC44608 chopper control chip IC106 as well, for good measure. On the secondary side of the circuit I found that the MUR460 HT rectifier D121 was short-circuit and R144 (1Ω, 2W) in the excess-current trip was open-circuit.

Once replacements had been fitted the power supply still wouldn't start up. Further investigation revealed two faulty components in the power-factor correction circuit between the mains bridge rectifier and the chopper transformer. The main components here are another FET, Q100 (MTP6N60E), and its driver chip IC107 (MC33260). This IC has an LT supply at pin 8 and a voltage-sensing input at pin 1. R112 (1·5MΩ) in the feed to pin 1was open-circuit while D106 (1N4148), which provides the LT supply at pin 8, was short-circuit. All was well once these two items had been replaced, but I'd love to know which of those nine faulty components was the cause of the mayhem. **S.H.**

SEG CT2103S (11AK30 chassis)

When this set, which was sold by a branch of the Lidl supermarket chain, was switched on it tripped back to standby after a few seconds. As you would expect under the circumstances, the front LED changed from red to green then back to red again. When I disconnected the supply to the line output transformer the LED stayed green and the HT measured 115V. So it seemed that the line output stage was drawing excessive current from the power supply. But checks in the line output stage failed to reveal anything amiss.

At this point I decided to try connecting a bulb as a dummy load in place of the line output stage. But the set still tripped. It even tripped when the bulb was connected in series with the feed to the line output stage.

The actual cause of the trouble was that the power supply was not able to supply sufficient current to the line output stage. When I carried out some checks on the primary side of the power supply I found that D800 (BA159) was short-circuit. It's in the snubber network that protects the chopper transistor. A replacement finally cleared the fault. **C.R.**

Naiko N2810DVD

This model is fitted with a variant of the PT92 chassis and has an ornamental drawer below the CRT – at least I've never come across one that actually plays DVDs! The usual capacitor trouble occurs in the line output stage (CD18, CD22), but one problem in particular I've had with these sets is that the picture intermittently shifts and wraps round the centre.

It will come and go when anything on the PCB is touched. When I carried out some scope checks I found that the shoulder on the sandcastle pulse vanished when the fault occurred. The cure is to resolder two surface-mounted resistors, RD01 which is next to pin 34 of the microcontroller/video processor chip IV01 and RD15 which is just below the middle of the PCB, to the right of the scart sockets.

Incidentally with all the sets I've come across with this model number the picture is very grainy and often has ghosting on it. This seems to be present from new, and replacing the tuner doesn't help. Most customers use the scart input from a satellite STB and are thus not too worried about it. **G.D.**

Sharp 76GF64H (DA100 chassis)

This heavy beast arrived from a colleague in the trade. He had suffered from some nasty experiences with the set before and asked me to have a try. Looking back on the repair, I know how he felt!

I decided to check the BUH515 line output transistor Q601 first. Out it came and, sure enough, there were low-resistance readings between its collector, base and emitter. There were no signs of damage or burns in the line output stage, and all the dry-joints associated with this chassis had been attended to. So I replaced Q601 and turned to the power supply. There didn't seem to be anything amiss here, and I found that the 170V avalanche diode across the HT reservoir capacitor C720 was intact – it was added as an afterthought to provide over-voltage protection. So, with some trepidation, I applied power slowly via my variac while monitoring the 150V HT supply.

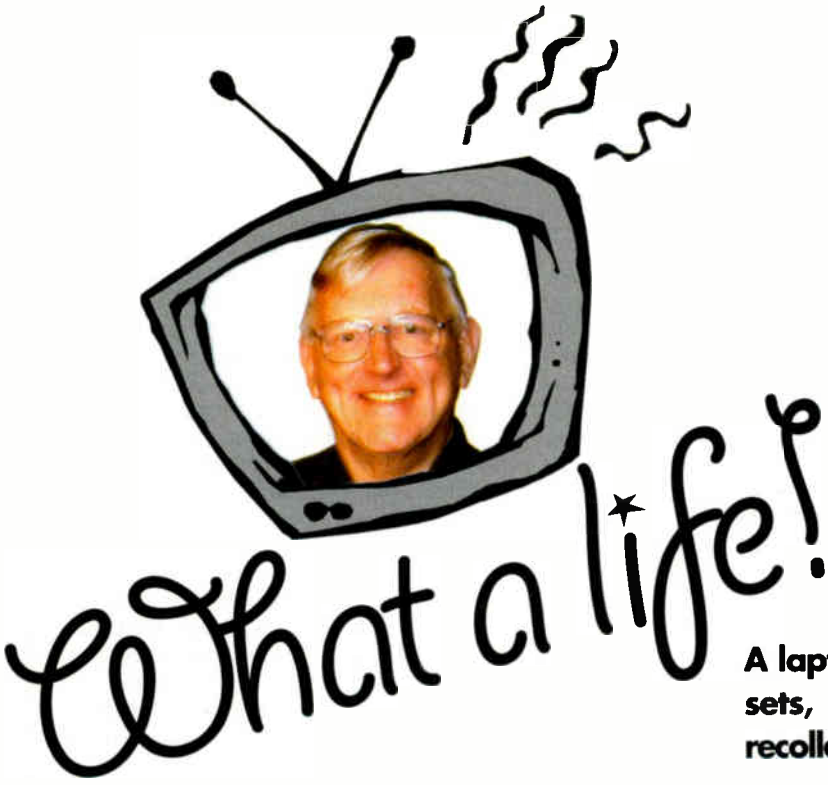
At just under 160V AC the power supply fired up, followed immediately by a loud crack from the avalanche diode as parts of it left my bench at high speed along with the new BUH515 transistor. I replaced both items, along with the regulation feedback optocoupler IC705 (MOC8106). Yes, I know, I should have replaced it before. Then, standing well back, I wound up the trusty variac once more and waited. The friendly voice of a BBC news announcer came from the speakers, and I obtained a reading of 142·5V across C720. But there was no rustle of EHT from the CRT's final anode. I leant forward, hoping to see a glow from the CRT's heaters, but there was nothing. I tried to keep up my spirits as I reached for the scope's probes.

A check at the base of Q603 in the transformerless line driver stage showed no signs of the line drive waveform. When I checked back from here I found that the LL4148 surface-mounted diode D601 was open-circuit. So I replaced it, along with Q603 (2SC2412) and C607 (330μF, 10V). There was a good line-drive waveform at the base of the inverter transistor Q802 (another 2SC2412) but nothing at its collector. This transistor is fed from the 5V rail via the 2·2kΩ surface-mounted resistor R812 which, on test, measured 5MΩ. So a replacement was fitted.

I confidently connected my oscilloscope to the input to the line output stage and once more wound up the variac. Sound came, along with the much-awaited EHT rustle. The smile on my face lasted for about ten seconds. Then, with a loud crack, the second BUH515 departed this world. Back to the drawing board, with gritted teeth.

The tuning capacitors in the line output stage were all removed and whipped across the capacitor meter. C601 (12nF) in the EW modulator circuit read 1·2nF, while the 2·2nF capacitor connected in parallel with it on the print side of the PCB read OK. I made up my mind that no more line output transistors were going to die, so I checked the neighbouring circuitry with paranoid intensity.

Finding nothing untoward, I switched on again (I admit to closing my eyes!). There was sound, then a good, clean picture. I breathed out. Flicking the teletext on, I noticed the telltale bowing that indicates an EW correction fault. The box of tissues at my side was very nearly exhausted by now, but I stubbornly carried on. Q501 (2SC2414) and IC503 (BA10393) came out, and replacements were fitted. This ended a long and hard-fought battle. Setting up the geometry after replacing IC503 seemed pure joy. The bottle of Australian red wine I consumed afterwards went some way towards calming my shattered nerves. **L.M.**



Donald Bullock's servicing commentary

A laptop is brought in for repair. Various TV sets, including an LCD model. Some recollections, and difficulty with hearing aids.

There are, I suppose, lots of different ways to start a day. I knew a dear old lady, the local Sunday-school teacher, who started hers at 6 a.m. with a double whiskey. She was a customer of mine. So was old Monty, the Elmbury pub landlord, who started his day by drinking a crate of Guinness before breakfast. Rest in Peace, Monty. Then there was my neighbour Everett Fry, a fitness freak, who used to enjoy himself at dawn by walking to his front-gate post-box on his hands.

I got up the other morning with no such intentions in mind, but did the best part of a double somersault when I stepped on a tray of chips and a sausage that some ass had kindly dropped just the other side of our gate. I pulled muscles I never knew I had, and felt a bit testy to say the least when I arrived at the shop. Steven and Paul were off doing an aerial job, and I was in no mood to suffer our first customer of the day. With his long, grey straggling locks and his pointed nose, he didn't look quite the ticket. The fact that he was carrying a laptop computer worried me.

Marvin's laptop

"By the way, I'm basically Marvin Snipe" he said. "Er, by the way, do you repair laptops, basically?"

I decided to box clever. "What are laptops?" I asked him, "little doily things you place on your lap when you eat runny ice-cream?"

He had a good laugh. "By the way, that's a good 'un, basically" he said, "you obviously do. By the way, this is my Toshiba Satellite Pro 6100. Basically, the orange light flashes when I plug it in, but it's dead otherwise. Here's my card."

"Well now, I'm not so sure . . ." I began as a car drew up outside. It was driven by a woman who looked like an all-in wrestler.

"By the way, gotta go, basically that's my wife" he said. And, instead of running the other way, he ran towards the car and jumped in.

I stood there, looking at the machine and wondering how I'd got myself involved with it. Then Sid the postman called in and saw it.

"Coo, wish I'd known you repair laptops" he said. "Mine's identical. It went dead when I plugged it in, and the orange light flashed on then off. I took it all over the place, but nobody does 'em locally. I ended up sending it away and paid nearly three hundred quid."

As he departed I looked at the laptop and it turned into a big pile of banknotes. Greeneyes, who at this point came clopping in with my mug of tea, said that my eyes had turned into rapidly rolling £ signs, like a crazy fruit machine.

Now son James Quentin is good at repairing laptops I mused. Pity he's such a long way away. Still, I'll give him a nudge on Messenger. And I did just that.

How to go about it

"It's a common fault with these" he replied. "The 80-pin miniature connector PJ852 is usually the cause. It connects the power supply to the main board and, since it's situated under the touch pad, the pressure applied to it eventually causes solder cracks, separating the pins from the board."

Facts without thinking! I switched my brain off. "How do I get into it?" I asked.

"Well, you have to remove the DVD drive battery and the keyboard" he replied, "then ease off the thin plastic cover above the function keys and remove the two screws under it. Incidentally, it's a good idea to draw an outline of the unit and stick the screws into the paper as you work – because they're of different lengths. Lift the keyboard gently, and remove the ribbon cable. Disconnect the two speaker plugs, a two-pin and a three-pin connector at the top right. Then disconnect the two display connectors, a white plug and a grey plug, and remove the mouse ribbon cable, just above the mouse pad. Lift the flap at the rear of the machine, and remove the two screws. Remove all the screws at the bottom of the casing, and remove the top cover.

Locate the power-supply PCB at the lower right-hand corner, remove the two fixing screws and, very gently, ease the board upwards to separate the connector. You can then see the 80-pin connector on the main board.

Using flux and your hot-air solder station, heat the solder carefully until it reflows. Then do the same to the other half of the connector. It's very important that you don't use any additional solder. That would short the pins together.

Ensure that all the pins are separate from one another, then reassemble the unit. Plug in the power, wait for ten seconds, then switch on. The two green LEDs should light, and the orange HDD one should flash. If not, the fault lies elsewhere."

I did exactly as he said, and it did the trick.

Charging

Later, when the boys got back, we discussed what the charge should be.

"I'm in favour of a £35 charge for a laptop quote" said Steven, "and a minimum of £95 for the repair. Some establishments charge much more. Depending on how long it took, I'd suggest a charge of about £125. Don't forget that the customer will expect a guarantee that means something. So the charge must include something to cover this."

George's Daewoo

Our next caller was George, an Old Codger from the sticks. He's not all that bright, and had a 28in. set in his little wagon. Once we'd got it in and on to the bench we found that it was a Daewoo Model DTH2881GB, fitted with the CP830F chassis.

"All I gets when I switches 'im on is a flashing traffic-lights

show, going like the devil" he said, "is that bad?"

"It's not good" I told him. "Now, as you aren't on the phone" I continued, "could you give us a ring later on?"

We gave him our number, and he read it back before departing.

The set's LED was rapidly flashing red and green, which indicates that there's a short of some sort inside. On inspection it turned out that the line output transformer was faulty. The part number is 1362-5022E. A replacement restored normal operation.

An LCD model

"Another of these!" Paul exclaimed as he started on the next job. It was a Logic LCD set, Model LCX15LN2, and was dead.

"The surface-mounted fuse seems to go open-circuit for no apparent reason" he said. This one had also failed. It's in the positive print that leads from the DC input jack and is marked type FS, which means that it has a hefty 4A rating. There was no indication of anything else being at fault, and a replacement restored normal operation.

A difference of opinion

My heart sank when Peter Goodman brought in his 28in. Lecron TV set, not so much at seeing it but at seeing him. He's a natural fixer of people's non-existent problems. His set, Model CTV900, suffered from line tearing that was worse with bright scenes. Trade veterans will recall the series of Pye valve sets that used to exhibit this symptom because of breakdown within the tripler.

As Steven was pulling the set on to his bench Tom Brightstone came in with another 28in. TV set, an LG Model RI-28CZ10RX. It's fitted with a Beko chassis and was dead. Tom tends to be argumentative, and is firmly convinced that most other people are asses.

I didn't like the mix. Pete gave Tom a friendly smile.

"Ah – we've both got 28in. sets" he commented, "we must be similar people."

Tom eyed him suspiciously.

"Ah, I see you have problems" said Pete, "let me help you!"

That started the arguing, which continued. I tuned out for a bit, then came back.

"Why are we here on this Earth?" Tom was bawling.

"I'm here to help people" said Pete, "and you're here to be helped. Now calm down and let me do that for you."

Tom was starting to go purple. I glanced at my watch. "Lunchtime!" I bawled, and we all trooped out. The boys and I popped over to the Red Lion, while Pete and Tom went off to continue their discussion elsewhere.

We were soon back, attending to the sets. The problem with Pete's set was caused by a faulty electrolytic, C605 (47μF, 160V). When it had been taken out we saw that it had leaked slightly, and that the corrosive electrolyte had eaten through the positive tag. The problem with Tom's set was in the power supply, where there was an almost invisible dry-joint at D608.

Another 28in giant

The Reverend Goode then appeared, accompanied by his shadow, Curate Blande. They started to bring in a Schneider set, another 28in. giant. Paul and Steven rushed across to take over. As Paul commented afterwards, 28in. tubes cause such a bang when they hit the floor . . .

"The set belongs to a member of our congregation, young Miss Wilkins" the Reverend said. "Her horse jumped on her foot you know, and it's now in plaster. Her foot I mean, not the horse. So we decided to help out. She's a very nice girl."

They departed and I thought "very nice girl no doubt, but I wonder what she's really like?"

The set, a Scinema Model 28-100T, was dead. It was another case of a faulty line output transformer, part no. 1372.0033C this time, and in addition the 2SC5129 line output transistor was short-circuit. It's important not to use any other type in this set, as it will fail prematurely.

Replacements got the set working again, but with east-west bowing. The cause of this was D308, which is a back-to-back assembly – type DMV32. Checks showed that it was leaky. The set produced excellent pictures once this final problem had been put right.

Recollections

Many of you enjoy reading about the trade memories we all have. Here's one that came to mind recently. I was on an evening service call to the Travellers Tavern, an ancient timber-framed building in the shadow of Gloucester cathedral. It has dark oak beams, charmingly crooked walls and had been renovated and decorated for use as an old folks refuge, providing a comfortable day-centre with a cheap mid-day meal.

While I was there repairing the TV set I was aware of the peace and tranquillity. I mentioned it to the dapper old-timer who was the warden.

"What a peaceful group of old souls you must have here" I added, "it must be very rewarding to experience their traditional ways and manners."

He gave me a straight look. "You've got to be joking" he replied, "they quarrel endlessly and sometimes violently, nurse grudges, run each other down and steal the toilet rolls as soon as they are provided. Whatever you put down disappears, and at lunch time they eye each others' meals and complain about the portions."

I looked at him in surprise, but he was serious. I was astonished.

I also recalled my early days as a self-employed TV engineer. So many different types of mains plugs and sockets were in use then that I recessed a five-inch strip of wood along the front of the bench and fitted two sets of live sockets, made up of every different type I knew. But I would still sometimes come across one I'd not reckoned on. Nowadays the workshop has only a few 13A sockets plus a lift-up-lid box that accepts and grips mains leads without plugs. How times change . . .

A regular caller in those days was the Factory Inspector. She was a friendly, motherly lady who would call to see that our soldering irons were earthed. The first time she called I explained patiently that since TV chassis were connected to the mains supply directly earthing our irons was out of the question. We would blow fuses and irons with every other chassis we tried to work on.

But she had her directives, and that was that. So we would apologise and earth our irons in front of her. She would then depart with a friendly smile. I'm sure she knew full well that the moment she went we would unearth them again.

Hearing aids

Finally I have to report that in order to humour Greeneyes, who sometimes sounds woolly to me because of her indistinct speech, I went for a hearing test and ended up with two modern digital hearing aids. "One for each ear!" cooed the sweet little Indian girl who fitted them. I later counted my ears and found that she'd got it right. They were made by Siemens and carry the company's model number and identification. I looked them up on the internet and found that they were on offer for sale in the US at seventeen hundred dollars each. They must have cost a couple of pounds to make.

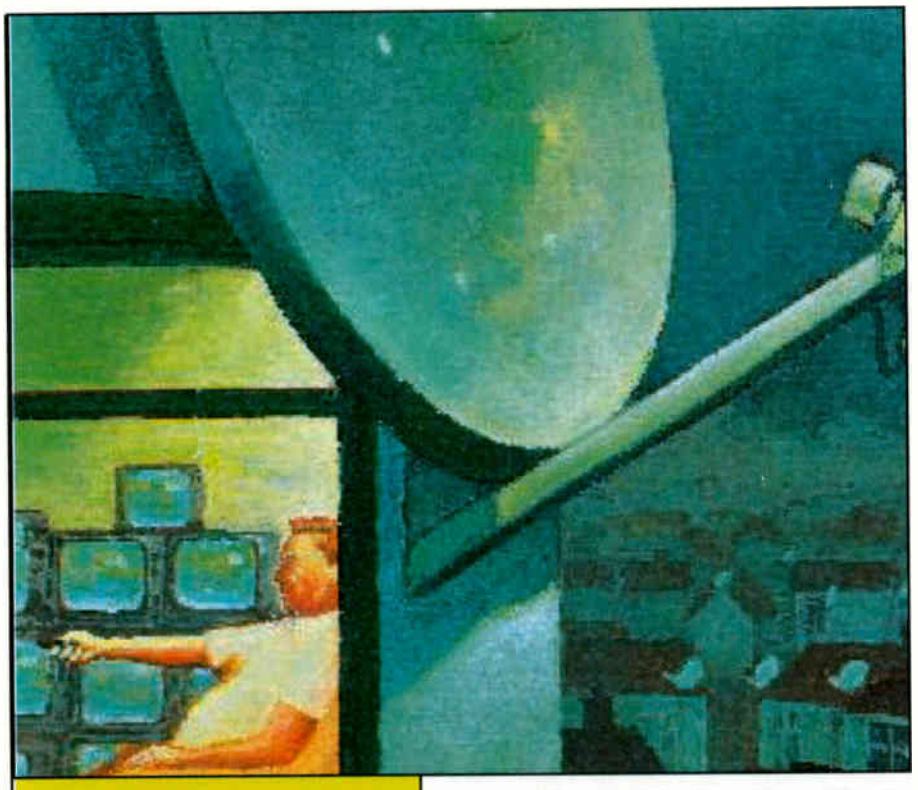
My verdict? They amplify sound, and lift the higher frequencies, but they certainly aren't hi-fi. They don't clarify sound, they compress it – and add an intrusive background hiss.

All in all they can be tiring, and when you remove them the clarity of what can be heard is bliss. I had hoped that they might be useful in the hubbub of busy bars or restaurants, as I enjoy intelligent conversation (when I can get it). But they aren't. The extraneous noises they pick up stifle conversation, and the sharp noises produced by glasses chinking or cutlery are intolerable. Wearing them both separates me from reality. All in all I'm glad that I don't really need them. But I'll have to send Greeneyes on an elocution course . . .

Communications

No room to report on letters and emails this month I'm afraid, but I'll return to the subject next time. They are always welcome. You can email me at

donald@wheatleypress.com



SATELLITE NOTEBOOK

Reports from Christopher Holland and Pete Haylor

More HDTV

The German Premier high-definition tests mentioned last month, using the H.264 video compression system, have come to an end for the moment. However the French pay-TV provider Canal Plus is now carrying out 1,080 x 1,920 line HDTV tests via the Astra 1 slot (19·2°E). MPEG-2 video compression is being used rather than the higher-compression H.264 system. The frequency is 12·582GHz, with vertical polarisation, a symbol rate of 22,000 and 5/6 forward error correction.

At present a loop of high-definition demonstration material is being used, see Photos 1-4. A full service is expected to start by the end of the year.

High-definition Forum tests, using MPEG-2 video, can now be seen via Hellas Sat 2 (39°E) at 12·606GHz, with horizontal polarisation, a symbol rate of 28,800 and 5/6 FEC. See Photos 5-7. More information can be found at the website www.hd-1.tv **C.H.**

BBC feeds for Live8

Many feeds were used to provide coverage of the recent Live8 concerts. Some high-definition feeds were apparently present via Intelsat 905 (24·5°W), but I missed them. Incidentally Intelsat 905 often has golf match feeds at about 11·500GHz V. The BBC uses Atlantic Bird 1 (12·5°W) for newsfeeds, and it was very busy on this occasion. The BBC feed frequencies have moved higher up the band and are now between approximately 11·040-11·110GHz, all with vertical polarisation and, generally, a symbol rate of 4,224 and 7/8 FEC (some Welsh feeds use a symbol rate of 6,138 and 7/8 FEC).

For the Live8 concerts 11·042, 11·054 and 11·066GHz were pressed into service, using a symbol rate of 8,448 (exactly twice the normal value), to carry concerts from South Africa and Germany in addition to London. Photos 8-10 show some tests carried out prior to transmission of the concerts.

While the wide symbol-rate transmissions were being used, newsfeeds using the normal 4,224 symbol rate were moved to the top of the BBC's frequency band, from around 11·075 to 11·110GHz. **C.H.**

Digital channel update (28·2°E)

The latest channel additions at 28·2°E are listed in Table 1. Where allocated, the EPG number is shown in brackets after the channel name.

The ITV1 sub-region channels shown in the table have recently started via Astra 2D. They appear at EPG no. 103 when a viewing card registered within the postcode area covered by the sub-region is used but can, however, be tuned in via the digibox's extra-channel menu. ITV1 Central West has moved from transponder 49 to transponder 44 (10·757GHz/V). This was previously the only Central ITV region via satelite.

Men and Motors TV (transponder 44, EPG no. 136) is now free-to-air and is expected to become ITV4 in November.

PTV Prime, EPG no. 815 (EB transponder D9S, 11·623GHz/H), is also now free-to-air though this may be temporary – a subscription was previously required.

Setanta Sports has moved from transponder 22 (Astra 2A) to Eurobird transponder C1 (11·265GHz/H). The EPG no. is 433.

Eurobird has just started testing two new frequencies, 11·222GHz/V and 11·260GHz/V – both transponder C2. **C.H.**

Express AM1 (40°E)

The Russian Express AM1 satellite uses the C and Ku bands for TV transmissions. This month we'll look at its Ku-band (11GHz) output. The satellite is only one degree to the east of the Greek Hellas 2 satellite, so locating it is critical.

At present there are only two perma-

Table 1: Latest digital channel changes at 28·2°E

Channel and EPG no.	*Sat*	*TP*	*Frequency/pol*
Arqiva tests (see Photo 11)	EB	C3	11·307GHz/H
ATN Bangla (842)	EB	D4S	11·527GHz/V
BT Tower caption	EB	C3	11·307GHz/H
DM Digital TV (841)	EB	C1	11·264GHz/H
ITV1 Anglia East (103)	2D	44	10·757GHz/V
ITV1 Central East (103)	2D	49	10·831GHz/H
ITV1 Central South (103)	2D	49	10·831GHz/H
ITV1 Scottish TV East (103)	2D	54	10·906GHz/V
TTV	EB	C4	11·390GHz/V

EB = Eurobird 2D = Astra 2D

Photo 1: A Canal Plus HDTV test transmission via Astra 1.

Photo 2: A Canal Plus HDTV test transmission via Astra 1.

Photo 3: A Canal Plus HDTV test transmission via Astra 1.

Photo 4: A Canal Plus HDTV test transmission via Astra 1.

Photo 5: An HD Forum test transmission via Hellas Sat 2 (39°E).

Photo 6: An HD Forum test transmission via Hellas Sat 2 (39°E).

Photo 7: An HD Forum test transmission via Hellas Sat 2 (39°E).

Photo 8: A BBC test transmission for Live8 via Atlantic Bird 1.

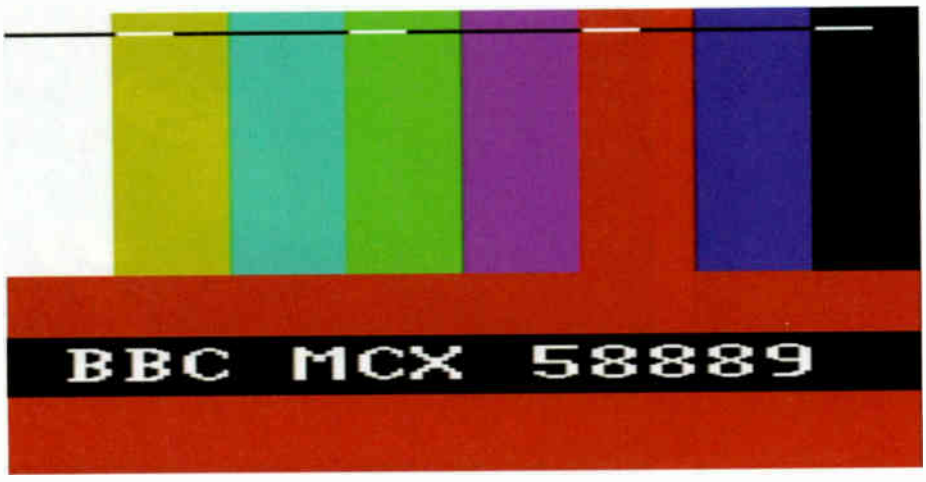


Photo 9: A BBC test transmission for Live8 via Atlantic Bird 1.

Photo 10: A BBC test transmission for Live8 via Atlantic Bird 1.

Photo 11: Arqiva test transmission via Eurobird.

nent TV channels as follows, but feed channels become active during rocket launches. Space TV Azerbaijan is at 11·159GHz/V (SR 3,333, FEC 3/4). MKTV Macedonia (also Macedonian Radio) is at 11·583GHz/V (SR 3,125, FEC 3/4).

Feed frequencies used are 11·168GHz and 11·186GHz, both with vertical polarisation, SR 4,000 and FEC 3/4. Other feed frequencies may be active at certain times but, so far, I've not seen any.

I recently saw coverage of the launch of the Express AM3 satellite, see Photo 13, though I unfortunately missed the lift off of the rocket that carried the satellite. Photo 14 shows the launch pad after the rocket had taken off! During this time Space TV also provided full coverage of the launch. Unfortunately AM3 is to be positioned well over the European horizon to serve the eastern part of Russia. **C.H.**

Strong 4155

"Hello, my name is George and my satellite is broke" the voice at the other end of the phone said. So a call was booked.

When I arrived I found that the dish was an old prime-focus type. Someone had taped a second LNB to the side of the original one (see Photo 12). These were removed and a new LNB was fitted but, when the system was tested in the house, there were still no signals. The cause was traced to a faulty joint in the garden, so a replacement cable was installed.

On test the number of channels listed by the Strong receiver, Model 4155, was five. A retune didn't add any more, so a factory reset was tried followed by a new scan. There was no difference.

The cure was to set the scan to include encrypted channels, even though the receiver is an FTA type with no CAM slot, and that the wanted channels were free to air! **P.H.**

Technomate TM1500+

A new batch of Technomate TM1500+ receivers arrived. I started to tune one in for a customer, and downloaded a pre-prepared channel list. As usual, some satellites were not required. I tried to remove them, using the blue button in the 'satellite setup' mode, but nothing happened.

I tried several times without luck, so an email was sent to Technomate. In the meantime I replaced the receiver in its packaging. The remote-control unit fell out, and I saw that it was totally different from the one I had been using – even though that one was for the same receiver. When the new one was tried the blue button worked.

When Technomate replied a short chat established that both remote-control units can be used, provided changes are made in the menu. So, for all fitters who don't read the instruction book, here they are:

Menu. System settings. Password settings. OK. 0000. Remote controller. Type 1 = old remote (the type with recessed buttons), type 2 = new type. Exit. Save settings = yes. Exit until the menu clears. **P.H.**

Safety

When is safety more important than money? That was a question I had recently. An old customer phoned to ask if I could fit a fourth feed from the Sky dish, with the lead to a front room. The

Photo 12: Taped LNBs. See Strong 4155.

Photo 13: Coverage of the launch of he Express AM3 satellite.

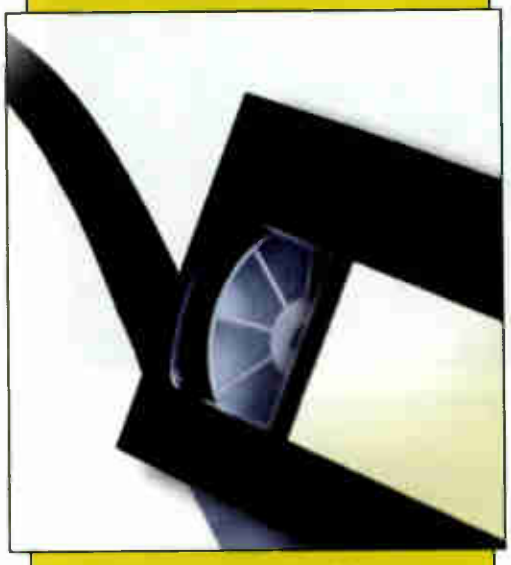
Photo 14: The launch pad after the rocket take off.

large house had three Sky receivers that had been installed by Sky as a price I couldn't match. But I had since installed several cables to other rooms via the respective RF2s. Now an LNB fed was required for a new receiver.

The dish had been fitted on the chimney, but the house had been extensively extended and the new roof levels were not in line with the original ones. There were pitched roof sections at several levels, with access via a bedroom window. I went on to the roof via the window, but the roof pitch was too steep to be able to reach the chimney and there was no access via the side of the property. The only way to reach the chimney would have been to slide down the roof and try to catch its side on the way. Failure to do so would have meant a two-story drop to the ground.

There was no way to get a cat ladder to the roof space through the window, and a full safety harness and ropes would have been required to try to reach the chimney safely – with all the requirements of the Health and Safety recommendations.

The job was not worth attempting, as two people would have been required and the customer was not prepared to pay extra. This was a job that was lost! P.H.



VCR CLINIC

Reports from
Bob Flynn
John Coombes
Paul Coles
David Packhan
Chris Bowers
and
Brian Battams

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Panasonic NVHS830 (Z deck)

If, after replacing a faulty take-up loading arm (item 43, part no. VXL2670), the VCR still won't go into the play position check the small metal rack slider with which the loading arm locates. You will find that it's jammed by bits of the broken plastic teeth. **B.F.**

LG KE14P2PX

The complaint with this fairly new TV/VCR combi unit was unusual: poor-quality video playback, similar to head-wear dropouts, but mainly down the left-hand side of the screen. Purely by instinct I added an earth wire between the rear of the deck and a nearby screening can. All was well after that. Apparently the symptom had been present from new. **B.F.**

Philips VR260

This seems to have become a common fault: we had four of these VCRs in on one day, all dead because D6301 (BYV127-200) was short-circuit. **J.C.**

Sony SLV-SE70

If one of these machines is dead, check the usual items – fuse, regulators and for dry-joints. In this case however capacitors C153 (47μF, 50V) and C154 (1μF, 50V) both produced a high ESR reading. All was well after fitting replacements. **J.C.**

Thomson VTH6320

If ERR is shown in the display when any of the front-panel buttons is pressed the mode switch needs to be replaced. As a temporary measure to confirm the diagnosis the switch can be cleaned and relubricated with a light oil. But a new switch is required for a lasting repair. **J.C.**

Sony SLV-SE720

If there is no display but the drive mechanism works, check whether resistors R668 and R669 have been changed from 10kΩ to 4·7kΩ. The next step, if necessary, is to replace C701 (470μF, 10V). Otherwise check the option settings. **J.C.**

Aiwa HVFX1500

The complaint was about an intermittent whistle in the E-E mode. The cure is to remove the PCB and fit a small 470pF capacitor between pin 5 of the tuner/RF modulator and chassis. **P.C.**

B&O Beocord 5000

There was no fast forward, rewind or play and the tape looped out, because there was no capstan rotation. I removed the capstan motor and stator, checked the PCB for acid leakage and cleaned it, replaced all four surface-mounted electrolytic capacitors (see below), checked around QR01 top and QR04 for damaged print, and resoldered PG02. When I refitted the motor to test I found that it continually wound the tape forwards. Normal operation was restored by replacing the DTC-type transistor QR01.

The transistor is available from Farnell under order code 622-835. The electrolytic capacitors are all available from CPC: C03 and C04, both 22μF, order code CA00731; C05 47μF order code CA00738; and C08 3·3μF order code CA00758. **P.C.**

JVC HRD720

During playback half of the picture was snowy. This was because the head switching was way out. I found that the 3·3μF capacitor on the drum-motor stator had dried up. A replacement restored normal operation. **P.C.**

Sony SLV-SF90US

This machine's recordings produced poor, streaky pictures because the heads were worn out. Complete drum replacement, which is expensive, is the only cure. MCES cannot fit new heads as they are bonded to the transformer. **P.C.**

Panasonic NVFJ710

Tape stuck inside, won't eject was the fault with this machine. It's nigh on impossible to remove the cassette deck with a tape loaded of course. I managed it by unscrewing the right-hand carriage guide, releasing the spring and freeing the carriage. After dismantling I found that the loading arm, part no. VXL2670, had broken teeth. It's available from SEME. **D.P.**

Sony AVD-K150G

There was no sound from this DVD/VCR/tuner unit with an AV input or tape playback via either the scart, RF or DTS outputs. Multimeter checks inside showed that the cause was the VHS hi-fi audio processor chip IC801. A replacement, part no. 9-885-033-01, cured the fault. **C.B.**

Philips VR6468

There was squealing from the power supply when cold. Replacement of the following capacitors cured the fault: C2021 (33μF, 50V), C2019 and C2007 (both 220μF, 16V). **B.B.**

Toshiba V703B

The display was dim and a squeal came from the power supply. The cause was the small 47μF, 16V capacitor on the sub-panel in the power supply. **B.B.**

Solution to Test Case 513

– see page 678 –

The basic fault with this 21in. Ferguson set was increased gain in the green-drive circuit, with a simultaneous change in the DC level. These two things should have rung a bell in Real Technician's brain, recalling a fundamental analogue-amplifier technique. But this didn't happen and, some long time after we left him, RT was to be found disconnecting the passive components in the green channel one at a time then checking them individually with an ohmmeter or component tester as appropriate. He had worked his way through many of them when a bright idea occurred to him: maybe the replacement IC he had fitted was faulty. After all it had been used before, as the residual solder on its lead-out pins when it lay in the stores proved.

But was it likely that both the original and the replacement ICs had failed in exactly the same way, one unlikely to arise with a bunch of directly-coupled semiconductor devices? No, not really! The failure was in the negative-feedback loop of course. The only item here outside the IC itself is the 68kΩ, 1W resistor RT23, which proved to be open-circuit. A replacement restored normality to the pictures. To be on the safe side its counterparts in the blue and red channels. RT63 and RT43, were also replaced – they were obviously from the same production batch.

NEXT MONTH IN TELEVISION

The days of 405-line TV

It's twenty years since the last 405-line TV transmitter was switched off. But it was the 405-line system that got TV as we know it going. Keith Hamer and Garry Smith recount the story, from the start of the service on 2 November 1936 to the 3 January 1985 closedown.

A LOPT tester

Faulty line output transformers continue to be a common cause of TV set failure. This tester was initially designed to save time when dealing with more modern sets that trip when the LOPT is defective. Paul Coles provides full information on construction, testing and use.

The ATX power supply

Power-supply modules for the ATX PC system are relatively cheap and are generally just replaced when faulty. Many faults are simple however, and the modules follow a similar pattern. So some repairs are worthwhile. Alun Rawson-Williams on how to go about it.

Fault-finding with plasma TVs

The final instalment in Fawzi Ibrahim's series concentrates on fault-finding, beginning with a description of the start-up process. There are numerous shots of fault symptoms.

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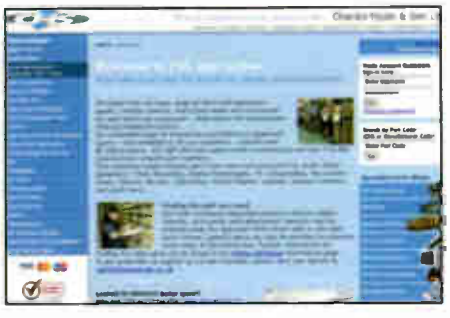

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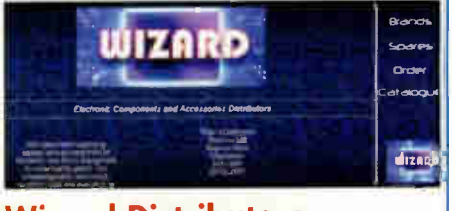

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