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Note that we are unable to answer technical queries over the telephone and cannot provide information on spares other than that given in our Spares Guide.

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ITV's mergers

Do we call it commercial or independent television? There was something a bit dishonest about it from the start, when the Television Act became law in July 1954. It was commercial television of course, reliant on advertisement revenue. But that was not considered to sound quite right, or shall we say acceptable? So it became officially known as independent television, and the Independent Television Authority was set up to control it. The ITA used an elaborate procedure for awarding franchises. It all worked reasonably well in practice: the public was pleased to have an alternative to the BBC, the main independent television companies made quite a lot of money, and advertisers were able to exploit a powerful new medium for promoting their goods and services.

From the beginning the authorities insisted that independent television should have a strong regional emphasis. London was not to be allowed to dominate, and studios and programme making extended across the regions. For several decades this worked well enough. There were some franchise changes, and the ITA became the IBA as it started to oversee independent radio as well. Subsequently it decided to become the Independent Television Commission. When the ITC last awarded ITV franchises, in October 1991, there were still fifteen regional franchisees. Their licences were for a ten-year period, commencing in January 1993. Almost ten years ago to the day.

But huge changes have taken place during that decade. There are now just two main ITV broadcasters, Granada and Carlton, plus four much smaller broadcasters that cover the more distant areas, Grampian Television, Scottish Television, Ulster Television and Channel Television (for the Channel Islands). Granada has taken over LWT, the previously merged Yorkshire Television and Tyne-Tees Television. Meridian, Anglia and Border Television, while Carlton has absorbed Central Television, HTV and Westcountry. This has been allowed to happen with little opposition, though it has destroyed the original intention to promote regional broadcasting. Now Carlton and Granada propose to merge.

The broadcasting world has changed a lot since 'independent' television was originally established. ITV now has to compete with Channel 4, Channel 5, BSkyB and the cable companies, as well as the newly resurgent BBC. In view of this you could claim that Carlton and Granada have a fair case for merging to form a more powerful broadcasting entity, maybe one that could hope to establish itself as a significant international operation. Or you could be a bit more brutal and say that Carlton and Granada have made such a mess of their operations that they need to merge to survive. It doesn't say much for the independent way of television that was supposed to hold out such promise.

Carlton and Granada have now announced agreed terms for a merger, and are pretty determined to press on with it. There are just two snags. The merger would be in breach of the present broadcasting rules and competition law. The first problem might be overcome when the government's Communications Bill is passed. This would abolish the curbs on audience share and the joint ownership of the two London ITV franchises. Dealing with the second problem would involve an agreement with the Competition Commission, which might be rather harder to achieve – especially as the major advertisers are not at all happy with the prospect.

Carlton and Granada have been badly hit by the recession and its effect on advertising revenue (not to mention ITV Digital). They might yet be able to prosper separately once the economy moves to a more favourable phase. They should certainly be able to generate sufficient income to survive as separate broadcasters. But the general feeling seems to be that the barriers should be removed and they should be allowed to proceed with their merger.

It's all rather sad. A tale of 'independent' television that has somehow lost its way. But few tears will be lost over broadcasters that seem to have become deal makers instead. It doesn't seem to be a set up that could nurture much by way of creative broadcasting. ■

ITV has undertaken a rebranding exercise, at a cost of £750,000. One outcome is its new logo, shown below. There will also be a £11m promotion campaign. How much enthusiasm will this create?

CORRESPONDENCE
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TELETOPICS

Freeview is here

Freeview, the free-to-view DTT service provided by the BBC, BSkyB and Crown Castle International as a successor to ITV Digital, went live on 30 October. It gives viewers up to thirty TV channels plus radio and interactive services. During the summer Freeview's parent company DTV Services increased the power of thirty of the eighty DTT transmitters by 3dB to improve reception. The transmitters include major ones such as Crystal Palace and Winter Hill. DTV hopes to increase the power of the remaining fifty DTT transmitters but this depends on local conditions – interference to co-channel analogue transmitters and, along the south coast, French transmitters. NTL is also boosting the power of some of its DTT transmitters.

According to DTV Services 75 per cent of UK households should be able to receive all six of the DTT multiplexes, though an aerial upgrade will sometimes be required. To improve reception, Freeview is using 16-QAM instead of 64-QAM. This should eliminate the blocking and freezing problems that many DTT viewers have experienced in the past. However the ITC has allowed ITV, Channel 4, Channel 5 and SDN to continue using 64-QAM, which means that many viewers will continue to experience problems with multiplexes 2 and A. DTV Services says that digital adapters, IDTVs and older ITV Digital set-top boxes will be able to cope with this dual-standard transmission. The commercial broadcasters want to stay with 64-QAM because it enables more channels to be broadcast per multiplex (six, compared with four when 16-QAM is used).

Dealers are not too happy with this compromise, as it could lead to a lot of viewer complaints about not being able to receive certain channels reliably.

Frontier Silicon has announced a new digital receiver chip, called Logie, that it claims could cut the cost of STBs and IDTV sets. The company is already supplying low-cost digital radio receiver chips.

The stylish Netgem iPlayer digital STB has now been launched and is expected to retail at about £150. It incorporates email and web-browsing facilities. Optional extras include a wireless keyboard at about £30.

BSkyB is raising the price of its services from January. The price of the basic package is to be increased by £2.50 a month while that of packages which include premium channels will be increased by £1 a month. This is the third successive annual increase.

Engineer shortage

At the annual general meeting of the Electronics Examination Board Hugh Peltor, the chairman, drew attention to the growing shortage of electronics and electrical servicing engineers. During his speech he said: "Electronics underpins the very fabric of our modern society, yet employers are facing growing shortages and action must be taken to encourage more young people to recognise that being trained in these skills leads to excellent job prospects and rewarding careers."

There is certainly a growing shortage, because so many have left the trade and so few are entering it. But the problem is that at present the job's rewards and the prospects are so poor. This will have to change eventually, hopefully soon. How else will the growing amount of increasingly sophisticated technology in people's homes be installed and maintained? It's not all throw-away stuff.

Exhibition dates

Next year's IFA (Internationale Funkausstellung) Berlin consumer electronics show will be open for six days, from 29 August to 3 September.

The Smart Show, which replaces the Electrical Retailing Show, will be held at the National Exhibition Centre Birmingham, Hall 1, on 6-8 April.

Sony's networking system

Sony has announced a series of products, to be sold in Japan initially, with the general name CoCoon. They are home AV gateway devices, such as set-top boxes, that are equipped with a large-capacity hard disk for recording and playing back music and video and have broadband internet connections. The devices will include personalisation, i.e. they will learn user preferences and on this basis select and record TV programmes. The products will be programmable via a PC or a mobile phone.

Sony's president Kunitake Ando explains that "our home network strategy has to date been PC-centred, but in the broadband era we will also supply non-PC gateways such as these AV products and mobile terminals".

Chomerics has introduced two thermal gap filler materials that provide a highly efficient path between hot components and heatsinks. Therm-a-gap T630 and T630G can be dispensed directly from a syringe or tube with out premixing or curing. The unique viscoelastic materials used achieve 50 per cent deflection with only 1 psi of applied pressure, effectively filling gaps caused by loose or varying assembly tolerances without stress to solder joints and leads. Type T630G differs in having an additional filler of 0·25mm diameter glass beads that act as a compression stop, which is essential where electrical isolation is required in addition to thermal transfer. Both can fill gaps ranging from 0·25mm to over 7·6mm and have a thermal conductivity of 0·7W/m-k. They are rated to UL94V-0 for flammability resistance. Along with other applications they are ideal for rework and field servicing. For further information Chomerics can be reached on 01628 404 000 or email chomerics_europe@parker.com

3D technology

Sharp has developed a new LCD that's able to produce 3D images without the need for viewers to wear special glasses. The display is electrically switchable between 2D presentation (planar mode) and 3D (stereo mode). According to Sharp the development could lead not only to new dedicated 3D-display equipment but could also be used with existing LCD products.

The 3D LCD combines a conventional TFT LCD with a Sharp proprietary switching LCD. The latter establishes an optical parallax barrier: by controlling the light pathway, the switching LCD makes it possible to separate the display images so that slightly different ones reach the left and right eyes. With the image displayed on the LCD as a stereoscopic pair, each eye sees only part of the image: the brain combines these, perceiving 3D images.

Since the switching LCD electrically controls the parallax barrier it can make this transparent. The light paths are then no longer separate and, with ordinary 2D material, both eyes see the same image. Thus the display also functions in the conventional 2D manner.

No launch date has been suggested.

The Hungarian firm Holografika claims to have produced a display that could lead to 3D TV. As the name suggests, it uses holographic techniques. When beams inside the unit strike the holographic screen, each pixel emits light of a different colour and intensity in different directions. The result is a 3D image that floats in space, appearing behind or in front of the screen. It seems that the main initial application would be for medical purposes – the output from a CAT scan could be presented on the screen in 3D form. Holografika is working in partnership with Sony and GE Medical.

Henkel Loctite Adhesives Ltd. has introduced a range of kits designed for the assembly of electronic components on PCBs. The kits are particularly suited to hand assembly, design and prototype work or reworking, and comprise adhesive, activator and dispensing needles. The kits come in a vacuum pack with an instruction leaflet.

The Output Kit is for mounting heatsinks on components, making clips etc. unnecessary. The adhesive has high thermal conductivity and, as a result of its self-shimming property, produces a consistent 0·15mm film. It cures rapidly at room temperature, is electricaly insulating and can be removed where rework is necessary. The Tak Pak Kit is for securing smaller components and attaching ECO wires. The 4105 version is for use with larger components, for bridging larger gaps or where greater shock resistance is required. The Chipbonder Kit is for bonding surface-mounted components, curing rapidly under UV or IR rays. The Varnistop Kit is ideal for warranty seals and securing trimmer settings. The Tempflex Kit consists of a transulent paste that forms a high-strength flexible rubber bond.

For further information Henkel Loctite Adhesives Ltd. can be reached on 01707 358 800 or email customer.enquiry@henkel.co.uk

Video news

Samsung has introduced a new range of DVD players. Model DVD-H40E also includes a 40GB hard disk that can store up to 40 hours of video. A 'Scene-again' feature enables the user to watch a programme while at the same time recording it on the hard disk for viewing later on. If viewing is interrupted, the user can watch the missing part from the hard drive while continuing to record the rest. The unit sells at about £700. Model DVD-L100 is a portable player, just 23·5mm wide, with a 10in. LCD screen. Other features include Memory Stick compatibility, MP3 audio file playback and photo-editing software. Selling price is about £1,300. Model DVD-N505 is the first player in the UK to incorporate Nuon technology, which adds interactive graphics, audio and other applications to DVD viewing. This includes adding visual-effects features to audio CDs. Price is about £230.

Hitachi's DVD-Cameras now incorporate InstantCD/DVD 6.5 software that enables them to be used as an additional PC storage device for various types of data. The software offers a variety of storage applications using 8cm DVD/R or DVD-RAM discs. Connection to a PC is via a USB port. With a capacity of 1·4GB per DVD side, the added software enables the camera to be used to store images, text and video. All current Hitachi DVD-Cameras – Models DZ-MV200E, DZ-MV230E and DZ-M270E – can, in combination with the optional PC-KIT (DZ-WINPC3/4), be used with the new software. Most discs can be used with these DVD-Cameras, including CD-R (W), DVD-R (W), DVD+RW, DDCD and DVD-RAM.

Sanyo has introduced a new range of three VCRs. The top-of-the-range Model VHR-H802E has several interesting features. Satellite Auto Recording enables it to become a 'slave' to a digibox: as a result of this programmes are controlled by the STB, ensuring that the two units are in sync. The Digital Picture Control feature is intended for use with worn/rental tapes. It enhances screen images automatically. The Commercial Skip feature gives the user the option to bypass advertisement breaks quickly.

Sony has launched a camcorder, Model DCR-IP220, with a two megapixel CCD image sensor that provides a resolution of 1,600 x 1,200 pixels. This MicroMV camcorder has improved PC integration and can be used as a digital still camera. Features include Sony's Zoom Ring and Sharpness Setting, which enables the user to select the sharpness in eight steps depending on the type of pictures required. A new night-framing facility can be used with the Sony Hologram AF feature to provide accurate framing, improved focusing and natural colour under low-light conditions. The camcorder has a 2·5in. hybrid touch-screen LCD monitor and incorporates Image Mixer software. The latter, when combined with the USB streaming capability, provides simple, fast transfer of images between the camcorder and a standard PC, where images can be edited, stored and emailed to friends and associates.

Sony has also introduced two new home cinema systems, Models DAV-S500 and DAV-S800, which have increased playback options and enhanced digital amplifier and speaker performance.

Pioneer has issued a warning about its DVD-RW recorders and computer drives. Apparently the laser can burn out if used, without modification, with the new high-speed blank discs. An upgrade is available to prevent this.

Optical disc technology

Philips has released information on its plans for optical disc technology. The company says that the DVD+RW recording format, which it developed with Sony, has over 80 per cent of the market in Europe, more than 60 per cent in the US and less than 40 per cent in Japan. It points out that compatibility with DVD-Video players is a key factor. Intellikey Labs in the US has carried out tests and found that there is 90 per cent compatibility with DVD+R discs, 77 per cent with DVD-R discs (these are the two write-once formats), 72 per cent with DVD+RW discs and 66 per cent with DVD-RW (video mode) discs. DVD-RAM and DVD-RW (video recording mode) discs were almost completely incompatible. This is not a precise estimate however, as Philips comments, since the tests were done with old and new players and didn't take into account brand share, while some companies get around the problem with multi-format players and drives that can read all the official DVD recordable and rewritable discs, or dual-format players and super multiplayers that can read everything.

The company has announced a DVD+R/+RW reference design and parts kit that could lead to the rapid availability of mass-market machines – some could be on display at next year's US Consumer Electronics Show. The design is based on Philips' Nexperia system, using the PNX7100 MPEG-2 AV codec and VAE8020 DVD+R/+RW drive and video recorder chips. Volume production of the kit is scheduled to start in the second quarter next year.

Philips is also backing the Blu-ray format, which uses blue-laser technology to store up to 27GB of information on a 12cm disc. It revealed that a caddy system is optional with this format. Use of a blue laser will represent the final stage with CD/DVD optical disc technology, as it will not be possible to develop systems that work with shorter-wavelength lasers or optical systems with higher numerical aperture values.

Philips has proposed a new miniature optical disc format based on Blu-ray technology. The Small Form Factor Optical disc would have a diameter of 3cm and be able to store up to 1GB of data. The US company Dataplay has developed a similar-sized optical disc with a storage capacity of 250MB.

Samsung has announced the largest LCD panel to date, at 46in. with widescreen format. The screen refresh rate is shorter than with Samsung's previous LCD panels, at 12msecs, while the resolution is 1,280 x 720 pixels. Use of the company's Patterned Vertical Alignment (PVA) technology means that the screen can be viewed from any angle up to 170° in any direction. The panel will go into full production in the first half of 2003.

Digital sound projector

Cambridge flat loudspeaker firm 1Limited is to develop, in conjunction with Philips, a low-cost version of its surround sound DSP (Digital Sound Projector). The present Projector sells at £20,000. Philips will be developing a high-performance transducer to replace the existing expensive type – each Projector uses 254 transducers. To further reduce costs 1Limited is developing a ten-channel driver chip that will replace some 700 discrete components. A licence to use the system has been signed with Pioneer. Tony Hooley, founder and president of 1Limited, believes that eventually anyone buying a standard TV set will buy a surround sound projector to go with it.

Philips wireless TV link

Philips has launched the SBCVL1200 wireless TV link. It enables video and audio signals from up to two sources with scart connectors, e.g. a TV set, DVD player, VCR or digital satellite STB, to be transmitted for viewing via TV sets around the house, eliminating the need for additional players or STBs. The basic link consists of two units, a transmitter and a receiver – additional receivers are available separately. The transmitter has two scart connectors for the input signals: the receiver can be installed anywhere in the home up to 30m away, alongside a scart-equipped TV set. The second-set user has full remote control of the signal sources sited elsewhere.

Transmission is low-power in the 2·4GHz band. There are four, selectable RF channels, so that interference can be avoided. It's claimed that the link maintains the integrity of today's high-quality signal sources. The link sells at about £100, with extra receivers at £60 each.

Vintage radio

Savoy Hill Publications, which is able to supply various vintage radio components and also buys and sells vintage equipment, has been taken over by Paul and Alex Ollivier. The address is Fir View, 7 Rabys Row, Scorrier, Redruth, Cornwall TR16 5AW, phone/fax 01209 820 771, or you can email sales@savoy-hill.co.uk

The UK subscription rate for the monthly newsletter is £7 for one year, £12 for two. Higher rates apply overseas.

Optical HD video transmission system

JVC has announced the development of an optical wireless high-definition video transmission system that's able to transmit uncompressed images with no loss of quality. The system uses optical wireless technology to achieve a data rate of up to 1·25Gbits/sec, the same as lossless transmission in cable. A laser diode is used for transmission with a high-sensitivity avalanche photodiode used for reception. The maximum transmission distance is 10m.

To meet eye safety requirements, the optical system is 'eye safe'. It can therefore be used anywhere in the home. Prototype receivers measure just 5mm wide, 45mm high and 20mm deep, but JVC says that it will be possible to reduce this and build receivers into displays.

The new system is intended for use in future home-entertainment equipment.

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Servicing

the Samsung SCT11D chassis

John Coombes provides a fault-finding guide for these popular small-screen sets

This chassis was designed to drive 14, 20 and 21in. tubes. The production run started in about 1996. It's used in several models, including the CI3373, CB501FZ1, CI5073 and CI5079. There was also the SCT11B version which is very similar – see note at end.

Dead set

Most faults occur in the chopper power supply circuit, see Fig. 1. It's quite simple, but a little unusual in having two ICs on the primary side. These are IC801 (SMR40200C), which incorporates the MOSFET chopper transistor, and a hybrid device, HC801 (HIS0169C), which incorporates most of the control circuitry.

It's not unusual to find a dead set with the mains fuse F801 (3·15AT) blown. What seems to happen is that HC801 fails, with the result that excessive voltages are produced. The over-voltage protection diode DZ801 (R2K) goes short-circuit and IC801 fails. Replace these items plus coil L803 and the following capacitors: C803 (2·2nF, 800V), C851 (22µF, 35V) and C852 (1·8nF, 16V). These components come in a power supply kit. Fit them all and resolder any suspect dry-joints at the resistors in the power supply. Also check the line output transistor Q401, which may have gone short-circuit. This is generally type KSD5072YD. See further note below.

There are other possible causes of a dead set of course. If D803 is open-circuit there will be no LT outputs from the power supply. This rectifier provides a start-up supply for the line driver stage and the input to the TDA8133/KA7630 regulator chip IC802. A 5V output should be present at pin 9 of this chip, with a switched 8V output at pin 8. The latter is switched by the microcontroller chip IC901 (on/standby control). If the 5V output at pin 9 is missing, check whether R809 (47Ω) is open-circuit. If R809 is OK, IC802 is suspect.

If the 5V output is present at pin 9 of IC802 but there is no 8V output at pin 8, check for about 4V at pin 16 of the microcontroller chip IC901. If this voltage is missing, check DZ903 (7·5V), DZ901 (5·1V) and IC901.

A short-circuit line output transistor (Q401) will give the dead set symptom of course. It may have failed because of a power supply problem, see previous note. Alternatively it could have failed because of dry-joints at the line driver transformer T401, the KSC2331Y line driver transistor Q402 and/or the line output transformer T444, which can develop shorted turns. Other items to check in the line output stage if necessary are the tuning capacitors C402 (7·2nF, 1·6kV) and C403. The value of the latter depends on tube size. If the line output transistor goes short-circuit repeatedly there could be shorted-turns in the scan coils. Michael Dranfield's letter last month (page 55) is relevant here.

A further dead set possibility is no line drive. Check back via the driver transistor Q402 to pin 13 of the M52777SPA jungle chip IC201. This chip contains the IF, colour decoder and timebase generator circuits.

Field faults

The TDA8356 field output chip IC301 has two supplies which are both derived from the line output transformer. There should be 15-16V at pin 3 and about 45V at pin 6. If the fault is field collapse, check that these supplies are present. The 45V supply will be missing if R304 (10Ω, 0·5W), D403 (TVR10G) or R410 is open-circuit. The relevant items in the 16V supply are R409 (0·22Ω, 0·5W fusible) and D404 (1R56U41). This chip does not have a flyback boost circuit. If the supplies are present IC301 is suspect. Other possibilities are dry-joints at the scan-coil plugs and sockets or open-circuit scan coils (check at TP13/14).

Tuner/IF faults

A very snowy picture and noisy sound can be caused by a dry-joint at the centre pin of the aerial input coaxial socket. This fault can be very intermittent.

For basic reception problems check the voltages at the pins of the tuner unit TU01. Incorrect voltages could be caused by a faulty tuner and/or the following SAW filter driver chip. This is a hybrid device, HC101 (PAP102). In either event, check by replacement.

If the tuner and HC101 seem to be OK check at the serial clock and data pins of the microcontroller chip IC901 (pins 39 and 40) and the AT24C04-10PC EEPROM chip IC902 (pins 6 and 5). If there's no activity, check the chips by replacement.

No sound

The sound IF signal is fed via a separate SAW filter (SF101) to

pins 1 and 16 of the TDA4445B sound IF chip ICK01. The output from pin 12 of this chip is fed to pin 2 of the jungle chip IC201, which provides an output at pin 46 to drive the TDA7056A audio output chip IC601. Input to this chip is at pin 3, with the output at pins 6 and 8. There should be a 12V supply at pin 2. In the event of no sound, check through this signal path, starting at ICK01. If the supply at pin 2 of IC601 is missing, check R812 and R813 (both 4·7Ω, 2W). Its source is D803.

No sound could also be caused by a fault in the muting circuit. The two transistors here are Q903 (KSC815Y) and Q907 (KSR1012). Check by replacement as necessary.

No text

Check that the 32·768kHz crystal X901 connected between pins 31 and 32 of the microcontroller chip IC901 is working. If not, suspect the crystal. IC901 provides RGB outputs at pins 24, 23 and 22 respectively, and a fast-blanking output at pin 25. These are fed to IC201, at pins 29, 27, 25 and 31 respectively. The RGB signals are capacitively coupled. Check the voltage conditions at these ICs then check them by substitution if necessary.

Miscellaneous faults

If the picture is faint there could be a video fault. In most cases however you will find that the set has been set to the mild position via the handset.

We have found that in some rare cases channels 1 to 4 are OK but channels 5 and 12 produce a snowy picture. The cause is a faulty tuner unit.

Remote-control faults

The most common problem with any remote-control unit is no operation because of faulty batteries or battery contacts. Alternative possibilities are dry-joints at the LED or the crystal, or possibly cracked legs here. If the legs are broken, you can in some cases solder leads on to what's left at the crystal.

A common fault is customer misuse, i.e. spillage of one sort or another. In some cases the unit can be cleaned up and reset for normal operation.

If individual buttons don't work, check by cleaning. If this fails a replacement handset may be required.

The SCT11B chassis

This is very similar to the SCT11D, and much of the information provided above applies to models fitted with this chassis. They include the CI3373Z, CI5373T and CI5079Z. There are a number of component differences however. For example IC201 is type M52309SP, and there's a combined SIF/VIF SAW filter. The main difference is in the field timebase. This uses a TA8445K chip (IC301) with a conventional flyback boost system. Its 24V supply, which is derived from the LOPT, is fed to pin 7. There is also an 8V supply at pin 1. A VPG101 hybrid IC, HC301, is interposed between the jungle chip and the TA8445K chip's input (pin 2). ■

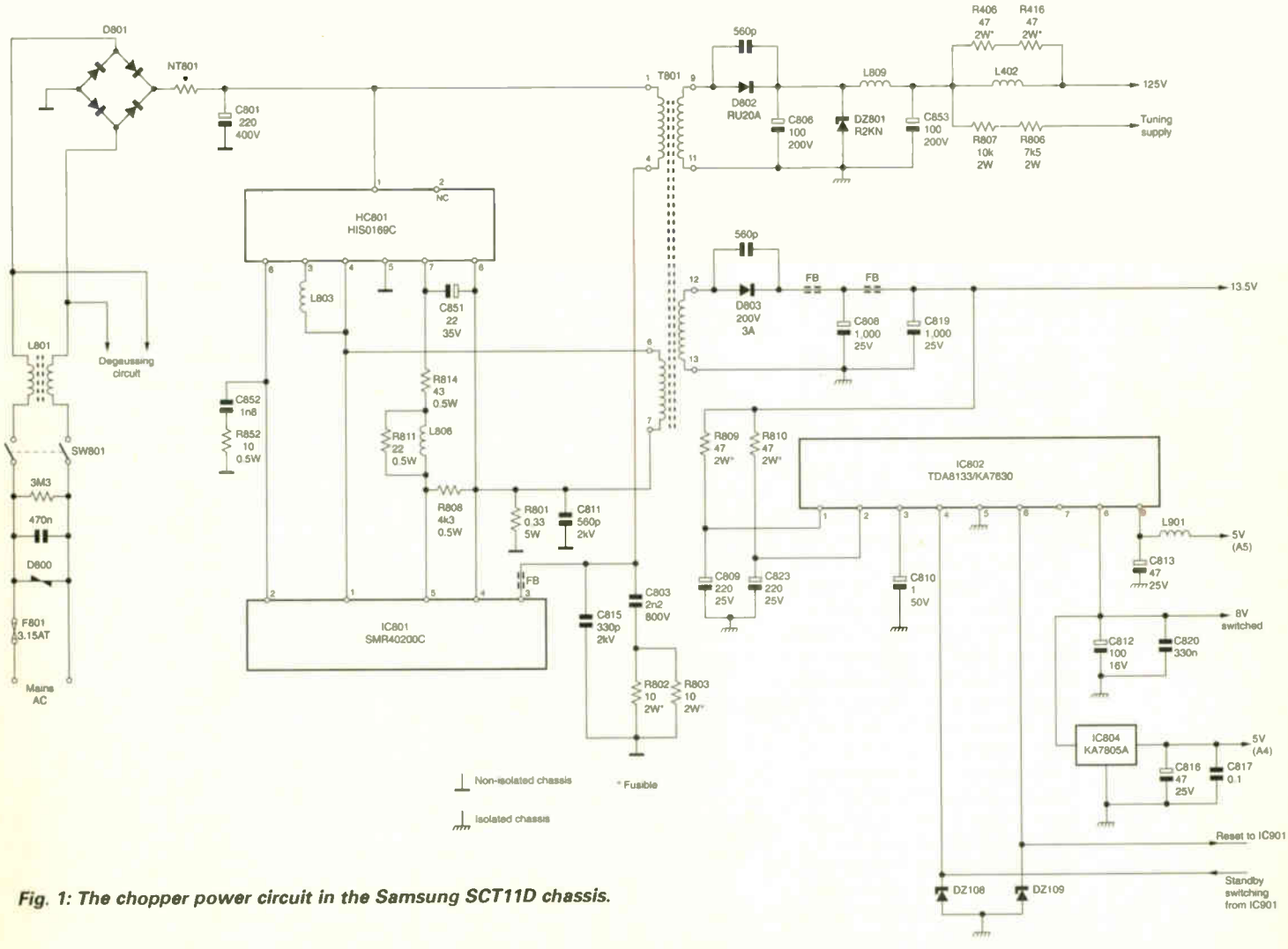

Fig. 1: The chopper power circuit in the Samsung SCT11D chassis.

Following his recent articles on state-of-the-art electronic technology Ralf Buckstone takes a look at some further radical innovations, including plastic memory, spintronics, the use of green fluorescent protein and DNA computing

The future: very small and very fast

Our heading picture shows green fluorescent protein biomolecules. GFP molecules can be modified to provide a single bit of optical memory.

The transistor effect was discovered in 1947, but for a while the transistor was more of a curiosity than a device that would change the world. When the junction transistor appeared in 1950, things started to happen. Today's commodity processor chips contain some forty million of them and run at clock speeds of 1-2GHz. But getting more and more transistor elements on to a wafer is just one approach: electronics could evolve in many different ways. This article describes a few of them, starting with plastic memory.

Plastic memory

The plastic is rather special of course. A very thin sheet of polymer is sandwiched between two grids of tiny electrodes, see Photo 1. The creators of this technology, ThinFilm Polymer, tell us that at each intersection of the grids a bistable device exists. It works like this: a voltage applied to a given cell modifies the organic nature of the polymer there, changing it from one state to another. The state can be read and is non-volatile, persisting when the power is removed. So we can create a memory array, with one or zero binary storage and no silicon. ThinFilm believes that devices can be produced using roll-to-roll manufacturing techniques – similar to the way in which a newspaper is printed. This would give huge economies of scale and incredibly cheap memory.

The main interest of this technology however is the memory density. Today's typical S-RAM memory cells occupy 4-6μm^2 of silicon. In comparison, ThinFilm's polymer cells occupy about 0·25μm^2. Conventional memory arrays are based on the use of transistors within an addressable matrix. Since the plastic memory array doesn't use active devices (transistors) to form its cells it is much more compact, consisting of a passive matrix of crisscrossed electrodes.

The active elements required to address the memory cells and carry out the read and write operations can be positioned at the edge of the memory matrix or under or above it, which makes new packaging structures possible. A gigabit of contemporary S-RAM uses 1·5-6·5 billion transistors: with ThinFilm's polymer memory approach only 0·5 million active elements are required for the same capacity. And 3D density is possible by stacking polymer memory sheets.

What might this plastic-memory density mean in practice? According to ThinFilm a single credit-card sized memory using the technology could store 60,000 DVD movies, 230 years of MP3 songs, 400,000 CDs or 250 million high-definition digital pictures. Companies that work at the limits of research and development are prone to making extravagant claims of course. But 87 per cent of ThinFilm is owned by Opticom ASA, the rest by Intel. If anyone is likely to be interested in silicon replacement technology, it would be Intel. So plastic memory could well be more than a designer's dream. We've had huge advances in memory technology before: from the mechanical relay to vacuum tubes, magnetic-core memories then silicon.

ThinFilm's approach is only one in the field of memory development however. Binary storage has a simple basic requirement: two recognisable states. The main aims in development work are density and speed of operation. The hunt is on to find other simple yet effective means of storing the digits. Two approaches are spintronics and biomolecules.

Spintronics

Spintronics takes us beyond the conventional approach to electronics, which is based on a flow of electrons. Canadian scientists claim to have reinvented the transistor with a device based on 'spin', a fundamental property of particles. It makes electrons behave like tiny magnets whose poles point up or down. The development

follows reports on the transistor-like behaviour of single atoms and molecules, also based on spin control. Those involved in this field consider that spintronic devices, many times smaller than today's transistors, could form the basis of tomorrow's electronics.

The spintronic transistor consists of a quantum dot, a sort of electrical well that holds just a few electrons. The wells are created by electric fields produced by tiny electrodes n a semiconductor surface. A uantum dot holds on to electrons just as the nucleus of an atom does. In other words, it's a sort of artificial atom, many times larger, to which electrons can be added individually. The spin of the electrons determines whether or not they can flow as current through the quantum dot.

Electron spin is irrelevant in normal electronics – all that matters is how many electrons there are in a current flow. Transistors used in computing operate by allowing current to pass or blocking it (on/off switching). Spintronic devices block or pass a current depending on whether the electron spin is up or down. A magnetic field tunes the quantum dot so that the electron spin is aligned one way or the other. A gate mechanism is thus achieved, with current flow through the dot dependant on electron spin.

Although the spintronic device is a laboratory innovation rather than a practical arrangement, it does demonstrate that information can be stored, read out and erased by manipulating the spins of electrons in a quantum-dot well.

Biomolecules

Biomolecules have become of increasing interest to researchers in the field of organic memory. Some time back a group of Italian researchers altered the structure of a special protein, GFP (Green Fluorescent Protein), creating single biomolecules that each provide a single bit of optical memory. The molecule used is a mutation of an enhanced GFP, which glows at room temperature and is commonly used in biology as an optical marker.

The biologically-engineered photophysical properties of the GFP allow two laser beams, of different wavelength, to address and control a shift between dark and bright states. Toggling between these offers the possibility of biological binary memory devices. The two states can be written and read and are non-volatile – exactly what's wanted.

According to Vittorio Pellegrini, a physicist at the National Enterprise for Nanoscience and Nanotechnology, Pisa, it will be relatively easy to construct large 3D arrays of these memory molecules.

The DNA computer is yet another possible approach to electronics evolution.

DNA computing

DNA computing is an outstanding example of knowledge convergence, in this case involving molecular biology and computer science. The research started in 1994 when L.M. Adleman, a computer scientist at the University of California, read a book by James Watson, who discovered the structure of DNA in 1953, and came to the conclusion that DNA had computational potential. The ball started to roll when Adleman wrote an article in which he demonstrated that standard molecular biology techniques can be used to solve computational problems.

The mathematical problem that Adleman used as his example is called the Directed Hamilton Path Problem, or the travelling-salesman problem. The goal is to find the shortest route between a number of cities, going through each city only once. As more cities are added, the problem becomes more difficult. Adleman chose to find the shortest route between seven cities.

In practice a pencil and paper would have provided the solution more quickly than the time Adleman took with his test-tube DNA computer, but he had to start from scratch. Here are the steps taken in his experiment:

(1) Strands of DNA represent the seven cities. With genes, the genetic coding is carried by four chemical bases that are known by the letters A, T, C and G. A sequence of these four letters represented each city and possible flight path.

(2) The molecules were mixed in a test tube, with some of the strands sticking together. A chain of these strands represents a possible answer.

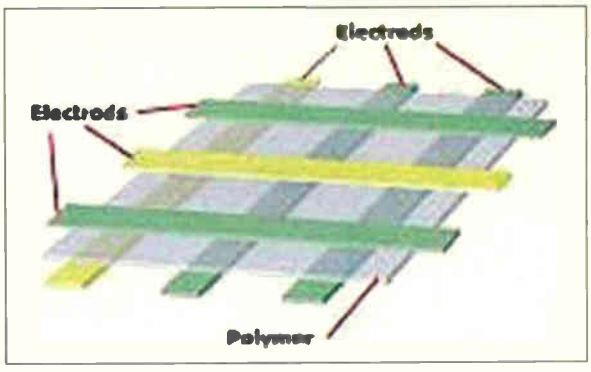

Photo 1: The ThinFilm Polymer plastic memory consists of a sheet of plastic sandwiched between a grid of electrodes. A cell able to store a one or zero exists at each electrode intersection.

(3) Within a few seconds all the possible combinations of DNA strands, which represent answers, are created in the test tube.

(4) Adleman eliminated the wrong molecules through chemical reactions, leaving behind only the correct flight paths that connect all seven cities.

The success of this experiment proved that DNA can be used to provide the answer to complex mathematical problems. But this early form of DNA computer was not a challenge to silicon in terms of speed. It created a group of possible answers very quickly, but Adleman took days to narrow down the possibilities. Data is represented by pairs of molecules on a strand of DNA. Two naturally-occurring enzymes act as the hardware to read, copy and manipulate the code. When it's all mixed together in the test tube, the software and hardware operate on the input molecules to create the output.

Another drawback of Adleman's DNA computer is that it requires human assistance. But the experiment set the goal for future research into DNA computing, the aim being to create a device that can work without human involvement. Since the original experiment,

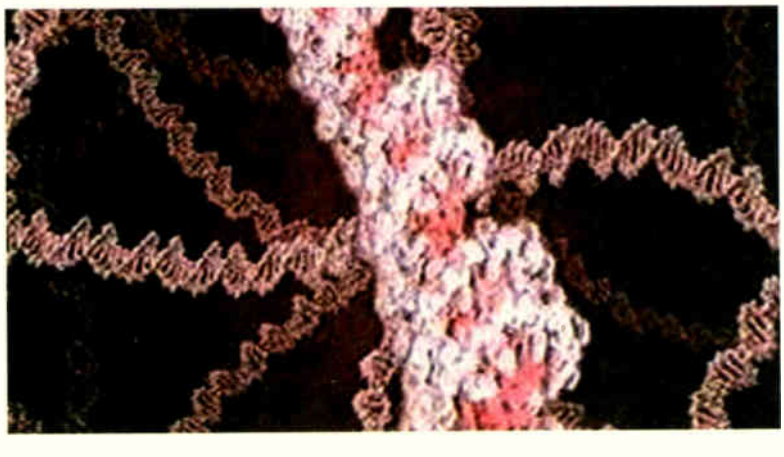

Photo 2: Structure of a DNA Helix.

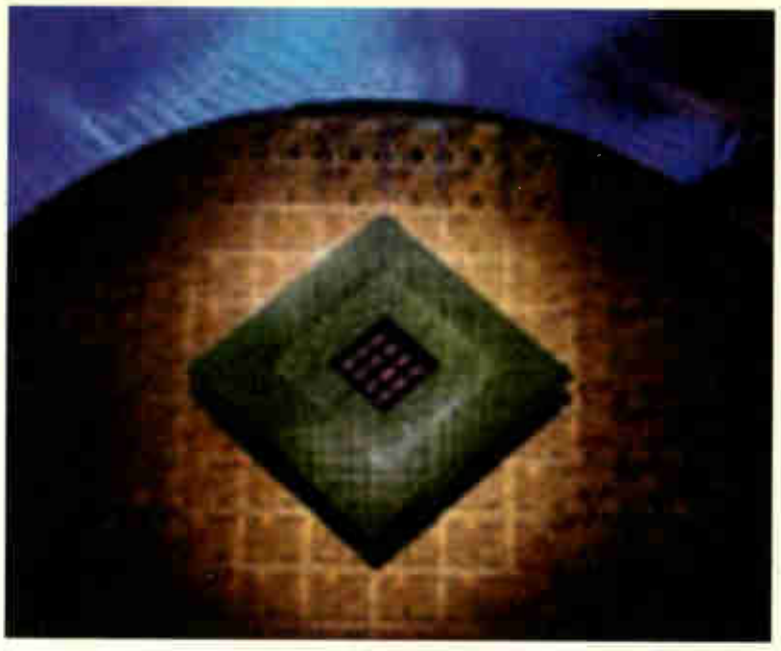

Photo 3: The teraHertz transistor is fabricated one atomic layer at a time and can switch on and off a trillion times a second.

researchers have developed several different models to solve other mathematical and computational problems.

Three years after Adleman's experiment, researchers at the University of Rochester developed logic gates made of DNA. This was the first step towards developing a DNA computer that has a similar structure to an electronic, silicon one. Instead of using electrical signals to perform logic operations, the logic gates rely on the DNA code. They detect fragments of genetic material as inputs and splice these together to provide the output. For example a genetic 'and' gate links two DNA inputs by chemically binding them so that they are locked in an end-to-end structure, similar to the way in which two pieces of Lego can be fastened together using a third piece between them. The researchers believe that these logic gates could be combined in DNA biochips to create a breakthrough towards future DNA computing.

DNA computers have the potential to take computing to new levels. There are several advantages over silicon: DNA is a cheap resource; DNA biochips are bio-friendly and can be made cleanly, unlike silicon chips that require toxic materials during fabrication; and a DNA computer would be many times smaller than the computers of today. It's this last point that holds the greatest potential.

The computing power of a teardrop-size computer using DNA logic gates could be greater than that of the world's most powerful supercomputer today. It has been estimated that more then ten trillion DNA molecules can occupy an area no larger than a cubic centimetre, able to store more data than a trillion CDs. A computer with this small amount of DNA could hold ten terabytes (10^{12}) of data and perform 10 trillion calculations at a time. Thus the information density of DNA is far greater than that of silicon.

Furthermore DNA computers can carry out calculations in parallel – conventional computers operate linearly, carrying out one task at a time. A test tube of DNA can contain trillions of strands, with each operation in the test tube done by all the strands in parallel. By adding DNA, more calculations can be performed. It's this parallel computing that enables a DNA computer to solve in hours a complex mathematical problem that would take an electronic computer hundreds of years to complete.

But much of the information that's been published on DNA computing is purely theoretical: it describes theoretical DNA computer arrangements. Even the concept didn't exist a decade ago however. Much work has been accomplished during this time, from observing the structure and dynamics of DNA to the proposal of rules for DNA computer operation. The practical side has developed much more slowly, because laboratory work is time-consuming and error prone. But progress is beginning to speed up. For example Ehud Shapiro of the Weizmann Institute, Israel has developed a DNA computer so small that a trillion of them can be fitted into a test tube and will carry out a billion operations a second with a claimed accuracy of 99·8 per cent.

Shapiro's creation is the first programmable, autonomous computing machine in which the input, output, software and hardware all consist of biomolecules. Although too simple to have any immediate applications, it's another step forward.

The potential of DNA as a memory and basis for computation is enormous. The double-helix molecule, which contains human genes, stores data on the four chemical bases previously mentioned, A, T, C and G. Each give it massive memory capacity. As Shapiro points out: "The living cell contains incredible molecular machines that manipulate information-encoding molecules such as DNA and RNA (a chemical cousin) in ways that are fundamentally very similar to computation. Since we don't at present know how to modify these machines or create new ones, the trick is to find naturally-existing machines that, when combined, can be steered to compute." This is all on the optimistic side. It's only fair to add that several papers which show the limitations of the DNA computing approach have been published.

In conclusion

Who knows how many of these developments will actually make it to the market? If one or more of them becomes practical, electronics will not be the same. Even if they don't work out, there are important evolutionary changes ahead, such as Intel's announcement of a THz (teraHertz) transistor. This is fabricated one atomic layer at a time and can switch on and off a trillion times a second, far faster than today's Pentiums. Power consumption is much less, so much less heat is generated. Intel expects this new type of transistor to be adopted in microprocessor chips within four years. According to Intel the prospect, during the next decade, is for commodity processor chips with twenty-five times more transistors in them than at present, running at ten times the speed yet with no increase in power consumption.

Intel is developing a processor with two brains, i.e. two chip cores on the same silicon substrate. This would make 'core hopping' possible, with a stream of calculations jumping from one core to the other to avoid the 'hot spots' that occur during intense number crunching, limiting performance. According to Wilf Pinfold, Intel's technical director for microprocessors, the aim is to develop a new approach to chip architecture design.

One way or another, things aren't going to stand still! ■

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Tom Baker's tales

Another security-code problem. Service with a smile – ideal transportation for field servicing. Make money with a Joule decoder

Just the thing for field servicing (heading photo), with plenty of room for the tellys. But it's as well to let your customers know when you are going to make a call.

I naturally leapt to attention when this nice young lady came into the shop with a VCR under her arm. It was an Aiwa HVGX955K. I took her name and address and noted the fault down on a pad then realised, as one does, that she had the same unusual surname and the same address as an old customer I'd not heard from for some sixteen years. So I asked how her parents were. "Fine" she replied.

Smalltalk over, I bade her goodbye and started to reminisce about the time when I had called on her parents and was on my knees behind their old Pye hybrid colour receiver, changing the PL802. A young girl dressed in a tutu came into the room with a tape recorder. She couldn't have been more than five or six years old. After turning the tape on she asked me to watch her, and started to dance across the lounge carpet. After a few minutes of this her mum came in to see what was going on, then apologised. She'd told her daughter that a man from the television company would be calling that day. Her daughter thought I was a talent scout for the BBC!

Security-code problem

But back to the plot. When I placed the VCR on the bench and plugged it in there were no functions. I took the cover off but there was no obvious cause inside, like toast or leggo pins. The next step was to insert a test tape and press play. Again nothing happened. Eject was OK however.

At this point I remembered my own golden rule and looked at the front of the machine to see if there was any mention of a 'security code'. There it was, shouting at me, by the manufacturer's name. Faster than the proverbial rat up the drainpipe. I was on the phone to the young lady. She gave me three combinations of numbers, not being sure which one was correct. One of them was her date of birth, and this was the one that unlocked the machine. A quick calculation told me that she would be twenty one in a month's time, which made me feel old!

We had a brief conversation next day when she called to collect her VCR, and paid for it. As she left she invited me to her 21st birthday party, knowing that I lived just down the road from the pub where it was to be held. I thanked her and felt young again for a few minutes. It wasn't really on, but I was grateful nevertheless.

Service with a smile

I still do house calls, and my trusty Sierra estate car normally gets me there and back all right. When I heard funny noises coming from its diesel engine, i.e. funnier than normal, I decided to take it to my friend's garage for a quick diagnosis as to whether or not it was sick. After a few minutes he said it was, but wasn't sure whether it was the big end or something. He carried out some checks with his compression meter, then announced that my pots were all right. So he revved the engine and, just as he was listening with his ear directed at the engine, a loud, metallic bang was heard. A lot of smoke came from the exhaust, and my car died.

What was I to do? There were at least three field calls to make that day!

"No worries" my friend said with a smile, "I'll lend you a replacement while we find out what's happened to yours".

That's great, I thought. Wonder what I'll get. A new estate car maybe, a people carrier – my mind played tricks as I waited.

About ten minutes later he returned with a bunch of Ford keys and took me round to the back of the garage, to the second-hand car compound.

My heart nearly stopped when he showed me the car – see picture. It was a seven-seater ex-funeral limousine, black of course. Or, as he said, "a hearst".

Well, I wouldn't have to lift the

back up, and there was plenty of room inside for the tellys, which could be put in through the doors. Bearing in mind that I'd no option, I thanked him for the 'hearst' and proceeded to the petrol station to put some fuel in it.

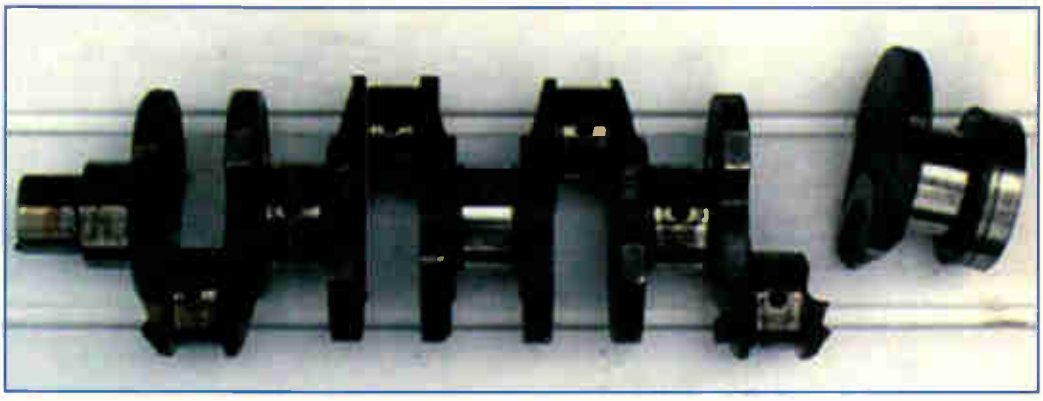
It was only then that I realised I'd been lent a 2·9-litre, V6 gas-guzzling junkie of a car that needed regular fixes of petrol every few miles, or so it seemed. This was all new to me, as my old Sierra seems to run for ever on one fill up of diesel.

After my first service call I came to the conclusion that I had better phone customers first, rather than just turn up in the limo, as I preferred to call it. Mrs Allbright, with the dicky ticker, had nearly collapsed when she saw what drew up outside her house, especially as Mr Allbright was in hospital at the time. After a brief explanation she saw the funny side, but I'd learnt a valuable lesson.

The problem with my own vehicle turned out to be a broken crankshaft, see second photo. I'm assured that this never happens with Sierra estates. I had to be the first, didn't I?

Nearly a week later, and many pounds lighter, I had my old Sierra back. Apart from the fact that I have to drive slowly for a while to bed things in, it's as good as new.

I'll never complain about the cost of diesel again. It cost me more to run the petrol 'hearst' for four days than it does to run the Sierra for two and a half weeks. Which just goes to show how much money funeral directors must be making, to be able to run these beasts all the time.



The cause of the car trouble. A broken crankshaft, something that "never happens" with Sierra diesels.

The Joule A400

Have I mentioned previously that I decode and repair car radios? I've been doing it for a number of years now, and have a monopoly in my area. You might find it worthwhile as a sideline.

The Joule A400 decoder is not cheap, with all its modules and adaptors, but over a period of time it will pay you back and more for your initial investment. I've also found that if I need help with decoding a particular radio the Joule service and decoding departments are more than willing to help if they can.

An average price for a job is between £10 and £15 trade. Customers seem to be happy to pay between £15 and £25 which, when you work it out, is in most cases good money for ten minutes' work.

Once the word gets round that you can provide this service, you'll have all the local garages bringing you the odd radio to decode. I've even found that the local car hi-fi shop, which used to regard me as competition, now sends its decode jobs to me. Business relations have been boosted as well. ■

Test Case 480

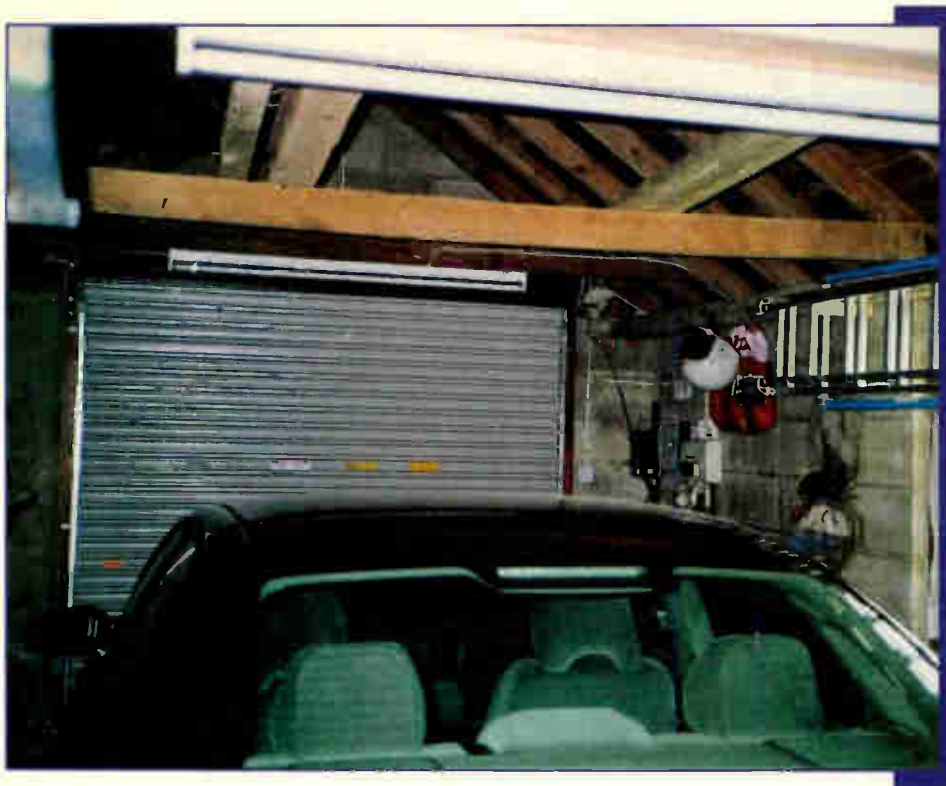
We left Tom Trotter last month with very good TV reception once Meticulous Aerials had supplied and installed the correct array. But the downlead went only as far as his living room. Signals still had to be piped around the Trotter household. He achieved this with help, once more, from Bert at the shop. Fortunately there was no cross-modulation trouble. First questions: what is this, how does it arise, and what are its effects? It's as relevant today as ever.

Tom's problems were by no means over however. He had looped the incoming UHF signals through the satellite box and the VCR so that they would be available elsewhere in the house. This made it possible to feed a cartoon programme to Ashley or his little sister, or watch a movie in the bedroom or the kitchen. But there was a problem with herringbone patterning on the Sky channels, wherever they were viewed in the house – except for the living room, where the big Sony TV set is connected to the set-top box via a scart cable. No matter how the other sets were tuned, Tom couldn't get rid of this interference effect. How did it arise, and what was the cure? This one involved another phone call to the ever-patient Bert at his shop in Duke Road.

Tom had long wanted a DVD player, and some Saturday overtime provided the means with which to buy one. A Dansai no less, from the local Tesco superstore at £85. With Ashley providing help, it was soon out of its box and on to the shelf under the TV set. In went a disc, rented from Videostar, where Tom had already taken out membership. A mains distribution block provided the power feed, and the player's scart lead was plugged into the TV set's scart 2 socket. The result was even better sound and vision than from the satellite and the Heathfield transmitter. Wow! A surround-sound system suddenly became the next big thought in Tom's mind. But meanwhile the DVD player had to be connected to the network. He and Becky would then be able to view Vanilla Sky and Lord of the Rings in the comfort of their bedroom! No aerial sockets, provision of RF loop-through or UHF modulator were required. How was it done? There's a cheap way and a more expensive way.

To make full use of the equipment and the house-wide web called for a way of controlling the gear in the living room from the bedroom. So it was back again to the shop, where Bert was anxious to oblige his now regular customer and new friend. A Sky/Global TV-link Eye gadget was produced: a mere £27 to you sir! Was it really suitable for Tom's needs? Maybe the shop stocked something that would have served better. What do you think?

In his quest for networked entertainment, you might think that Tom had by now encountered just about every possible problem. There was yet another one however. It involved Becky's cordless phone, which was unpacked and hooked up a couple of weeks later. This item caused spasmodic break-up of the satellite picture on some channels – even when it was not in use. Tom and Becky knew it was the cause, because all had been well before it had been made operative, and the symptoms disappeared when its power was removed. This time Bert was unable to provide a diagnosis. Have you any ideas about the cause of the problem and the cure? You can check on the solutions by turning to page 123.



In this concluding instalment Keith Cummins provides constructional details for his infra-red beam control system and full component information

Motorised garage door control

Last month I described the basic operation of motorised garage door systems and the circuitry I devised to add a monitoring infra-red beam arrangement for improved safety – by stopping door closure should anything obstruct the entrance. The system is housed in three ABS boxes: two small ones, types PX1 and PX2, for the IR transmitter and receiver respectively, and a large H2507 type for the control unit. The accompanying photograph shows internal views of the three boxes.

The IR units

The IR transmitter and receiver PCBs that come with the Velleman kit from Maplin fit into PX1 and PX2 boards nicely, as you can see. There is just enough room at the ends of the boards to enable box-fixing holes to be drilled, close to the edges. The boards are mounted on pillars, with the connections to the control unit made with four-core telephone cable. The transmitter unit uses two cores, for +9V and 0V, the receiver unit three, for +9V, 0V and the signal line.

The Velleman instructions show the two LEDs and the phototransistor mounted directly on the boards. For our application the two IR LEDs are mounted adjacent to each other in the sideways-facing edge of the PX1 box and are wired to the board. Terminal pins are soldered into the board to provide connections for the interconnecting phone cable.

The phototransistor is mounted in a small, black plastic tube which sets it back about an inch from the edge of the PX2 box. The end of this tube is stuck in a hole drilled in the facing side of the box, like the transmitter unit. The purpose of the tube is to protect the phototransistor from excessive ambient light – sunlight could cause saturation. In effect the device is 'blinkered', so that it can see only in the direction of the LEDs at the other side of the door. The principle is the same as that which enables you to see the stars on a bright, sunny day if you are unfortunate enough to be stuck down a well and look upwards!

Fig. 8 shows the positions of the two LEDs and the phototransistor tube in the sides of the PX1 and PX2 boxes.

The control unit

The large H2507 box is ideal for housing the main control unit. Its top is screwed to the wall while its bottom is at the front. It may seem odd to use the box in this way but there are good reasons for doing so. First, the two halves of the box and their panels are held together by just two screws that enter from the bottom. Obviously these screws must be at the 'front'. In addition the bottom has a circular slotted area that's convenient for mounting the warning bleeper. Ventilation slots are provided at what are now the top and bottom edges.

The bottom half is generously equipped with plastic mounting pillars on to which the internal components, the transformer etc. can be assembled. As these are all on the reverse side to the front, there are no leads strung between the separate parts of the box. You may think that this makes it difficult to connect the incoming and outgoing cables. But all you

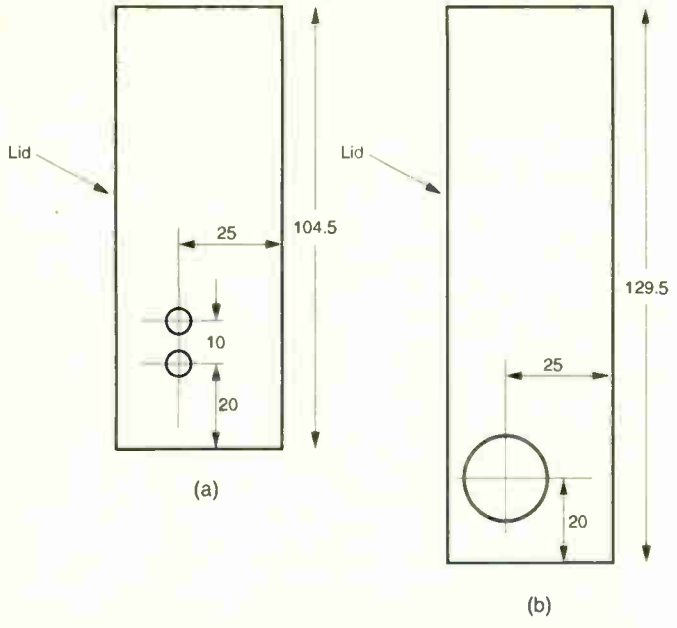


Fig. 8: Positions of the IR LEDs in the side of the PX1 box (a). Position of the phototransistor tube in the side of the PX2 box, (b). Dimensions in mm.

have to do is to hang the unit up by a piece of string passed through the upper mounting screw hole. Connections can then be made to the terminal strip, and the unit can be checked out prior to final boxing up.

At the centre of the bottom (now the front) there is an injection moulding point that's not very pretty. It can be drilled out and the position used to mount the override switch. The positions for other items are shown in Fig. 9.

Fig. 10 shows the suggested positions for the items within the control box. Note that the relay is mounted separately from the power supply and interface board so that, if it's used to switch the mains supply, this is kept off the board. Also the wiring from the relay contacts to the keyswitch and the terminal strip to the outside world needs to be heavy enough to carry the DC motor current should this mode of operation be chosen. The relay can be mounted upside down on a double-sided sticky pad, with a 'finger' attached to an adjacent plastic pillar to hold it.

Testing

It's best to check out the system on the bench prior to installation. When you are satisfied that it is working correctly, go ahead with the installation. But fix the transmitter and receiver boxes with one screw each, ensuring that the IR LEDs and the phototransistor are at the same height – 18in. (46cm). This initial one-screw fixing enables the alignment to be checked before fitting each box with two screws. If you want to be really sure, connect a scope to the junction of D3 and RA (see Fig. 3) in the receiver box and adjust for maximum signal. A simpler test is to use your finger to cover one of the two IR LEDs. If the system still shows 'status green', you know you have at least 6dB of headroom.

If you are using the system with a roller-shutter door, an auto-test facility can be incorporated. Attach a small metal shutter to the bottom of the door so that it interrupts the beam when the door reaches the 18in. level. If you are not using dynamic braking, the shutter will interrupt the beam but the door will coast on past for about three inches. The beam is then uninterrupted, so after four seconds the door continues its movement up or down. The beam-protection facility can in this way be checked every time the door is opened or closed.

In conclusion

I hope you found this account of a somewhat different technology interesting. Even if you don't make the beam unit, the information on motorised garage door operating systems may lead to you consider maintenance and repair of the electronics involved as another possible source of income. But remember this: although the electronics side is not risky for someone used to servicing work, the mechanical aspects of garage doors should always be treated with particular caution, because of the weight, the spring tensions involved and the mechanical forces produced by gearing down the motor.

It's essential to use the correct lubricant should you think that the door is jamming and causing the power supply to trip. Roller-shutter door guides should normally be lubricated using a silicone aerosol,

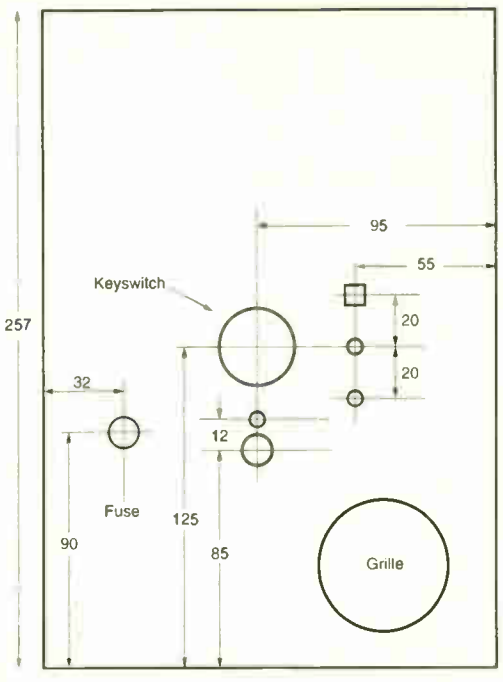


Fig. 9: Positions of the items at the front of the control box (this is the bottom of the box, see text). Dimensions in mm.

Internal views of the assembled IR transmitter, IR receiver and control boxes.

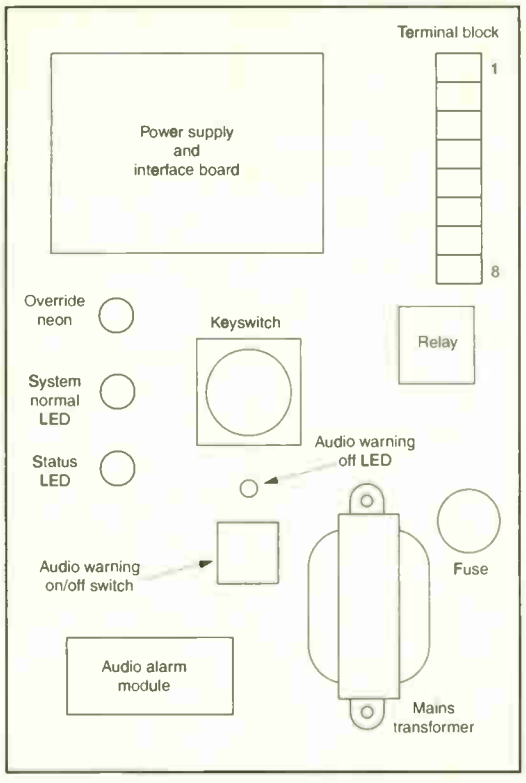
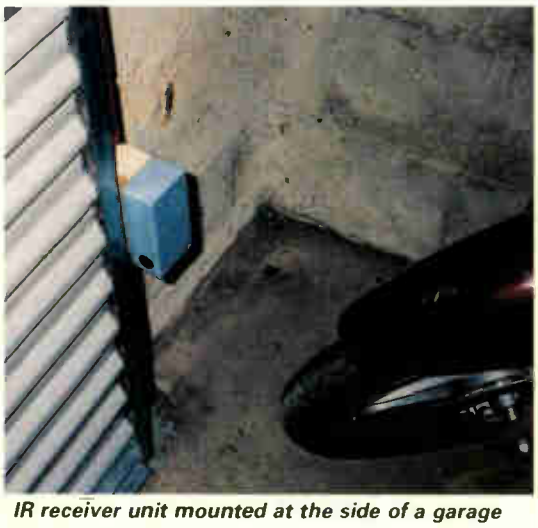


Fig. 10: Suggested locations of the various items inside the control box. Component layout for the power supply and interface board and the audio alarm module is not critical in any respect. Drill fixing holes for the power supply and interface board to match mounting pillars in the box. Terminal block connections are as follows: 1 signal in; 2 +9V out; 3 0V; 4 mains live in; 5 mains neutral in; 6 earth; 7 and 8 relay contacts (mains or motor control).

not Molyslip or WD-40. Always study the manufacturer's instructions, if these are available.

If you are in doubt about the mechanical aspects, call in the specialists. Usually they don't know much about the electronics, so there may be an opportunity to set up a useful partnership, with complementary skills, that can benefit all concerned. ■



IR receiver unit mounted at the side of a garage door.

Components list

IR transmitter and receiver units

Velleman MK120 kit	Maplin LL64U
ABS box type PX1	Maplin YU52G
ABS box type PX2	Maplin YU53H

Resistors: 1kΩ, 2·2kΩ, 4·7kΩ (0·3W, 5%), see text

Power supply and interface board

R1, R9	100Ω	R4	4·7kΩ
R2, R8	470Ω	R5, R6	100kΩ
R3, R7	47Ω	All 0·3W, 5%	

C1	2,200µF, 35V aluminium electrolytic
C2, C3	100nF, 63V ceramic
C4	220µF, 16V aluminium electrolytic
C5	See text
D1/2/3	1N4002
D4	Bi-colour LED, Maplin QY83E
IC1	L78S09, 5V regulator
REC1	W0005 bridge rectifier
RLA	Relay, Maplin UT38R
Tr1-4	ZTX450

Audible warning module

R1	470Ω	R2	4·7kΩ
R3	1MΩ	All 0·3W, 5%	

C1	10µF, 16V aluminium electrolytic
C2	0·47µF, 35V tantalum
BUZ1	Bleeper. From Velleman kit
D1	Red LED. From Velleman kit
D2	1N4002
D3	Green LED, 5mm
IC1	555 timer IC

General items

ABS box type H2507	Maplin BZ77J
Fuseholder (for 250mA quick 20mm fuse)	Maplin GU76H
Fuseholder insulating boot	Maplin FT35Q
IND1	Neon indicator, Maplin RX83E
SW1	Keyswitch, Maplin FH40T
SW2	Min. DP, CO toggle, Maplin FH04E
T1	Mains transformer, 15V, 250mA
VDR1/2	Transient suppresssors, Maplin HW13P

Sundries

Stripboard, equipment wire, terminal pins, interconnecting cable, spacers, nuts and bolts, terminal block, black plastic tuber for phototransistor tunnel etc.

Grandata Ltd

distributor of electronic components

Transistors / Linear IC's

Part No.	Price
BU208A	£0.75
BU2506DF	£0.90
BU2506DX	£1.00
BU2508A	£1.00
BU2508AF	£1.10
BU2508AX	£1.30
BU2508D	£1.30
BU2508DF	£1.20
BU2508DX	£1.50
BU2520AF	£1.70
BU2520AX	£1.40
BU2520DF	£2.25
BU2520DX	£2.00
BU2522AX	£1.50
BU2525A	£3.25
BU2525AF	£2.20
BU2525AX	£1.90
BU2525D	£2.40
BU2525DF	£1.75
BU2527AF	£4.00
BU2527AX	£2.50
BU2527DF	£2.00
BU2527DX	£2.00
BU2532AL	£3.25
BU2708AF	£2.00
BU2708AX	£2.00
BU2708DF	£2.00
BU2708DX	£2.00
BU2720AX	£2.00
BU2720DF	£2.00
BU2720DX	£2.00
BU2722AF	£3.30
BU2725AF	£2.00
BU2725DF	£2.00
BU2725DF	£2.00
BU2727AF	£2.00
BU2727A	£2.00
BU2727AF	£2.00
BU506DF	£1.00
BU508AF	£0.60
BU508APH	£0.60
BU508AXI	£0.90
BU508D	£0.75
BU508DF	£0.85
BU508DR	£1.30
BUH1015	£4.25
BUH1215	£4.50
BUH515	£2.00
BUH515D	£2.50
BUH517	£2.75
BUH517D	£1.75
BUH715	£4.25
BUL310	£1.25
BUL381	£1.50
BUL381D	£1.25
BUT11A	£0.35
BUT11AF	£0.35
BUT11AX	£0.50
BUT12	£0.80
BUT12A	£0.80
BUT12AF	£0.90
BUT18	£0.80
BUT18A	£0.80
BUT18AF	£0.65
BUT56A	£0.65
BUT56AF	£2.00
BUZ71	£0.75
BUZ71AF	£1.00
BUZ72A	£1.00
BUZ72AF	£1.00
BUZ73A	£1.50
BUZ73AF	£0.60
BUZ76A	£1.10
BUZ77A	£2.00
BUZ77B	£2.50
BUZ80	£1.35
BUZ80AF	£2.00
BUZ83	£2.00
BUZ900	£10.00
BUZ901	£15.00
BUZ905	£10.00
BUZ906	£16.00
BUZ90	£1.50
BUZ90A	£1.80
BUZ90AF	£2.80
BUZ91A	£2.60
BUZ93	£1.50
IRF120	£2.25
IRF130	£4.75
IRF140	£5.50
IRF230	£5.50
IRF240	£4.25
IRF250	£3.75
IRF251	£6.50
IRF330	£6.00
IRF340	£3.25
IRF350	£7.50
IRF440	£5.50
IRF450	£6.50
IRF510	£0.70
IRF520	£0.75
IRF530	£0.75
IRF540	£1.00

Part No.	Price
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IRF5740	£3.00
IRF5840	£3.00
IRF610	£0.80
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IRF630	£0.75
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IRF640	£1.50
IRF640F	£2.00
IRF630S	£2.00
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IRF644	£2.00
IRF650	£2.00
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IRF720	£0.85
IRF730	£1.25
IRF740	£0.90
IRF740F	£3.00
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IRF830	£0.85
IRF830F	£1.60
IRF840	£0.85
IRF840F	£1.75
IRF9140	£10.00
IRF9230	£4.00
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IRF9511	£1.50
IRF9520	£1.50
IRF9530	£1.25
IRF9531	£2.00
IRF9540	£1.75
IRF9541	£2.00
IRF9610	£0.95
IRF9620	£0.85
IRF9622	£2.00
IRF9630	£1.30
IRF9640	£2.30
IRFBC20	£1.10
IRFBC30	£1.20
IRFBC40	£2.10
IRFBE30	£2.25
IRFD120	£1.00
IRFD9120	£1.20
IRFD9220	£1.00
IRFF120	£3.00
IRFIBC40	£1.00
IRFIBC40G	£2.00
IRFP054	£4.00
IRFP064	£5.00
IRFP140	£2.50
IRFP150	£2.40
IRFP240	£3.00
IRFP250	£2.80
IRFP340	£2.50
IRFP350	£3.25
IRFP360	£8.00
IRFP450	£2.70
IRFP460	£4.00
IRFP9140	£14.50
IRFP9240	£3.00
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IRFPC60	£6.00
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IRFPE50	£4.50
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IRFPF50	£4.50
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IRFS840	£1.25
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IRFZ42	£2.75
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IRFZ46N	£1.50
IRFZ48	£2.75
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MJ11016	£3.00
MJ11032	£8.00
MJ11033	£8.00
MJ15003	£2.50
MJ15004	£3.00
MJ15015	£2.50
MJ15016	£3.50
MJ15022	£4.00
MJ15023	£4.00
MJ15024	£3.00
MJ15025	£3.00
MJE13004	£1.00
MJE13005	£0.60
MJE13007	£1.00
MJE13009	£1.00
MJE15028	£2.00
MJE15029	£2.00
MJE15030	£2.50
MJE15031	£4.00
MJE16002	£3.00
MJE18004	£1.25
MJE18006	£1.20
MJE18008	£1.50
MJE243	£0.60
MJE253	£0.85
MJE340	£0.25

Part No.	Price
MJE350	£0.80
MJF	
MJF16206	£4.50
MJF18004	£1.75
MJF18006	£2.00
MJF18008	£1.75
MJF18204	£2.50
STK0025	£4.20
STK0039	£6.00
STK086	£10.00
STK1039	£4.60
STK1040	£6.40
STK1049	£7.00
STK1050	£6.50
STK1060	£7.00
STK2025	£6.20
STK2028	£5.00
STK2029	£6.00
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STK2038	£7.00
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STK401-120	£10.00
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STK4028	£5.50
STK4032 II	£5.10
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STK4036	£4.70
STK4036V	£8.00
STK4038	£6.80
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STK4042 II	£8.00
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STK405-050A	£12.00
STK405-070A	£8.00
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STK407-040	£7.00
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STK4101	£5.00
STK4111	£4.00
STK4112	£5.00
STK411-230	£12.00
STK411-240E	£14.00
STK4121	£4.80
STK412-150	£18.50
STK4122	£5.60
STK4130 II	£7.00
STK4130II	£7.00
STK4131	£4.80
STK4132 II	£6.00
STK4133 II	£7.50
STK4140 II	£8.00
STK4141 II	£4.20
STK4141 V	£6.00
STK4142	£5.30
STK4151	£6.80
STK4152	£6.50
STK4154V	£14.00
STK4161	£6.50
STK4161V	£8.50
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STK417-130	£15.00
STK4172 II	£6.80
STK4181	£6.80
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STK419-140	£16.00
STK4192	£7.00
STK4197 II	£9.50
STK4199 II	£10.50
STK4199II	£10.50
STK420	£4.00
STK4204 II	£10.50
STK4204II	£10.50
STK4211 II	£10.00
STK4211 V	£8.00
STK4221 II	£12.00
STK4231 II	£10.50
STK4231 V	£14.00
STK4241	£10.50
STK4241 V	£12.50
STK4272	£5.00
STK4273	£5.50
STK4274	£5.00
STK4274	£5.00
STK430	£5.00
STK4301	£5.00
STK4311	£6.50
STK433	£4.00
STK4332	£3.65
STK435	£3.75
STK4352	£5.00
STK436	£4.30
STK4362	£4.50
STK437	£6.00
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STK4392	£5.00
STK441	£8.80
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STK4432	£6.00
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STK459	£5.60
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STK461	£6.00
STK463	£9.50
STK465	£9.00
STK4773	£8.20
STK4793	£8.00
STK4803	£10.00
STK4813	£8.00
STK4833	£8.50
STK4843	£7.20
STK4853	£17.00
STK4863	£7.00
STK4873	£11.00
STK488-010	£8.00
STK488-050	£8.00
STK4893	£10.00
STK4913	£9.00
STK501	£5.50
STK50322	£3.50
STK5314	£4.75
STK5315	£5.00
STK5323	£6.00
STK5324	£3.00
STK5325	£3.70
STK5326	£7.50
STK5330	£8.50
STK5331	£3.00
STK5332	£1.80
STK5333	£6.50
STK5335	£3.50
STK5336	£3.50
STK5337	£5.00
STK5338	£2.95
STK5339	£4.00
STK5340	£3.50
STK5342	£2.45
STK5343	£3.80
STK5352	£5.00
STK5352	£5.00
STK5353	£4.00
STK5361	£3.75
STK5362	£4.00
STK5364	£2.50
STK5364	£2.50
STK5371	£3.50
STK5371	£3.50
STK5372	£2.60
STK5373	£3.75
STK5383	£3.00
STK5391	£3.75
STK5392	£5.00
STK5421	£4.50
STK5422	£3.75
STK5431	£5.50
STK5434	£5.70
STK5436	£5.00
STK5441	£3.50
STK5443	£5.75
STK5446	£3.50
STK5451	£3.90
STK5461	£5.00
STK5462	£3.50

Part No.	Price
STK5464	£3.00
STK5466	£5.00
STK5467	£4.00
STK5468	£3.00
STK5471	£9.00
STK5472	£3.75
STK5473	£4.80
STK5474	£5.00
STK5476	£3.50
STK5477	£4.50
STK5478	£2.50
STK5479	£3.00
STK5481	£4.70
STK5482	£2.85
STK5483	£4.40
STK5486	£4.50
STK5487	£5.25
STK5488	£4.80
STK5490	£4.50
STK561	£4.00
STK563	£4.15
STK5632	£3.00
STK5720	£4.00
STK5725	£3.50
STK5730	£3.00
STK583	£4.00
STK6316	£3.00
STK6324B	£5.00
STK6327	£12.00
STK6328A	£4.00
STK6431	£6.00
STK6607	£4.00
STK6712BIV	£5.50
STK6722	£8.50
STK6732	£10.00
STK6822	£7.50
STK6875	£6.50
STK6922	£10.00
STK6932	£4.50
STK6962	£2.75
STK6972	£3.00
STK6981B	£5.00
STK6982	£6.00
STK6982H	£6.00
STK7216	£4.20
STK7217	£2.50
STK7225	£5.00
STK7226	£17.00
STK7233	£7.00
STK7251	£5.00
STK7253	£6.50
STK730-060	£6.50
STK730-080	£8.00
STK7308	£7.00
STK7309	£4.00
STK7310	£3.20
STK73405 II	£5.50
STK7310	£3.50
STK73410 II	£5.00
STK7348	£4.00
STK7356	£4.25
STK7358	£4.40
STK7359	£4.25
STK73605	£3.75
STK73907	£7.00
STK73908	£5.50
STK73908	£5.50
STK7402	£5.60
STK7404	£6.00
STK7406	£6.50
STK7406H	£7.50
STK7408	£6.75
STK7410	£15.00
STK7458	£12.50
STK746	£9.00
STK752	£3.00
STK7554	£4.80
STK7561	£6.50
STK7561A	£7.00
STK7562	£10.00
STK7563	£8.00
STK7563F	£6.50
STK7573	£3.00
STK7576	£15.00
STK760	£5.00
STK761	£3.00
STK770	£4.00
STK7707	£9.00
STK780	£4.80
STK78603	£7.50
STK78617	£24.00
STK795	£3.25
STK8050	£16.00
STK8250	£5.00
STK8260	£12.00
STK8280	£18.50
STR10006	£4.50
STR11006	£3.25
STR17006	£5.00
STR20005	£4.50
STR30115	£2.75
STR3315	£2.75
STR370	£3.00

Part No.	Price
STR371	£4.00
STR380	£3.50
STR381	£3.90
STR383	£4.10
STR384	£3.50
STR40090	£3.50
STR40115	£6.00
STR4090A	£6.50
STR41090	£3.30
STR4142	£4.50
STR4211	£3.15
STR43111	£9.50
STR440	£8.00
STR441	£9.50
STR44115	£4.75
STR442	£16.00
STR450A	£7.00
STR451	£8.00
STR45111	£5.50
STR4512	£4.00
STR452	£4.75
STR453	£5.00
STR454	£13.00
STR455	£5.50
STR456	£4.70
STR457	£6.00
STR470	£3.00
STR50020	£3.50
STR50092	£5.50
STR50103A	£2.60
STR50112A	£6.50
STR50113	£5.00
STR50115	£5.00
STR50213	£4.00
STR50330	£4.75
STR51041	£5.00
STR51213	£5.00
STR51424	£7.00
STR53041	£4.00
STR54041	£3.20
STR5412	£2.80
STR55041	£4.50
STR56041	£5.50
STR58041	£2.50
STR59041	£3.00
STR60001	£5.25
STR6008X	£5.75
STR6020	£2.70
STR61001	£4.75
STR7001	£6.00
STR80145	£4.75
STR81145	£3.75
STR81159	£4.00
STR8124	£10.00
STR83145	£5.00
STR83159	£7.00
TDA1420	£8.00
TDA1470	£12.00
TDA1514A	£3.25
TDA1540	£4.20
TDA1541	£5.00
TDA1541A	£4.00
TDA1546T	£10.50
TDA1547	£10.00
TDA1552Q	£3.50
TDA1553AQ	£3.25
TDA1553CQ	£3.00
TDA1554Q	£3.00
TDA1555Q	£3.75
TDA1556Q	£3.25
TDA1557Q	£3.00
TDA1558Q	£3.00
TDA1561Q	£5.00
TDA1562Q	£5.50
TDA1580	£4.25
TDA1599	£4.00
TDA1602A	£4.00
TDA16846	£2.00
TDA1670A	£2.00
TDA1675	£2.50
TDA1675A	£2.00
TDA16833	£2.00
TDA16846	£2.00
TDA1701	£14.00
TDA1770	£7.50
TDA1771	£2.00
TDA1870A	£2.00
TDA1872A	£2.75
TDA1908A	£2.50
TDA1940	£6.00
TDA1941	£3.00
TDA2003	£0.65
TDA2004	£1.50
TDA2005	£1.50
TDA2006	£0.70
TDA2009	£1.60
TDA2020	£1.20
TDA2030	£0.80
TDA2030H	£1.00
TDA2048	£6.00
TDA2050V	£2.00
TDA2051V	£4.50
TDA2052V	£5.25

Part No.	Price
TDA2450-3	£10.00
TDA2460-2	£0.70
TDA2501	£3.00
TDA2506T	£8.00
TDA2507	£4.50
TDA2510	£4.50
TDA2514A	£5.00
TDA2515	£4.50
TDA2520-1	£9.00
TDA2521	£8.00
TDA2522	£12.00
TDA2523	£8.50
TDA2525	£4.50
TDA2530	£3.00
TDA2548	£2.00
TDA2549	£3.00
TDA2558	£4.00
TDA2560Q	£7.00
TDA2560-3	£14.00
TDA2574V	£3.50
TDA2576A	£9.00
TDA2577A	£2.00
TDA2578A	£7.00
TDA2579A	£2.10
TDA2579B	£3.25
TDA2652	£48.00
TDA2653A	£4.50
TDA2710-1	£4.00
TDA2820M	£1.00
TDA2822M	£0.60
TDA3190	£2.00
TDA3301B	£16.00
TDA3303	£7.00
TDA3501	£3.00
TDA3502	£3.60
TDA3504	£3.00
TDA3507	£4.50
TDA3521	£7.50
TDA3560	£6.00
TDA3561	£3.00
TDA3561A	£3.00
TDA3562A	£2.60
TDA3563	£3.50
TDA3563A	£4.00
TDA3564	£3.25
TDA3565	£2.20
TDA3566	£2.80
TDA3566A	£3.00
TDA3567	£3.50
TDA3569	£3.00
TDA3570	£3.75
TDA3576B	£7.00
TDA3650	£6.75
TDA3651	£2.00
TDA3651A	£3.50
TDA3652	£5.00
TDA3652TX10	£8.00
TDA3653B	£0.80
TDA3653C	£0.85
TDA3654	£0.80
TDA3654Q	£0.85
TDA3724	£3.00
TDA3725	£3.00
TDA3730	£4.00
TDA3740	£4.00
TDA3750	£4.00
TDA3770	£7.75
TDA3771	£4.60
TDA3803A	£5.00
TDA4400	£1.75
TDA4420	£1.20
TDA4421	£3.00
TDA4422	£2.00
TDA4427	£3.00
TDA4429T	£20.00
TDA4431	£1.50
TDA4474	£4.00
TDA4480	£6.00
TDA4481	£2.15
TDA4482	£11.00
TDA4500	£3.00
TDA4501	£2.80
TDA4502	£4.00
TDA4503	£3.25
TDA4504B	£8.00
TDA4505A	£3.00
TDA4505E	£6.50
TDA4510	£2.00
TDA4556	£3.70
TDA4557	£4.00
TDA4560	£2.70
TDA4565	£1.50
TDA4566	£2.50
TDA4568	£2.25
TDA4580	£10.00
TDA4600	£2.00
TDA4600II	£1.60
TDA4601	£1.20
TDA4601D	£0.65
TDA4605	£1.90
TDA4610	£3.70
TDA4650	£3.00
TDA4651	£8.00

Part No.	Price
TDA4665	£2.50
TDA4670	£4.75
TDA4671	£5.00
TDA4680	£3.50
TDA4681	£4.50
TDA4685	£2.75
TDA4686	£5.00
TDA4687	£5.00
TDA4700A	£7.50
TDA4710H	£7.00
TDA4714C	£3.50
TDA4716C	£4.50
TDA4720	£6.60
TDA4725	£7.50
TDA4780	£6.00
TDA4800	£3.00
TDA4810	£5.00
TDA4850	£4.75
TDA4851	£3.25
TDA4852	£3.25
TDA4854	£5.00
TDA4855	£6.00
TDA4856	£5.00
TDA4858	£3.50
TDA4860	£2.00
TDA4861	£3.50
TDA4866	£2.75
TDA4880	£4.50
TDA4918A	£17.00
TDA4930	£5.00
TDA4935	£3.00
TDA4940	£2.00
TDA4941	£2.80
TDA4942	£2.00
TDA4950	£1.00
TDA4951	£4.50
TDA5010	£3.00
TDA5400	£6.00
TDA5500	£9.00
TDA5600	£4.50
TDA5610-2	£7.50
TDA5620	£4.50
TDA5702	£13.00
TDA5830-2	£11.00
TDA6100Q	£1.50
TDA6101Q	£1.20
TDA6103Q	£2.25
TDA6106Q	£1.25
TDA6107Q	£3.00
TDA6108JF	£3.00
TDA6111Q	£2.25
TDA6120Q	£5.50
TDA6160-2S	£4.75
TDA6160-2X	£2.50
TDA7052	£1.20
TDA7056	£2.00
TDA7262	£3.25
TDA7263	£3.50
TDA7263M	£4.00
TDA7264	£5.00
TDA7265	£5.00
TDA7266	£5.00
TDA7269	£5.00
TDA7269A	£2.75
TDA7293V	£5.50
TDA7294V	£5.50
TDA7295	£4.00
TDA7296	£5.00
TDA7297	£3.50
TDA7300	£5.50
TDA7302	£4.50
TDA7310	£8.00
TDA7312	£4.50
TDA7313	£6.50
TDA7318	£5.50
TDA7330A	£7.00
TDA7340	£8.00
TDA7350	£3.00
TDA7359	£3.00
TDA7360	£7.00
TDA7362	£4.50
TDA7365	£5.50
TDA7370V	£3.25
TDA7372A	£4.50
TDA7374V	£3.50
TDA7375V	£5.25
TDA7376B	£10.00
TDA7377	£4.50
TDA7381	£11.00
TDA7384A	£11.00
TDA7385	£10.00
TDA7386	£11.00
TDA7393	£10.00
TDA7394	£6.00
TDA7396	£4.50
TDA7431	£7.00
TDA7439	£6.50
TDA7495	£4.25
TDA7560	£18.00
TDA8000	£4.25
TDA8116	£3.50
TDA8120B	£4.00
TDA8137	£2.00

Part No.	Price
TDA8138	£2.00
TDA8138A	£1.30
TDA8138B	£2.00
TDA8139	£2.00
TDA8140	£2.00
TDA8143	£1.60
TDA8145	£1.20
TDA8146	£2.00
TDA8153	£10.00
TDA8170	£1.70
TDA8171	£2.30
TDA8172	£2.00
TDA8173	£1.75
TDA8174	£2.00
TDA8175	£7.00
TDA8177	£3.00
TDA8177F	£3.50
TDA8179S	£7.50
TDA8180	£12.50
TDA8205	£12.50
TDA8212	£3.50
TDA8214B	£10.50
TDA8215H	£3.00
TDA8217	£2.25
TDA8303	£2.50
TDA8304	£4.00
TDA8305	£5.00
TDA8305A	£5.00
TDA8310	£6.00
TDA8350Q	£2.75
TDA8351	£2.00
TDA8354Q	£2.75
TDA8356	£2.00
TDA8360N3	£8.00
TDA8361AN3	£8.00
TDA8361N3	£9.00
TDA8362AN	£12.00
TDA8362AN3	£7.50
TDA8362BN3	£8.50
TDA8362N3	£12.00
TDA8362N4	£9.00
TDA8362N5	£12.00
TDA8366N2	£15.00
TDA8366N3	£11.50
TDA8370	£11.50
TDA8372A	£16.50
TDA8374	£10.00
TDA8375A	£12.50
TDA8376	£15.00
TDA8380	£2.00
TDA8424	£4.00
TDA8425	£5.00
TDA8432	£5.50
TDA8433	£6.00
TDA8440	£3.00
TDA8443	£3.50
TDA8451	£3.25
TDA8453	£3.50
TDA8461	£9.50
TDA8501	£3.75
TDA8505	£11.00
TDA8560Q	£4.25
TDA8561Q	£5.25
TDA8562Q	£5.00
TDA8563Q	£4.75
TDA8565Q	£11.00
TDA8566Q	£5.50
TDA8567Q	£7.00
TDA8568Q	£6.00
TDA8569Q	£8.00
TDA8571J	£9.00
TDA8703	£5.00
TDA8708	£6.00
TDA8709	£7.00
TDA8741	£5.50
TDA8745	£8.50
TDA8840	£10.00
TDA8841	£10.00
TDA8842	£14.00
TDA8843	£15.00
TDA8844	£14.00
TDA9102C	£2.50
TDA9103	£4.75
TDA9105	£5.00
TDA9109	£10.00
TDA9141	£6.25
TDA9143	£4.00
TDA9144	£12.00
TDA9151	£11.00
TDA9160A	£9.50
TDA9162	£11.00
TDA9170	£7.00
TDA9176	£6.50
TDA9177	£8.00
TDA9210	£4.50
TDA9302H	£2.25
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TDA9503	£9.00
TDA9610H	£9.50
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Part No	Price	Part No	Price	Part No	Price
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KSS 210A Replacement	£9.50	KSS 213 F	£12.00	RCTRTH8112	£14.00
KSS 210 B	£15.00	KSS 240 A	£30.00	RCTRH8147 Mech	£ 10.00
		NKS 240 A Replacment for KSS240A	£20.00		

CD Spindle Motors

22.5 mm Shaft — Order Code : CDMOT1 — Price : £ 2.00 + vat

8mm Shaft — Order Code : CDMOT2 — Price : £ 2.00 + vat

105°c Radial Electrolytic Capacitors

VALUE	CODE	PRICE	PER PACK
10 Volts			
100uF	CAP118	£0.45	10
470uF	CAP29	£1.20	10
1000uF	CAP119	£1.50	10
2200uF	CAP120	£2.10	10
16 Volts			
22uF	CAP121	£0.35	10
33uF	CAP122	£0.35	10
47uF	CAP123	£0.35	10
100uF	CAP124	£0.60	10
220uF	CAP125	£0.80	10
330uF	CAP30	£1.75	10
470uF	CAP31	£1.75	10
680uF	CAP32	£2.10	5
1000uF	CAP33	£2.10	10
2200uF	CAP34	£5.25	10
3300uF	CAP35	£5.00	5
4700uF	CAP36	£6.10	10
25 Volts			
10uF	CAP37	£0.45	10
22uF	CAP38	£0.45	10
33uF	CAP126	£0.40	10
47uF	CAP39	£0.48	5
68uF	CAP127	£0.55	10
100uF	CAP40	£0.70	10
120uF	CAP128	£0.85	10
150uF	CAP41	£0.95	5
220uF	CAP42	£1.20	10
330uF	CAP43	£1.40	5

VALUE	CODE	PRICE	PER PACK
35 Volts...continued			
470uF	CAP44	£1.90	10
680uF	CAP45	£3.15	5
1000uF	CAP46	£3.65	101500uF
	CAP47	£3.90	5
2200uF	CAP48	£2.00	2
3300uF	CAP49	£2.20	2
4700uF	CAP50	£3.65	2
6800uF	CAP51	£3.90	2
35 Volts			
1uF	CAP130	£0.40	10
3.3uF	CAP131	£0.40	10
4.7uF	CAP132	£0.45	10
10uF	CAP52	£0.50	10
22uF	CAP53	£0.45	10
33uF	CAP54	£0.50	5
47uF	CAP55	£0.85	10
68uF	CAP133	£0.55	10
100uF	CAP56	£0.85	10
150uF	CAP57	£0.95	5
220uF	CAP58	£1.45	5
330uF	CAP134	£1.60	10
470uF	CAP135	£1.75	10
680uF	CAP59	£6.50	10
1000uF	CAP60	£4.35	10
2200uF	CAP61	£2.45	2
3300uF	CAP62	£10.00	5
4700uF	CAP136	£3.50	2
50 Volts			
1uF	CAP137	£0.35	10

VALUE	CODE	PRICE	PER PACK
50 Volts...continued			
2.2uF	CAP138	£0.35	10
3.3uF	CAP139	£0.35	10
4.7uF	CAP140	£0.35	10
10uF	CAP63	£0.50	10
22uF	CAP64	£0.70	10
33uF	CAP141	£0.85	10
47uF	CAP65	£0.85	10
68uF	CAP142	£0.90	10
100uF	CAP66	£0.85	10
220uF	CAP67	£1.75	10
330uF	CAP68	£2.45	10
470uF	CAP69	£4.35	10
680uF	CAP70	£4.90	5
1000uF	CAP71	£5.25	10
1500uF	CAP143	£4.50	5
2200uF	CAP72	£3.25	2
3300uF	CAP144	£3.25	2
63 Volts			
0.22uF	CAP145	£0.45	10
0.47uF	CAP73	£0.35	10
1uF	CAP74	£0.35	10
2.2uF	CAP75	£0.35	10
3.3uF	CAP76	£0.50	10
4.7uF	CAP77	£0.35	10
10uF	CAP78	£0.50	10
15uF	CAP79	£0.95	5
22uF	CAP80	£0.75	10
33uF	CAP81	£0.85	10
47uF	CAP82	£0.95	10

VALUE	CODE	PRICE	PER PACK
63 Volts...continued			
68uF	CAP83	£1.30	5
100uF	CAP84	£1.20	10
150uF	CAP85	£2.80	5
220uF	CAP86	£2.80	10
330uF	CAP87	£4.00	10
470uF	CAP88	£5.25	10
680uF	CAP89	£5.00	10
1000uF	CAP90	£5.40	5
100 Volts			
0.47uF	CAP91	£0.50	5
1uF	CAP92	£0.85	10
1.5uF	CAP93	£0.70	5
2.2uF	CAP94	£0.50	5
3.3uF	CAP95	£0.50	5
4.7uF	CAP96	£0.50	5
10uF	CAP97	£0.95	10
22uF	CAP98	£1.05	10
33uF	CAP99	£1.55	5
47uF	CAP100	£1.75	10
100uF	CAP101	£2.10	10
220uF	CAP102	£6.00	5
470uF	CAP103	£6.00	5
160 Volts			
2.2uF	CAP146	£0.45	10
10uF	CAP147	£1.40	10
22uF	CAP148	£1.80	10
33uF	CAP149	£2.30	10
100uF	CAP150	£3.25	5

VALUE	CODE	PRICE	PER PACK
200 Volts			
100uF	CAP151	£3.25	5
250 Volts			
1uF	CAP152	£0.60	10
3.3uF	CAP104	£1.75	10
10uF	CAP105	£2.60	10
22uF	CAP153	£2.30	10
47uF	CAP106	£4.35	10
100uF	CAP154	£4.50	5
220uF	CAP155	£2.00	2
350 Volts			
1uF	CAP156	£0.70	10
3.3uF	CAP157	£1.50	10
10uF	CAP158	£2.25	10
22uF	CAP159	£3.40	10
400 Volts			
1uF	CAP107	£2.15	5
2.2uF	CAP108	£2.25	5
4.7uF	CAP109	£3.15	5
10uF	CAP110	£4.00	5
22uF	CAP111	£2.50	2
47uF	CAP112	£3.50	2
100uF	CAP160	£4.00	2
220uF	CAP161	£7.00	2
450 Volts			
1uF	CAP113	£2.80	5
2.2uF	CAP114	£3.20	5
4.7uF	CAP115	£4.95	5
10uF	CAP116	£5.50	5
22uF	CAP117	£4.15	2

Fuses

20mm Glass

Time Lag

CURRENT RATING	ORDER CODE	PRICE
100mA	FUSE36	75p
160mA	FUSE01	75p
250mA	FUSE02	75p
315mA	FUSE03	75p
400mA	FUSE04	75p
500mA	FUSE05	75p
630mA	FUSE06	75p
800mA	FUSE07	60p
1A	FUSE08	60p
1.25A	FUSE09	60p
1.6A	FUSE10	60p
2A	FUSE11	50p
2.5A	FUSE12	50p
3.15A	FUSE13	55p
4A	FUSE14	55p
5A	FUSE15	60p
6.3A	FUSE16	60p

Quick Blow

CURRENT RATING	ORDER CODE	PRICE
100mA	FUSE37	60p
160mA	FUSE17	60p
250mA	FUSE18	60p
315mA	FUSE19	60p
400mA	FUSE20	60p
500mA	FUSE21	60p
630mA	FUSE22	60p
800mA	FUSE23	60p
1A	FUSE24	60p
1.25A	FUSE25	60p
1.6A	FUSE26	60p
2A	FUSE27	60p
2.5A	FUSE28	60p
3.15A	FUSE29	50p
4A	FUSE30	50p
5A	FUSE31	50p
6.3A	FUSE32	50p

All above Fuse prices are for a pack of 10

Wickman Fuses

Fast Blow

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

Slow Blow

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

All above Wickman Fuse prices are for single units

Axial Lead Fuse Protectors

CURRENT RATING	COLD RESISTANCE (Ohms)	ORDER CODE	PRICE
125mA	1.7	FUSE95	£3.00
250mA	0.665	FUSE96	£3.00
375mA	0.395	FUSE97	£1.20
500mA	0.28	FUSE98	£3.00
750mA	0.175	FUSE99	£3.00
1A	0.125	FUSE100	£1.20
1.5A	0.0823	FUSE101	£2.00
2A	0.0473	FUSE102	£1.20
2.5A	0.036	FUSE103	£2.00
3A	0.029	FUSE104	£2.00
3.5A	0.024	FUSE105	£2.00
4A	0.0204	FUSE106	£2.00
5A	0.0155	FUSE107	£1.20
7A	0.10105	FUSE108	£2.00
10A	0.00705	FUSE109	£2.00

SPECIFICATION

Voltage Rating : 125 V upto 5A , 50V 7A,10A

Operating Temperature : -55C TO +125C

All above Axial Lead Fuse Protetor prices are for a pack of 5

Grandata Ltd

distributor of electronic components

Television Repair / Mod Kits

MAKE & MODEL	KIT TYPE	CODE
ALBA		
1452T	PSU	ONWAKIT
1427T	PSU	ONWAKIT
1402	PSU	ONWAKIT
1455T	PSU	ONWAKIT
1456T	PSU	ONWAKIT
1458T	PSU	ONWAKIT
1459T	PSU	ONWAKIT
1499Y	STANDBY	MODKIT37
2002	PSU	ONWAKIT
2009B	PSU	ONWAKIT
2052T	PSU	ONWAKIT
2152T	PSU	ONWAKIT
2099TX	STANDBY	MODKIT37
BTV17	STANDBY	MODKIT37
CTV501	PSU	ONWAKIT
CTV701	PSU	ONWAKIT
CTV840	PSU	ONWAKIT
CTV841	PSU	ONWAKIT
CTV485	PSU	ONWAKIT
AKAI		
CT1417	PSU	ONWAKIT
CT2159U	PSU	ONWAKIT
CT2162UNT	PSU	ONWAKIT
CT2863UNT	PSU	ONWAKIT
DECCA/TATUNG		
TVC563	STANDBY	MODKIT37
GOLDSTAR		
CF25A50F	FRAME	MODKIT36
CF25C22C	FRAME	MODKIT35
CF28A50F	FRAME	MODKIT36
CF28C22F	FRAME	MODKIT35
CF28C28F	FRAME	MODKIT36
CF29C42F	FRAME	MODKIT35
GOODMANS		
147TT	PSU	ONWAKIT
149T	PSU	ONWAKIT
1430RA	PSU	ONWAKIT
1430RS	PSU	ONWAKIT
1430RW	PSU	ONWAKIT
1450T	PSU	ONWAKIT
1455TS	PSU	ONWAKIT
2019R	PSU	ONWAKIT

MAKE & MODEL	KIT TYPE	CODE
GOODMANS..Continued		
2029T	PSU	ONWAKIT
2029TA	PSU	ONWAKIT
F16 CHASSIS	FRAME	GOODKIT1
F16 CHASSIS	LINE	GOODKIT1
F16	PSU	GOODKIT1
F16	VIDEO	GOODKIT1
GRUNDIG		
CUC 7350		GRUNDIGKIT1
CUC 7301/3 (BUZ90)	PSU	GRUNDIGKIT2
CUC 7301/3 (MJF18004)	PSU	GRUNDIGKIT3
HINARI		
HIT14RC	PSU	ONWAKIT
JVC		
AV29SX1EK	FIELD O/P	JVCKIT1
AV29SX1EN	FIELD O/P	JVCKIT1
AV29SX1EN1	FIELD O/P	JVCKIT1
AV29SX1PF	FIELD O/P	JVCKIT1
AV29TSIE1	FIELD O/P	JVCKIT1
C14E1EK	PSU	ONWAKIT
C14T1EK	PSU	ONWAKIT
C21ET1EK	PSU	ONWAKIT
CS21M3EK	PSU	ONWAKIT
MATSUI		
1455	PSU	ONWAKIT
1498	PSU	ONWAKIT
2086	PSU	ONWAKIT
2098	PSU	ONWAKIT
21V1N (BUZ90)	PSU	GRUNDIGKIT2
21V1T(MJF18004)	PSU	GRUNDIGKIT3
TVR180R/T/2080	STANDBY	MODKIT37
MITSUBISHI		
AV1 SERIES	PSU	MITSKIT3
CT1M5B	PSU	MITSKIT3
CT21M5BT	PSU	MITSKIT3
CT25M5BT	PSU	MITSKIT3
CT21A2STX	TDA 8178S	MITSKIT1
CT21AX1B	PSU	MITSKIT3
CT21A3STX	TDA 8178S	MITSKIT1

MAKE & MODEL	KIT TYPE	CODE
MITSUBISHI..Continued		
CT21AV1BS	PSU	MITSKIT3
CT25A2STX	TDA 8178S	MITSKIT1
CT25A3STX	TDA 8178S	MITSKIT1
CT25A4STX	TDA 8178S	MITSKIT1
CT25A6STX	TDA 8178S	MITSKIT1
CT25AV1B	PSU	MITSKIT3
CT25AV1BS	PSU	MITSKIT3
CT25AV1BD	PSU	MITSKIT3
CT25AV1BDS	PSU	MITSKIT3
CT28AV1B	PSU	MITSKIT3
CT28AX1BD	PSU	MITSKIT3
CT28AV1BDS	PSU	MITSKIT3
CT29AS1	TDA 8178S	MITSKIT2
CT29A4	TDA 8178S	MITSKIT2
CT29A6	TDA 8178S	MITSKIT2
CT29B2	TDA 8178S	MITSKIT2
CT29B3	TDA 8178S	MITSKIT2
CT29B6	TDA 8178S	MITSKIT2
CT33B3	TDA 8178S	MITSKIT2
M5 SERIES	PSU	MITSKIT3
NEI/NIKKAI		
CE25 CHASSIS	PSU	NIKKAIKIT1
C289FTXN	PSU	NIKKAIKIT1
C28F41FXN	PSU	NIKKAIKIT1
PANASONIC		
IC561	TDA 8175	PANKIT1
TX25XD60	VERT OUTPUT	PANKIT2
TC28XD60	VERT OUTPUT	PANKIT2
TX28XD70	VERT OUTPUT	PANKIT2
TX29XD70	VERT OUTPUT	PANKIT2
TX-W26D3	VERT OUTPUT	PANKIT2
PHILIPS		
310.10708		PHILKIT3
310.20491		PHILKIT2
310.20496		PHILKIT10
310.31994		PHILKIT6
310.32252		PHILKIT5
310.32253		PHILKIT4
310.32254		PHILKIT9
310.32255		PHILKIT7

MAKE & MODEL	KIT TYPE	CODE
PHILIPS..Continued		
310.32262		PHILKIT8
310.62264		PHILKIT1
ANUBIS A	SOPS	PHILKIT2
CP110 CHASSIS	SOPS	PHILKIT8
G90A CHASSIS	SOPS	PHILKIT10
G90B CHASSIS	SOPS	PHILKIT10
G110 CHASSIS	SOPS	PHILKIT3
GR2.1 CHASSIS	SOPS	PHILKIT1
GR2.2 CHASSIS	SOPS	PHILKIT1
D-16 CHASSIS	SOPS	PHILKIT6
HSM VIDEO	SOPS	PHILKIT5
JSM VIDEO	SOPS	PHILKIT4
KSM VIDEO	SOPS	PHILKIT9
LSM VIDEO	SOPS	PHILKIT7
SAMSUNG		
CI5944	FRAME	SAMKIT2
CI6844	FRAME	SAMKIT2
VIK310	PSU	SAMSUNGKIT
VIK320	PSU	SAMSUNGKIT
VIK350	PSU	SAMSUNGKIT
VI375	PSU	SAMSUNGKIT
VI395	PSU	SAMSUNGKIT
WINNER 1	PSU	SAMSUNGKIT
SHARP		
51CS03H	PSU	SHARPKIT1
51CS05H	PSU	SHARPKIT1
59CS03H	PSU	SHARPKIT2
59CS05H	PSU	SHARPKIT2
59CSD8H	PSU	SHARPKIT2
59DS03H	PSU	SHARPKIT3
66CS03H	PSU	SHARPKIT2
66CS05H	PSU	SHARPKIT2
66CSD8H	PSU	SHARPKIT2
THOMSON		
35029400		THOMKIT2
35065920		THORNKIT1
FV70	PSU	THORNKIT1
ICC7 CHASSIS	TDA 8178FS	THOMKIT1
ICC7 CHASSIS	FRAME	THOMKIT3
ICC8 CHASSIS	TDA 8178FS	THOMKIT1
ICC8 CHASSIS	FRAME	THOMKIT3
ICC9 CHASSIS	EAST/WEST	THOMKIT4
R3000	PSU	THOMKIT2
R4000	PSU	THOMKIT2
TX92F CHASSIS	EAST/WEST	THOMKIT4

ORDER CODE	PRICE
GRUNDIGKIT1	£ 10.50
GRUNDIGKIT2	£ 10.50
GRUNDIGKIT3	£ 10.50
GOODKIT1	£ 11.00
JVCKIT1	£ 11.00
MITSKIT1	£ 3.00
MITSKIT2	£ 15.00

ORDER CODE	PRICE
MITSKIT3	£ 6.00
MODKIT35	£ 9.50
MODKIT36	£ 5.00
MODKIT37	£ 6.50
NIKKAIKIT1	£ 12.00
ONWAKIT	£ 12.00
PANKIT1	£ 11.00

ORDER CODE	PRICE
PANKIT2	£ 9.00
PHILKIT1	£ 7.60
PHILKIT10	£ 8.50
PHILKIT2	£ 2.50
PHILKIT3	£ 4.00
PHILKIT4	£ 4.25
PHILKIT5	£ 5.75

ORDER CODE	PRICE
PHILKIT6	£ 5.50
PHILKIT7	£ 7.60
PHILKIT8	£ 4.25
PHILKIT9	£ 7.50
SAMKIT2	£ 8.00
SAMSUNGKIT	£ 16.00
SHARPKIT1	£ 11.00

ORDER CODE	PRICE
SHARPKIT2	£ 11.00
SHARPKIT3	£ 9.00
THOMKIT1	£ 7.00
THOMKIT2	£ 12.00
THOMKIT3	£ 9.00
THOMKIT4	£ 4.00
THORNKIT1	£ 12.75

Satellite Repair / Mod Kits

Amstrad DRX100
Tuner Repair Kit

Order Code
SATKIT35

Price
£ 1.40 + vat

Amstrad DRX100
Power Supply
Reliabilty Kit

Order Code
SATKIT36

Price
£ 12.00 + vat

Amstrad DRX100
Power Supply
Repair Kit

Order Code
SATKIT37

Price
£ 13.50 + vat

Grundig GDS200
Digital Satellite Receiver
Repair Kit

Early psu
MODEL : DS0 - 0385 REV C

Order Code: SATKIT34A
Price : £ 10.00 + vat

Grundig GDS200/300
Digital Satellite Receiver
Repair Kit

LATER psu TYPE REV 03
DSO - 0375 REV A
DSO - 0385 REV 5

Order Code: SATKIT34B
Price : £ 10.00 + vat

Digital Satellite Receivers Fan Kit

Suitable for
Amstrad DRX100 , DRX200
Grundig GDR200 , GDS200
Pace Digibox
plus many more analogue makes and models

Order Code : FANKIT1
Price : £ 10.00 + vat

Panasonic Digital Satellie Receiver Fan Kit

Suitable for Panasonic TU-DSB20/30 , TU-DSB31/35

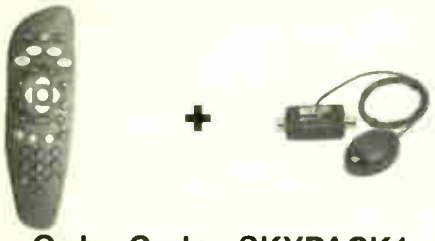
Order Code : FANKIT2
Price : £ 15.00 + vat

Grandata Ltd

distributor of electronic components

Aerial & Digital Satelitte Accessories

Sky™ Digital Remote & TV Link Eye Combination



Order Code : SKYPACK1

Price : £ 16.00 + vat each

5 +

£ 14.50 + vat each

Sky™ Digital Remote Controls

Order Code : RCSKY

1 +
£ 7.95 + vat each

5 +
£ 7.45 + vat each

10 +
£ 6.95 + vat each

Sky™ Digital Remote & SLx Link Eye Combination

Order Code : SKYPACK2

Price : £ 13.00 + vat each

5 +

£ 11.50 + vat each

SLx Aerial Amplifiers

Now with built in Digital ByPass Operates with Sky™ DigiEye

Class leading noise figure of 4dB or less

6dB signal amplification on all models

Description	Order Code	Price
2 Way - No Bypass	SLX2	£ 8.00 + vat
2 Way - With Bypass	SLX2B	£ 9.25 + vat
4 Way - No Bypass	SLX4	£ 13.00 + vat
4 Way - With Bypass	SLX4B	£ 14.00 + vat
6 Way - No Bypass	SLX6	£ 18.00 + vat
6 Way - With Bypass	SLX6B	£ 19.00 + vat
8 Way - No Bypass	SLX8	£ 18.50 + vat
8 Way - With Bypass	SLX8B	£ 20.00 + vat

Integrated Digital By Pass

SLx Masthead Amplifiers

UHF TV antenna pre amplifier designed for the professional aerial installer

15dB gain masthead amplifier ideal for majority of domestic installations

26dB gain masthead amplifier for longer cable runs (loss of more than 3dB) or if connected to passive splitters

Requires 12V DC power supply via downlead either via dedicated power supply unit or from a distribution amplifier with line powering

15dB Amp Order Code : 27830R
Price : £ 4.30 + vat

26dB Amp Order Code : 27831R
Price : £ 4.50 + vat

SLx Masthead Amp PSU
Order Code : 27832R
Price : £ 5.00 + vat

Postage for 2+ £ 5.00 + vat

Coax Plug Aluminium

Order Code : PLG51
Bag of 10
Price : £ 1.25 + vat
Bag of 100
Price : £ 9.00 + vat

Screw Type Coax Plugs

Order Code : PLG62
Bag of 10
Price : £ 1.60 + vat
Bag of 100
Price : £ 12.50 + vat

Twist On F Connectors

Order Code : PLG101
Bag of 10
Price : £ 1.00 + vat
Bag of 100
Price : £ 6.00 + vat

Coax Coupler Socket to Socket

Order Code
PLG54
Bag of 10
Price : £1.50 + vat

Coax Coupler Plug to Plug

Order Code
PLG55
Bag of 10
Price : £1.50 + vat

Y Splitter Inductive 3 way

Order Code
YSPLITTER
Price : 40p + vat
Bag of 10
Price : £ 3.00 + vat

SLx Link Eye

Allows control of Sky™ Digibox via the signal feed for second TV

Order Code : 27833R

1 - 9
£ 6.50 + vat each

10 - 24
£ 5.50 + vat each

Sky™ Digital TV Link Eye

Order Code : TVLINKEYE

Price
£ 10.75 + vat

5 +
£ 7.99 + vat each

10+
£ 6.99 + vat each

SLx Amp By Pass Kit

For use with aerial amplifiers and Sky™ Digibox

Allows for operation of Link Eye in conjunction with a distribution amplifier

Order Code : 27829R
Price : £ 5.00 + vat

Digital Satellite splitters 5 - 2400 MHz

Item	Code	1 +	10 +
2 way splitter (Power Pass 1 Port)	27900R	£ 2.40	£ 2.00
3 way splitter (Power Pass 1 Port)	27901R	£ 2.70	£ 2.25
4 way splitter (Power Pass 1 Port)	27902R	£ 2.80	£ 2.40
6 way splitter (Power Pass 1 Port)	27903R	£ 5.00	£ 4.00
8 way splitter (Power Pass 1 Port)	27904R	£ 5.60	£ 4.65

Grandata Ltd

distributor of electronic components

Konig Remote Controls

KONIG ELECTRONIC

KONIG ELECTRONIC

Part No.	Code
AKAI	
CT2582E	IR9700
CT2585	IR9700
CT2885	IR9700
CT2885E	IR9700
IR16	IR9700
RC556	IR9397
RC85	IR9700
AMSTRAD	
SRD550	IR9386
SRX510	IR9386
AE6001	IR9352
B & O	
Beolink 100	IR9843
BEKO	
RC51321	IR9398
RC51331	IR9398
RC61331	IR9398
BLAUPUNKT	
8669493	IR9188
1532	IR9503
1570-46	IR9516
8627 105 463	IR9188
8668813000	IR9516
I555-46	IR9516
I563-46	IR9516
IB16	IR9504
IC16	IR9504
ID32	IR9503
IL32	IR9503
IM32	IR9503
IM55-16	IR9516
IM63-16	IR9516
IM70-16	IR9516
IP32	IR9503
IQ16	IR9504
IR32	IR9504
TC106	IR9406
TC110 PIP	IR9248
TC143	IR9406
TC144	IR9406
TC190	IR9529
TC192	IR9529
TC194	IR9529
CROWN	
RC51331	IR9398
RC61331	IR9398
2190T	IR9397
DAEWOO	
DMQ1414	IR9397
DMQ14A 1	IR9840
DMQ20A 1	IR9840
DMQ2195	IR9840
DMQ2595	IR9840
DMQ2895	IR9840
FERGUSON	
20H3	IR9594
22B5	IR9584
22H3	IR9594
2415	IR9584
2422	IR9584
2423	IR9584
2433	IR9584
2445	IR9584
2452	IR9584
2453	IR9584
2463	IR9584
2475	IR9584
26H3	IR9594
29132	IR9584
36K2	IR9594
41H3	IR9594
4233	IR9584
4414	IR9584
4415	IR9584
4423	IR9584
4433	IR9584
51A0	IR9584
51A2	IR9584
51A3	IR9584
51A4	IR9584
51A5	IR9584
51G2	IR9594
51G3	IR9594
51H3	IR9594
51H4	IR9594
51J7	IR9584
51K3	IR9594
5980	IR9584
59B2	IR9584
59B3	IR9584
59B4	IR9584
59B5	IR9584
59D2	IR9584
59D3	IR9584
59G2	IR9594
59G3	IR9594
59H4	IR9594
59H5	IR9594
59J7	IR9594
59LS2	IR9639
6223	IR9584
6245	IR9584
66B2	IR9584
66B3	IR9584
66H3	IR9594
66H4	IR9594
66H5	IR9594

Part No.	Code
FERGUSON ..continued	
66L52	IR9639
A10R	IR9259
A14R	IR9259
A36R	IR9259
B51F	IR9639
B51NX	IR9639
B59F	IR9639
B59N	IR9639
B59NX	IR9639
B68F	IR9639
B68NX	IR9639
C59NX	IR9639
C68NX	IR9639
D51ND	IR9639
D59F	IR9639
D59N	IR9639
D68N	IR9639
D78N	IR9639
E51N	IR9639
E59R8	IR9639
RCU1734	IR9584
RCU1742	IR9584
RCU1785	IR9594
RCU1789	IR9594
RH880	IR9594
RH885	IR9325
RHT01	IR9259
RHT10	IR9639
RHT30	IR9259
T49F	IR9639
T49N	IR9639
T51F	IR9639
T51N	IR9639
T59F	IR9639
T59N	IR9639
T68N	IR9639
T742	IR9584
T752	IR9584
T758	IR9584
T789	IR9594
T78DPL	IR9639
GOLDSTAR	
105-068	IR9403
105209B	IR9862
105210A	IR9862
105-219J	IR9854
105-224V	IR9854
105-229H	IR9854
105230A	IR9862
105-230C	IR9854
38T1	IR9854
CB20E40X	IR9854
CBT2190E	IR9403
CBT4902	IR9403
CBT4902E	IR9403
CBT9905	IR9403
VS068K	IR9862
GRUNDIG	
CUC503	IR9614
CUC5200	IR9614
CUC5301	IR9529
CUC5302	IR9529
CUC5310	IR9614
RC212	IR9614
RC300	IR9614
TP500VT	IR9500
TP590VT	IR9509
TP600VT	IR9509
TP610	IR9509
TP621	IR9299
TP630	IR9509
TP650	IR9509
TP661	IR9562
TP661 TOP	IR9615
TP663	IR9614
TP710	IR9529
TP711	IR9529
TP712	IR9614
TP715	IR9749
TP720	IR9614
TP760HIFI	IR9614
TP770	IR9749
TP771	IR9749
TP800	IR9749
TP900	IR9749
TRC1	IR9715
TRC2	IR9715
HITACHI	
2970491	IR9479
A518780	IR9142
C1405	IR9476
C1414	IR9476
C2057H	IR9142
C2067	IR9142
C2067H	IR9142
C2114	IR9476
C2146TN	IR9677
C2147TN	IR9677
C2156TN	IR9983
C2166TN	IR9677
C2170TN	IR9983
C2186TN	IR9983
C2257H	IR9142
C2259H	IR9142
C2261	IR9142
C2267H	IR9142
C2268H	IR9142
C2273	IR9142
C2273H	IR9142
C24W1TN	IR9983
C24W511TN	IR9983

Part No.	Code
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C2546	IR9677
C2546TN	IR9677
C2547TN	IR9677
C2556TN	IR9983
C2566TN	IR9677
C2567TN	IR9983
C2567TN2	IR9983
C2586TN	IR9983
C2659H	IR9142
C2660	IR9142
C2661	IR9142
C2846TN	IR9677
C2847TN	IR9677
C2856TN	IR9983
C2866TN	IR9677
C2886TN	IR9983
C28W410TN	IR9983
C28W510TN	IR9983
CBP1476R	IR9142
CBP1646R	IR9142
CBP2067	IR9142
CBP2216	IR9142
CBP222	IR9142
CBP226	IR9142
CBP260	IR9142
CL2156TAN	IR9983
CL24W1TAN	IR9983
CL2556TAN	IR9983
CL2586TAN	IR9983
CL2856TAN	IR9983
CL2886TAN	IR9983
CL28W1TAN	IR9983
CL28WD2TAN	IR9983
CL32WD2TAN	IR9983
CLE871A	IR9602
CLE871B	IR9602
CLE874A	IR9602
CLE874B	IR9602
CLE876	IR9476
CLE876C	IR9477
CLE876D	IR9477
CLE876G	IR9477
CLE902A	IR9677
CLE902B	IR9677
CLE903A	IR9677
CLE921A	IR9983
CLE921B	IR9983
CLE922A	IR9982
CLE922B	IR9982
CLR876E	IR9477
CP2146TA	IR9677
CP2546	IR9677
CP2546TA	IR9677
CP2556TAN	IR9983
CP2841TA	IR9677
CP2856TA	IR9983
CP2856TAN	IR9983
CP2886TAN	IR9983
CP28WD2TAN	IR9983
CP32WD2TAN	IR9983
CPT1556	IR9576
CPT1557	IR9576
CPT1560	IR9576
CPT1561	IR9576
CPT2155	IR9575
CPT2164	IR9575
CPT2558	IR9575
CPT2564	IR9575
CPT2566	IR9575
CPT2669	IR9575
CPT2785	IR9575
CPT2870	IR9575
CS11430	IR9576
CST1435	IR9576
CST1560	IR9576
CT2116	IR9476
CTRM200M	IR9542
JVC	
AV21TS1EN	IR9698
AV25TS1EN	IR9698
AV25VM1EN	IR9698
AV28VM1EN	IR9698
AV29SX1EN	IR9698
AV29TS1EN	IR9698
AV32WZ2EN	IR9698
RC8072	IR9698
RC8074	IR9698
RMC530	IR9698
RMC682	IR9698
RMC761	IR9698
RMC7611E	IR9698
RMC770	IR9698
RMC771	IR9698
RMC7711E	IR9698
RMC793	IR9698
RMC7931E	IR9698
LOEWE	
FB300	IR9616
FB50	IR9514
FB52	IR9514
FB70	IR9514
FB72	IR9514
FB80	IR9514
FB91	IR9514
MATSUI	
076G047240	IR9490
076L067240	IR9490
2076R	IR9490
2092T	IR9490

Part No.	Code
NOKIA	
3126	IR9157
3126F	IR9157
C1	IR9161
C2	IR9161
C3	IR9161
C4	IR9161
CM 1	IR9569
D1	IR9161
D2	IR9161
E1	IR9161
E2	IR9161
EM2	IR9700
ES5	IR9701
FS10	IR9573
FS11	IR9506
FS41	IR9573
FS42	IR9573
FS5	IR9506
FS51	IR9573
FS9	IR9506
FS9	IR9573
IRC1	IR9157
IRC2	IR9157
IRM1	IR9535
IRS1	IR9535
IRS2	IR9535
IRS3	IR9535
RCN610	IR9752
RCN620	IR9751
RCN624	IR9757
SM1	IR9491
SM2	IR9491
PANASONIC	
02280227	IR9835
91[illegible]926	IR9835
EUR60100	IR9826
EUR51920	IR9835
EUR51921	IR9835
IR3592	IR9826
TC1485DR	IR9826
TC14S1R	IR9834
TC150E	IR9562
TC1656PFR	IR9826
TC1785DRS	IR9826
TC1785IR	IR9826
TC1785UR	IR9826
TC2185DRS	IR9826
TC2185IR	IR9826
TC21R1C	IR9826
TC21R1U	IR9826
TC21S1R	IR9834
TCC23PFR	IR9826
TNQ1410	IR9826
TNQ8E0421	IR9826
TNQ8E0422	IR9826
TNQ8E0428	IR9826
TNQ8E0430	IR9826
TNQ8E0432	IR9826
TNQ8E0435	IR9836
TNQ8E0436	IR9836
TNQ8E0441	IR9826
TNQ8E0461	IR9834
TX14S1T	IR9834
TX21S1RC	IR9834
TX21S1T	IR9834
TX21S1TC	IR9834
TX21T1C	IR9826
TX25A2C	IR9836
TX25A2CI	IR9836
TX25W2	IR9836
TX25W2C	IR9836
TX25W2CI	IR9836
TX28A1D	IR9826
TX28A2C	IR9836
TX28A2CI	IR9836
TX28W2	IR9836
TX28W2C	IR9836
TX28XDP1C	IR9835
TX29AD1D	IR9835
TX29W2CI	IR9836
TX33A2C	IR9836
TX33A2CI	IR9836
PHILIPS	
RC5002	IR9510
RC5140	IR9510
RC5154	IR9510
RC5240	IR9510
RC5250	IR9510
RC5260	IR9510
RC5300	IR9510
RC5350	IR9510
RC5410	IR9553
RC5420	IR9553
RC5540	IR9510
RC5701	IR9434
RC5801	IR9553
RC5801	IR9556
RC5901	IR9556
RC5903	IR9556
RC6008	IR9434
RC6404	IR9465
RC6416	IR9465
RC6512	IR9464
RC6804	IR9434
RC7118	IR9464
RC7141	IR9465
RC7500	IR9464
RC7507	IR9710
RC7512	IR9864
RC7535	IR9864
RC8201	IR9434
RC8205	IR9710
RC9010	IR9434

Part No.	Code
PHILIPS ..continued	
RC9020	IR9434
RC9030	IR9434
RC9050	IR9556
RC9057	IR9710
RC9060	IR9556
RC9070	IR9434
RC9133	IR9710
SAMSUNG	
CX5312W	IR9432
CX5325W	IR9432
CX532WT	IR9432
CX534WT	IR9432
RM104	IR9432
RM109	IR9546
SANYO	
4AA4U1TO092	IR9459
JXBA	IR9457
JXCL	IR9530
JXCR	IR9530
JXFF	IR9457
JXGA	IR9139
JXGE	IR9139
JXGT	IR9460
JXGW	IR9460
JXGY	IR9460
JXLB	IR9460
JXLG	IR9460
RC238	IR9974
RC254	IR9974
RC258	IR9530
RC305	IR9974
RC307	IR9457
RC308	IR9457
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RC318	IR9457
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RC612	IR9457
RC625	IR9457
RC628	IR9457
RC642	IR9530
RC645	IR9974
RC685	IR9457
RC700	IR9139
RC702	IR9139
RC710	IR9139
RC711	IR9460
RC901	IR9139
S02	IR9460
S03	IR9460
SHARP	
37AM12S	IR9788
51AM12S	IR9788
51AT15S	IR9788
54AM12S	IR9788
54AT15S	IR9788
54CS05SN	IR9711
5V2044	IR9487
5V2145	IR9487
70CS03S	IR9711
72CS03S	IR9711
72CS05SN	IR9711
C1421	IR9487
C2021	IR9487
CV2121	IR9487
CV3707	IR9487
CV3709	IR9487
CV3710	IR9487
CV3720	IR9487
DV1416SN	IR9487
DV1506SN	IR9487
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DV21081S	IR9711
DV2130EX	IR9487
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DV28037S	IR9711
DV28071S	IR9711
DV28081S	IR9711
DV28083S	IR9711
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DV5160S	IR9788
DV5403S	IR9711
DV5432S	IR9711
DV5465S	IR9711
DV5470S	IR9711
DV5935H	IR9711
DV6301S	IR9711
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DV6336S	IR9711
DV7001S	IR9711
DV7002S	IR9711
DV7003S	IR9711
DV7011S	IR9711
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DV7032S	IR9711
DV7036S	IR9711
RRMCG0351CESA	IR9487
RRMCG0351CESB	IR9487
RRMCG0351CESD	IR9487
RRMCG0370CESA	IR9487
RRMCG0483PESA	IR9487
RRMCG0489CESB	IR9487
RRMCG0568PESA	IR9487
RRMCG0617PESA	IR9487
RRMCG0618PESA	IR9487

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SHARP ..continued	
RRMCG0662PESA	IR9487
RRMCG0739BM5A	IR9711
RRMCG0777PESA	IR9487
RRMCG0833PESA	IR9487
RRMCG0898CESA	IR9487
RRMCG1014BM5A	IR9711
RRMCG1023BM5A	IR9711
RRMCG1031BM5A	IR9788
RRMCG1036BM5A	IR9711
RRMCG1046BM5A	IR9788
RRMCG1048BM5A	IR9788
RRMCG1050BM5A	IR9788
RRMCG2799CESA	IR9487
SV2044G	IR9487
SV2044S	IR9487
SV2145G	IR9487
SV2145S	IR9487
SV2577S	IR9487
SV2777S1	IR9487
SV2877S	IR9487
SV2877S1	IR9487
SONY	
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RM607	IR9974
RM609	IR9974
RM615	IR9511
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RM630	IR9511
RM631	IR9511
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RM641A	IR9321
RM650	IR9336
RM651	IR9336
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RM654	IR9336
RM656	IR9448
RM657	IR9336
RM658	IR9321
RM661A	IR9321
RM670	IR9123
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RM672	IR9123
RM673	IR9123
RM677	IR9448
RM681	IR9442
RM682	IR9442
RM683	IR9442
RM684	IR9442
RM685	IR9442
RM686	IR9442
RM687B	IR9448
RM[illegible]7C	IR9448
RM689	IR9441
RM[illegible]4	IR9452
RM[illegible]8	IR9442
RM717	IR9448
RM719	IR9448
RM816	IR9441
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RM820	IR9452
RM826	IR9441
RM828	IR9452
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RM[illegible]2	IR9443
RM833	IR9451
RM834	IR9452
RM836	IR9871
RM837	IR9451
RM839	IR9871
RM841	IR9452
RM842	IR9443
RM883	IR9871
RM886	IR9871
THOMSON	
14G21D570	IR9639
14GM53	IR9639
14GM56	IR9639
14M570	IR9639
21M576	IR9639
21MG51	IR9639
925TX1 049	IR9508
RCT2000	IR9259
RCT3000	IR9831
RCT5000	IR9259
RCT5020	IR9502
RCT5141S	IR9470
TOSHIBA	
1400	IR9962
1400R	IR9962
1400RB	IR9962
1400RBG	IR9962
1400RBN	IR9962
1400RBT	IR9962
1400RBW	IR9962
1400RDT	IR9962
1440RB	IR9852
1440RBT	IR9852
1440RD	IR9852
1440TB	IR9852
1440TBT	IR9852
1450RB	IR9852
1450RD	IR9852
1480RB	IR9953
1480RBT	IR9953

Part No.	Code
TOSHIBA ..continued	
1480RBW	IR9953
1480TB	IR9953
1480TBT	IR9953
1480TBW	IR9953
1480TBY	IR9953
1480TBZ	IR9953
1510RBT	IR9962
1510RDT	IR9962
1510RT	IR9962
155R9B	IR9962
155R9BT	IR9962
155R9BW	IR9962
155R9BZ	IR9962
156R9	IR9962
156R9B	IR9962
156R9BG	IR9962
156R9BW	IR9962
1720RB	IR9962
1722TB	IR9852
1732TD	IR9852
2100RB	IR9962
2100RBG	IR9962
2100RBT	IR9962
2101RBZ	IR9962
2102RBZ	IR9962
2121RD	IR9962
2132DB	IR9852
2140RB	IR9852
2140TB	IR9852
2141TB	IR9852
2145DB	IR9852
2145DD	IR9852
2150TD	IR9953
2152DB	IR9953
2152DD	IR9953
2155DB	IR9953
2163DB	IR9953
2163DB	IR9953
216R9B	IR9962
216R9B2	IR9962
2173DB	IR9953
2180TD	IR9953
2181TB	IR9852
2181TB	IR9953
219R	IR9962
219R9B	IR9962
219R9B2	IR9962
2522DB	IR9953
2522DD	IR9953
2527DB	IR9953
2535DB	IR9852
2535DD	IR9852
2537DD	IR9852
2545DB	IR9852
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2550TB	IR9953
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2555DB	IR9953
2555DD	IR9953
2557DB	IR9953
2563DB	IR9953
2563DD	IR9953
2573DB	IR9953
2577DB	IR9953
2579DB	IR9953
2636B	IR9953
2835DB	IR9852
2837DD	IR9852
2852DB	IR9953
2853DD	IR9953
2855DD	IR9953
2857DB	IR9953
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2873DB	IR9953
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2879DB	IR9953
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3339DB	IR9953
3357DB	IR9953
3377DB	IR9953
3387DB	IR9953
3787DB	IR9953
40PW8DB	IR9953
48J6DB	IR9953
48PJ6DG	IR9953
55PJ6DB	IR9953
56PW8DB	IR9953
7037DD	IR9852
7053DD	IR9953
CT6869	IR9953
CT9369	IR9962
CT9383	IR9962
CT9387	IR9962
CT9396	IR9962
CT9399	IR9962
CT9414	IR9962
CT9432	IR9962
CT9455	IR9962
CT9475	IR9962
CT9476	IR9962
CT9480	IR9962
CT9552	IR9962
CT9626	IR9953
CT9784	IR9953
CT9785	IR9953
CT9859	IR9953
CT9867	IR9953
CT9868	IR9953
CT9900	IR9953
CT9949	IR9953

Price : £ 6.50 + vat each

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Grandata Ltd

distributor of electronic components

Line Output Transformers

Part No	Code	Price
ALBA		
3714002	LOT02	£12.00
043714002J	LOT02	£12.00
43700000	LOT02	£12.00
AMSTRAD		
1810951	LOT55	£14.00
3714002	LOT02	£12.00
043714002J	LOT02	£12.00
43700000	LOT02	£12.00
AM152591	LOT55	£14.00
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06 D-3-083-002	LOT82	£12.50
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06 D-3-087-001	LOT23	£12.50
06 D-3-088-001	LOT84	£14.50
06 D-3-093-001	LOT204	£16.00
06 D-3-508-003	LOT276	£14.00
06 D-3-512-001	LOT204	£16.00
29201-022-01	LOT63	£17.00
473197	LOT304	£15.50
D 059 / 37	LOT200	£14.00
GOODMANS		
1352.5008	LOT1167	£15.00
HINARI		
3714002	LOT02	£12.00
043714002J	LOT02	£12.00
43700000	LOT02	£12.00
CF 124 B	LOT67	£14.50
CF 124 E	LOT67	£14.50
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2432461	LOT169	£15.00
2432761	LOT169	£15.00
2433453	LOT82	£12.50
2433751	LOT01	£13.00
2433752	LOT01	£13.00

Part No	Code	Price
HITACHI..continued		
2433891	LOT23	£12.50
2433892	LOT84	£14.50
2433893	LOT23	£12.50
2433952	LOT33	£10.00
2434002	LOT226	£14.50
2434141	LOT33	£10.00
2434274	LOT44	£10.50
2434393	LOT405	£22.50
2434593	LOT44	£10.50
2435006	LOT401	£17.00
2435131	LOT251	£14.50
2436201	LOT90	£12.50
23236465	LOT392	£15.00
2433891H	LOT23	£12.50
45150504	LOT362	£16.00
MATSUI		
20070	LOT438	£16.00
20071	LOT438	£16.00
20072	LOT438	£16.00
20073	LOT438	£16.00
20074	LOT438	£16.00
20075	LOT438	£16.00
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3221008	LOT438	£16.00
043714002J	LOT02	£12.00
043221088P	LOT438	£16.00
43700000	LOT02	£12.00
7140021	LOT02	£12.00
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731003	LOT51	£15.50
334 P 18506	LOT51	£15.50
OREGA		
40153201	LOT349	£17.50
ORION		
3714002	LOT02	£12.00
043714002J	LOT02	£12.00
43700000	LOT02	£12.00

Part No	Code	Price
PANASONIC		
TLF 14512 F	LOT39	£18.50
TLF 14520 F	LOT40	£15.00
TLF 14521 F	LOT39	£18.50
TLF 14567 F	LOT39	£18.50
TLF 14568 F	LOT40	£15.00
TLF 14584 F	LOT41	£17.00
TLF 14586 F	LOT42	£17.00
PHILIPS		
3119 108 31260	LOT90	£12.50
3119 108 31290	LOT73	£11.50
3119 108 31440	LOT433	£16.00
3119 108 31441	LOT433	£16.00
3119 108 31442	LOT433	£16.00
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3122 138 36070	LOT111	£15.00
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3122 138 36920	LOT57	£11.00
3122 138 36922	LOT57	£11.00
3122 138 36923	LOT57	£11.00
3122 138 37050	LOT132	£15.00
3122 138 37620	LOT90	£12.50
3122 138 37771	LOT129	£14.00
3122 138 37992	LOT1116	£19.00
3122 138 38040	LOT73	£11.50
3122 138 38123	LOT395	£12.00
3128 138 20200	LOT433	£16.00
3128 138 20201	LOT433	£16.00
3128 138 20202	LOT433	£16.00
3138 108 30100	LOT106	£12.50
3138 108 30101	LOT106	£12.50
3138 108 30103	LOT106	£12.50
3139 128 30400	LOT90	£12.50
4812 140 10246	LOT111	£15.00
4812 140 10349	LOT106	£12.50
4812 140 10369	LOT90	£12.50
4812 140 10421	LOT90	£12.50
4822 140 10246	LOT111	£15.00
4822 140 10274	LOT123	£14.50

Part No	Code	Price
PHILIPS..continued		
4822 140 10306	LOT57	£11.00
4822 140 10349	LOT106	£12.50
4822 140 10381	LOT128	£13.00
4822 140 10384	LOT127	£15.50
4822 140 10406	LOT73	£11.50
4822 140 10544	LOT433	£16.00
4822 140 10566	LOT433	£16.00
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AT 2077 / 81	LOT121	£15.00
AT 2078 / 21	LOT395	£12.00
AT 2079 / 15	LOT129	£14.00
AT 2079 / 21	LOT395	£12.00
AT 2079 / 24	LOT392	£15.00
AT 2079 / 40	LOT73	£11.50
AT 2079 / 99	LOT276	£14.00
AT 2079/30 01	LOT106	£12.50
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HELP WANTED

The help wanted column is intended to assist readers who require a part, circuit etc. that's not generally available. Requests are published at the discretion of the editor. Send them to the editorial department – do not write to or phone the advertisement department about this feature. Alternatively e.mail to tessa2@btinternet.com

Wanted: Passive radiator baffle for the Bang and Olufsen speaker Model 5700 Beovox. Also any old AM (not British FM) multichannel CB radios. N.D. Simpson, 149 Brookmill Road, London SE8 4JH. Phone/fax 020 8692 2748.
Wanted: Circuit diagrams for the Grundig radio Models Satellite 2000 and Satellite 3000. Fair price and expenses paid. Peter Ward. Petgra, Forest Corner, Ringwood, Hants BH24 3JW. Phone 01425 475 445.
Wanted: I need to know the line driver transistor type in my Sony CPD G200 monitor. It's faulty but I am unable to read the type. Can someone supply this information? F.W. Pepall, 73 Hermitage Drive, Twyford, Reading RG10 9HT. Phone 0118 934 0675 or email FPepall@aol.com
Wanted: Working main board for the Amstrad Model CTV3021N; an Akai VS23EK VCR for spares; an Hitachi VT63E VCR for spares. Ron White, 29 Nunnery Street, Castle Hedingham, Essex CO9 3ND. Phone 07751 674 650 (mobile).
For sale: Back issues of *Television* from September 1990 to present date. Buyer collects. Offers please to Ernie Sugden on 01706 224 725 (Rossendale, Lancs).
Wanted: Remote-control unit and, if possible, manual for the Alba TV10 (or equivalent) televideo. Also a remote-control unit for the Wharfedale TV Model 550 (or equivalent) – I need to tune it in. R. Long, 32 Ransdale Avenue, Hants PO9 4DZ. Phone 07789 812 572.
Wanted: Tuner-IF-modulator for the Sharp VCR Model VGH710NZ. It's a New Zealand model, so I need a UK module with 6MHz sound IF. Ron Coates, 35 Tetbury Hill, Avening, Tetbury, Glos GL8 8LT. Phone 01453 832 720.
Wanted: Can anyone provide the name of a supplier of circuit diagrams for Ford car radios? Phone John Riley on 01664 569 566 or email john@rileyc4.fsnet.co.uk
Wanted: Old half-inch ferrite rods. Must be six inches long or more. Good money paid for them. Peter Tankard, 16A Birkendale Road. Sheffield S6 3NL. Phone mobile 07931 463 823 from 9 am to 9.30 pm.
Wanted: For spares etc. Quad 405 or 405-2 power amplifiers; Quad FM3 tuners (working or not); Quad 405-2 modules; moving-coil input module for the Quad 44 control unit; any other Quad modules; also Denon DL103 cartridges. Phone Mike on 01758 613 790.
Wanted: Tube base for the Dell Model D1025HE monitor (Sony CRT). P.J. Herring, Eastern TV Services, 99A Rotterdam Road, Lowestoft, Suffolk NR32 2EY. Phone/fax 01502 565 427.
Wanted: Magnetic assembly that's up to standard, with movement or without, for the Avo Model 8 meter – or how can it be remagnetised? P.T. McKeever. 4 Castleview Park, Derry BT48 8DL. Phone 02871 353 613.
Wanted: Betamax remote-control units type RMT216 and RMT230 (or sheet rubber replacements). Ron Bruce, 11 New Zealand Way, Rainham, Essex RM13 8JP. Phone 01708 558 792.
Wanted: Ferguson TX100 chassis with good LOPT for 22/26in. FST 110° tubes. Expenses paid. Paul Farnfield, 24 Hillside Road, Ashkard KT21 1RX. Phone 01372 275 351.
Wanted: Product catalogues from the 1970s and 1980s, e.g. National Panasonic, JVC, Toshiba etc., for historical purposes. If you can help, please phone Tony Agar on 01740 650 536 or email tonygill@dishcom.freeserve.co.uk
Wanted: Line driver transformer for the Hitachi Model CPT2278 (NP83CQ Mk II chassis). The original has shorted turns. Laminations clamp is stamped 2260021. W. Milne, 20 Graham Road, Wimbledon, London SW19 3SR. Phone 020 8543 9542.
Wanted: Motor PCB for the Matsui CD550/Saisho CDX100. The part number on the board is PRLC421PL/94VO. All expenses paid. Reg Stroud, 2A Linden Road, Gloucester GL1 5HD. Phone 01452 503 581.
Wanted: Head cover for the Philips stereo reel-to-reel tape recorder Model N4418. Mark Oughton, 22 Fern Hill, Langdon Hills, Basildon, Essex SS16 5UE. Phone 01268 414 654.
Wanted: Remote-control unit, with LCD display, for the Panasonic VCR Model NVHD100B. Doesn't need to be working as only the case is required. Phone C. Hart on 01872 271 407 (Truro) or email chartelectron@aol.com

Corrections

More trouble last month (November issue) with some minus signs and dashes in diagrams appearing as a lower-case n with a tilde above. This strange fault, which is introduced in the computer chain after we pass for press, doesn't affect all diagrams, only some. The ones corrupted by the 'bug' last month are Fig. 1 in the motorised garage door control article (page 15) and Figs. 1-3 in the Thomson TX92 article (pages 29-32). We have still to discover how this error occurs.

We can't blame anyone else for the error, which a reader kindly pointed out, in Fig. 1 (page 712) in the Panasonic Euro-7 chassis article (October issue). An extra connection 'blob' appeared, shorting the input to the mains bridge rectifier. The left-hand blob is correct, connecting the mains input to the bridge rectifier, D843 and the degaussing circuit. The right-hand blob, after the circuit path from RL801 and L810, should not be there.

Guide to the

Thomson TX92 chassis

In this second instalment in the series Mark Paul describes the circuitry used in the line and field timebases. The chassis can drive 4:3 and widescreen tubes

In the first instalment last month we looked at the power supply arrangements used in the chassis. This time attention is turned to the scanning circuitry.

The line driver stage

The line drive pulses are produced by the colour decoder/video processor/timebase generator chip IV01, whose line drive output is at pin 36. This is fed to the fairly straightforward line driver circuit shown in Fig. 4. The pulses are AC coupled via CL32, with DL34 providing DC restoration. The two transistors TL30 and TL31 drive the coupling transformer LL19. The stage operates in the flyback mode, i.e. energy is stored in the primary winding of LL19 when the two transistors are switched on, then transferred to the secondary side when the transistors are switched off.

When the line drive pulse is in its high state the two transistors are saturated and current builds up in the primary winding of LL19. Because the primary and secondary windings of the transformer are connected with opposite polarities, the line output transistor TL19 is reverse biased. When the line drive pulse falls to its low state CL32 discharges, TL30/31 switch off and the energy previously stored in LL19's primary winding is transferred to the secondary side, producing current flow via the base of the line output transistor, which is driven to saturation. The leakage inductance of LL19's secondary winding limits the current decay in TL19's base region as it switches off, providing a small collector current switch-off delay.

The network DL38/CL38/RL38 clamps the peak voltage which appears at the collector of TL31 when it's switched off. This is necessary to ensure the reliability of TL31, since its maximum collector-emitter voltage is 45V. RL32 and CL33 adapt TL19's base current to its collector current, increasing the driver stage's efficiency.

The supply for the driver stage is the Ustby line, which is at about 10V in standby and 13V when in the on mode. Thus during start up of the line timebase the supply voltage is less than in the normal operating mode. This does not present a problem because in standby Usys is only 90V compared with 130V in the on mode, so TL19's collector current is reduced.

In addition there's a soft-start mechanism. There are two aspects to this. First, CL30 is discharged when deflection starts, and secondly the width of the line drive pulses from IV01 is held for a limited period at 40 per cent of the normal working width. The result is that TL19's collector current is reduced during the start-up phase.

One advantage of the line driver stage design is that deflection simply stops should TL31 go short-circuit. There will then be no 13V supply from the line output stage and IP50 will limit the Ustby supply at 1A.

The line output stage

The TX92 chassis is designed for use with 110° 4:3 and 106° 16:9 tubes. It includes format control, which is necessary with widescreen tubes. The circuitry is shown in Fig. 5.

The output stage circuit follows conventional lines. DL21, DL22, CL21 and CL22 form the EW diode modulator, while the scan-correction capacitor CL24 and the linearity coil LL26 are connected in series with the scan coils. There's a damper network across CL24, consisting of RL25, DL25, DL26 and CL26. Its job is to attenuate the forward sweep resonance in the event of sudden load changes. There are two diodes in series in case one goes short-circuit.

TL41 is the EW driver transistor, whose input comes from pin 13 of the STV2145 chip IF02. This chip is controlled by the I²C bus, via which the width, EW amp (1 and 2) and EW tilt can be adjusted. The potential-divider network RL42, RL44 and RL48 adjust and correct the working point for the EW control.

The line output transformer LL05 generates various supply voltages, also feedback pulses and a beam-current limiting output for IV01. Beam-current limiting information is tapped from the earthy end of the EHT section (pin 8). The voltage here goes increasingly negative as the beam current increases. The potential divider RL03-07 determines the current value at which beam limiting commences. Four resistors are used in the upper arm of the network to divide the power dissipation.

Format control

An additional circuit is included in parallel with CL24 in sets fitted with widescreen tubes. This is shown in a broken-line box

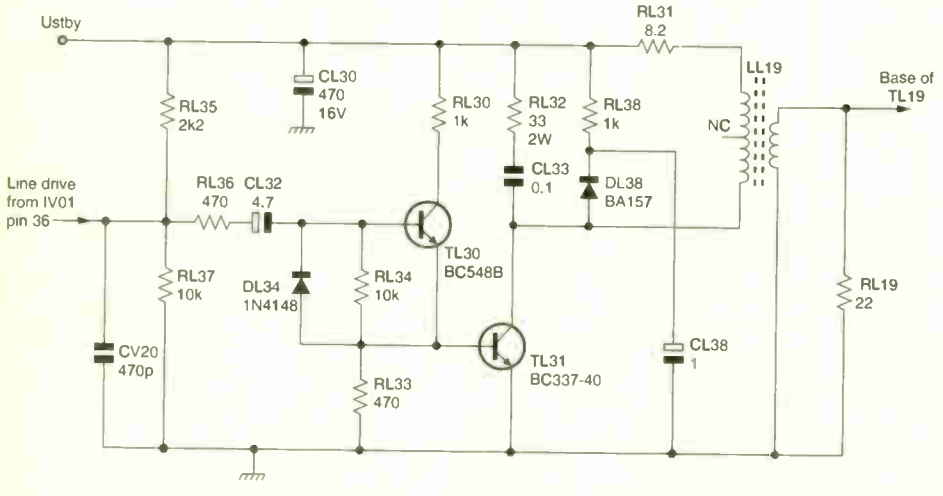

Fig. 4: The line driver stage circuit used in the Thomson TX92 chassis.

in Fig. 5. When the command to switch to 16:9 format is received, the microcontroller chip IR01 generates, in conjunction with the memory chip IR02, the 'format' signal. This appears at pin 28 and is fed to the base of TL53, which in turn drives TL52. The latter switches thyristor TL51 on, which in turn connects CL51 across CL24. The addition of CL51 reduces the line scan current and improves the linearity of a centred 4:3 picture.

Safety circuit

TL60 monitors various parameters, producing a safety signal that's fed to pin 30 of the microcontroller chip IR01 to switch to standby in the event of a fault condition. The factors monitored are that the line and field output stages are working, that the 13V supply is present and the beam current.

In normal operation a rectifier circuit in the field output stage produces sufficient output for the 24V zener diode DL63 to conduct. TL60 is therefore switched on. In the event of failure of the field output stage TL60 switches off. In the event of failure of the line output stage there is no 26V supply for the field output stage so TL60 again switches off. Failure of the 13V supply or excessive beam current also reduce TL60's base voltage with the same result.

The TX92F chassis has an extra input for TL60 to sense partial failure of the line output stage. An additional transistor (TL61) monitors the line output transformer derived 200V supply, which will drop with a reduction of the energy stored in the line output stage. Again the result is to switch off TL60, but in this case switching is initiated in TL60's emitter circuit.

The field timebase

As with the line timebase, the basic field drive waveform is generated by IV01. An additional IC is used between IV01 and the TDA8177 field output chip IF01 however to enhance the functionality and meet various zoom and raster correction requirements with different types of tube. This is IF02, type STV2145.

Picture formats

The various picture formats possible

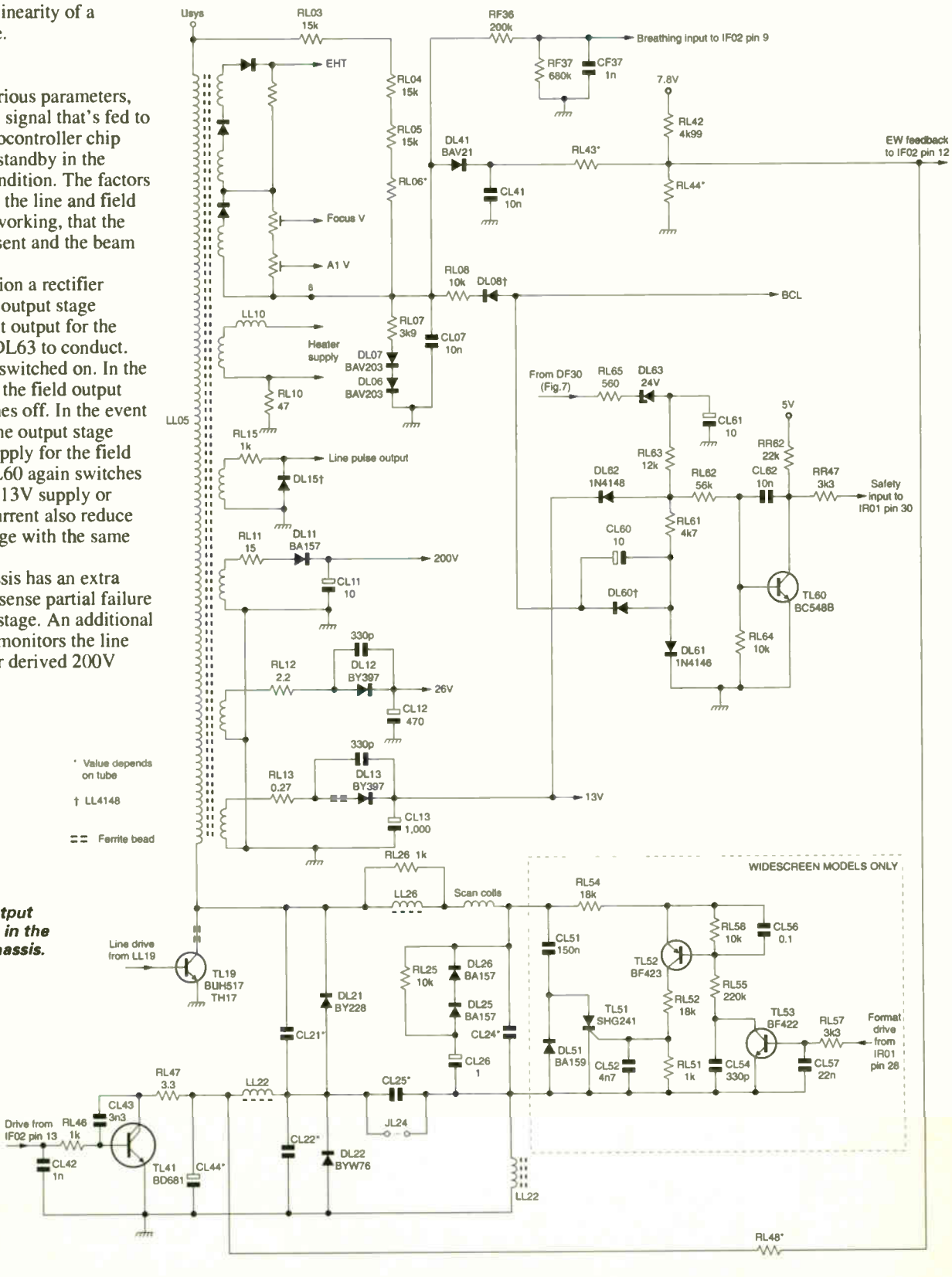

Fig. 5: The line output stage circuit used in the Thomson TX92 chassis.

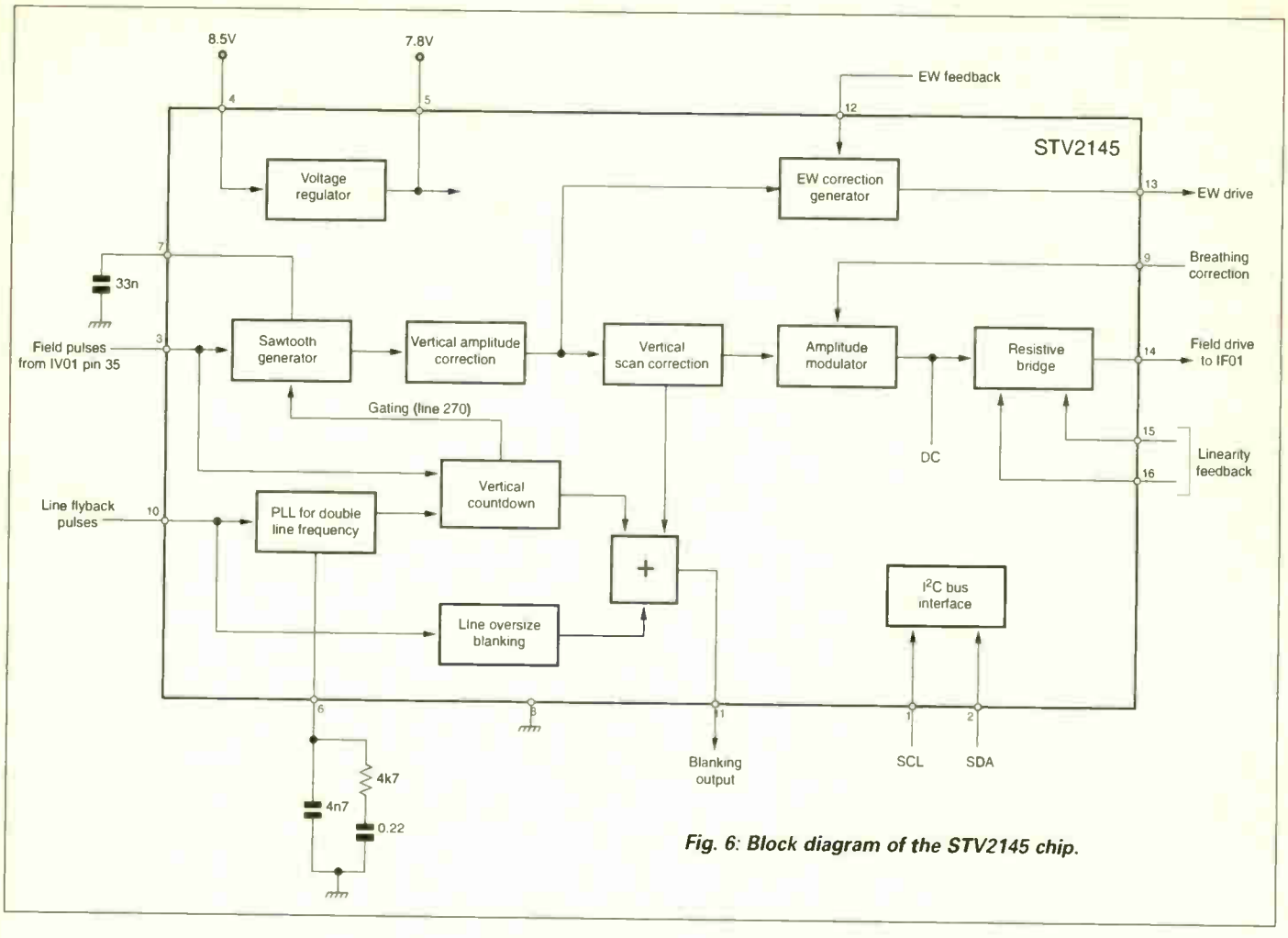

Fig. 6: Block diagram of the STV2145 chip.

with this chassis are as follows:

4:3 tubes: Either normal 4:3 picture as transmitted with 7 per cent vertical and horizontal overscan, or a 16:9 picture as transmitted with 7 per cent horizontal overscan and reduced vertical amplitude (black at top and bottom) to maintain the correct aspect ratio.

16:9 tubes: In this case there are three possible formats. First a 16:9 picture as transmitted with 7 per cent overscan at the top and bottom. Secondly a 4:3 picture as transmitted with 7 per cent vertical overscan and black bands at the left and right of the screen. To 'clean up' the left and right edges of the picture in this mode, 7 per cent oversize blanking is applied (via the fast blanking in IV01). Thirdly a zoom fills the screen horizontally (plus 7 per cent overscan) with a 4:3 picture, with some loss of picture vertically and 7 per cent aspect ratio distortion. To avoid possible beam reflection at the top and bottom in this mode 25 per cent oversize vertical blanking is applied.

With a conventional 4:3 picture display (without zoom) the blanking requirement is to cut off the video signal during the line and field flybacks – the edge of the tube 'cleans up' the border of the picture. Things become more complex with 16:9 scanning and zoom. A centred 4:3 display on a 16:9 tube needs oversize horizontal blanking as the tube edge doesn't provide any help. With a 4:3 aspect ratio zoom, vertical oversize blanking is required to avoid wasted picture power above the top and bottom of the screen and the reflections this can cause.

The STV2145 chip

These blanking requirements, plus generation of the EW correction waveform and processing of the field drive waveform, are carried out by the STV2145 chip IF02. Fig. 6 shows a block diagram for this device.

The blanking output (OBLK) is at pin 11. Quite a lot of effort is required to produce it in the zoom mode. This is based on checking the DC value of line 270.

The following is a summary of the operations carried out by IF02. (1) Field sawtooth generator with amplitude control loop. (2) Fast vertical amplitude correction for breathing (pin 9 is used to sense the beam current). (3) I²C bus control of field amplitude, position and linearity. (4) Generation of the EW correction signal. This is fed out at pin 13 and is such that only a simple Darlington transistor driver stage is required externally. (5) I²C bus control of the EW functions – width, EW amplitude, EW shape (corner correction) and EW tilt (trapezium). (6) Production of a blanking output to suit the picture format.

Field output stage

The field output stage is quite simple, being based on a TDA8177 chip. This is IF01, see Fig. 7. The scan coils are connected between IF01's output pin 5 and the 13V supply in a bridge configuration. Field deflection power is drawn from the 26V supply, which is derived from the line output transformer.

During the first half of the forward scan (the top half of the picture) CF15 charges via the scan coils and IF01 from the 26V supply. During the second half of the forward scan (bottom half of the picture) the direction of current flow reverses, with CF15 discharging via the scan coils and IF01 to chassis. As the value of CF15 is large, the 13V supply is not loaded by the field scan current. With some tubes however a small current may be required to centre the field scanning. This current, less than 40mA, is the only load on the 13V supply.

A conventional boost arrangement is used to provide the flyback.

Field linearity correction

The flatter the CRT faceplate the greater the need for field scan current correction over each scanning cycle. An S-shaped sawtooth waveform is required for good field linearity. The conventional way to achieve this is to use an *RC* network. But where a zoom mode is required correction has to be dynamic, to adapt with the zoom

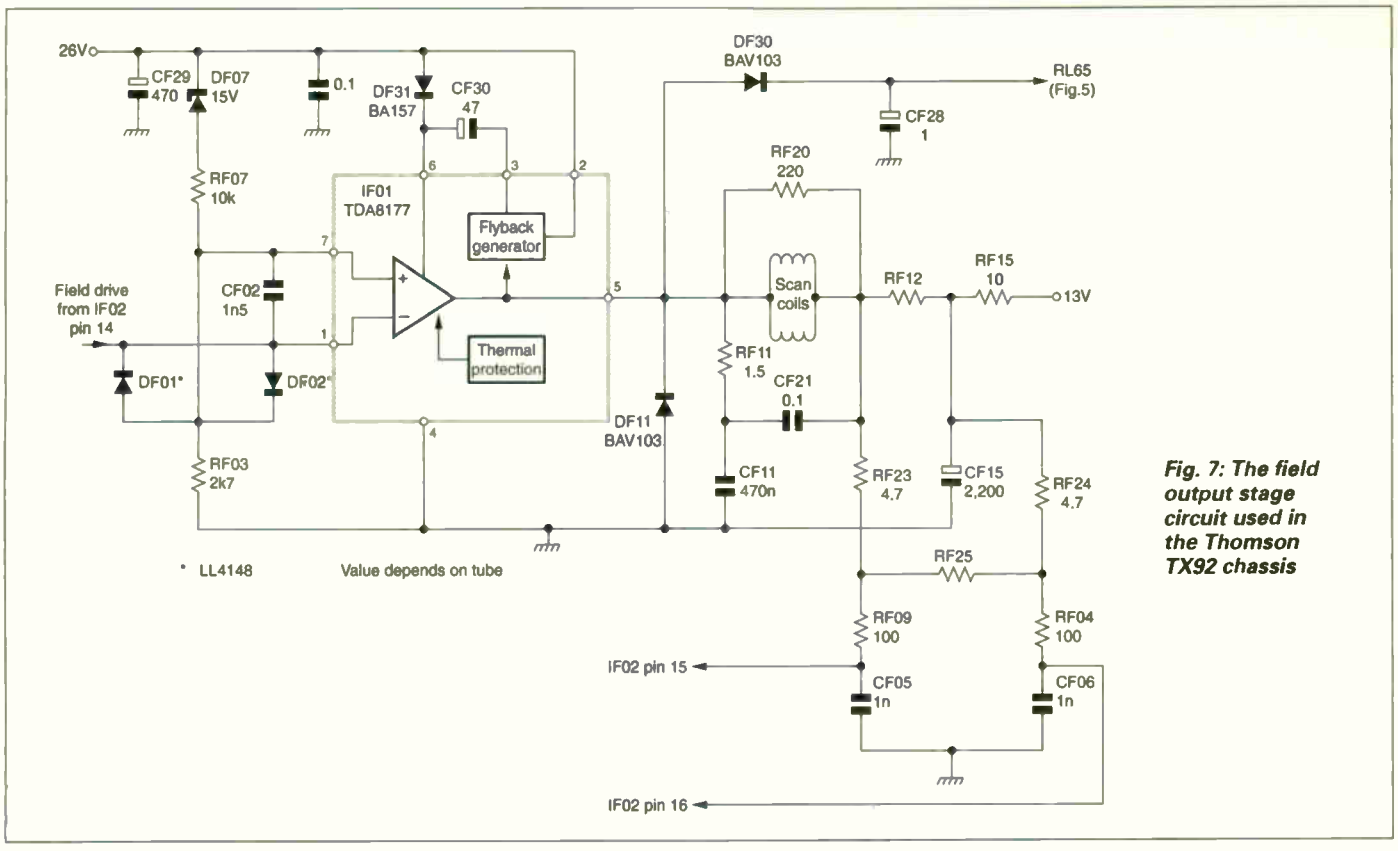

Fig. 7: The field output stage circuit used in the Thomson TX92 chassis

setting. IF02 has built-in adjustable scan correction. But only the amplitude of the scan correction is adjustable, not its start and end.

A resistor bridge within IF02 carries out scan correction in conjunction with an error amplifier. Feedback to the bridge is at pins 15 and 16. These are connected via a resistor network to each side of RF12, which is in series with the scan coils.

Next month

In Part 3 next month we'll take a look at the signals circuitry.

Know your adhesives

Adhesives provide the solution to many workshop problems. But it's no good reaching for any old tub of sticky stuff. To be able to select the right type, you have to understand how adhesives work. Pete Roberts explains what happens when surfaces are stuck together, and summarises the characteristics of the main types of adhesive in common use

Our heading photograph shows the cyanoacrylate distillation plant, Hylock Ltd., Runcorn.

So you've a cracked cabinet or a broken ferrite core: what do you use to repair it? It's not just a case of reaching for the old tube of glue that has languished at the back of the cupboard for years. Modern materials call for modern adhesives when repair is needed.

How adhesives work

The first thing is to understand how adhesives work. Adhesion is a chemical process whereby an adhesive attaches itself to the billions of tiny molecular 'hooks' that protrude from the surface of even the most highly polished material. The adhesive itself is a liquid or paste that sets by polymerisation, when short molecules link up to produce a mass of tightly interlinked long chains – a polymer. As long as a mutually compatible adhesive is used, virtually any material (known as the substrate) can be joined to any other.

A very few materials, typically the polyolefin plastics and PTFE, lack these molecular hooks and can be joined only after using a special primer that attacks the surface chemically, then gluing with cyanoacrylate (superglue) or a structural acrylitic adhesive. Such materials can generally be recognised by their waxy feel, and include polyethylene and polypropylene. As the primers required to stick these materials are expensive, it might be more prudent to attempt welding instead. I've not used polyolefin primers myself, so cannot comment on their efficiency.

Compatibility

The next consideration is compatibility. In addition to being able to combine chemically with the surfaces to be joined, the adhesive must be physically compatible. It wouldn't, for example, do to use a rigidly setting epoxy resin to stick the sole on to a shoe. The size of the gap is also a factor, as some adhesives can retain their strength across a wide gap better than others. Finally there's the question of chemical compatibility: some solvent-based glues will dissolve polystyrene and similar plastics, while most silicone rubbers release acetic acid while curing – this corrodes copper wire.

Contact adhesives

The best-known adhesives are

probably the so-called 'contact' types, for example Evostick and Bostick. These were originally introduced in the Fifties, primarily to stick in place Fablon and similar furniture finishes, and were soon used for general DIY applications.

Contact adhesive is made by dissolving synthetic rubber-like polymers in a suitable solvent, commonly a mixture of xylene and toluene. Some, like Bostik and Uhu, are clear: Evostick is straw-coloured. Application may be via tube nozzle, from a pot using a spatula, or as a spray. The adhesive is applied thinly to both surfaces to be joined and allowed to dry until tacky: the items being glued are then brought together and accurately positioned before being pressed together firmly to complete the joint.

Contact adhesives have relatively low tensile strength (resistance to being pulled apart) and relatively low shear strength (resistance to sliding stress), so small joints are weak. They are best suited to joining large surface areas, such as sticking loudspeaker cloth in place or recovering old radio cabinets. They are at their best when joining fibrous or porous non-metallic materials, and also work well with rough, broken ceramic surfaces, but should not be used where there may be exposure to hot water or high temperatures in general. They won't stick polyolefins and PTFE. As they are flexible, you can use contact adhesive to stick the loose sole to your shoe.

Because of the solvent, contact adhesives are highly flammable in their liquid form and their fumes are toxic. Skin contact should be avoided, but any adhesive that does stick to skin can be readily pealed off. Contact adhesives are the materials that 'glue sniffers' abuse, so any use by children should be closely supervised.

Water-based PVA adhesives

Water-based PVA adhesives include child-safe paper glues and Evostick Resin W. They consist of a suspension of polyvinyl acetate in water, and have the advantage that spills or excess remain water-soluble until the adhesive dries.

While setting, the PVA undergoes further polymerisation as the water evaporates: the long-chain molecules of PVA join up to produce even longer chains that also cross-link with each other. This is an irreversible process that results in a mass of tightly interlocked molecules with quite high tensile and shear strength.

When used with wood, Resin W forms a strong, water-resistant bond – so much so that in some applications nails are not necessary. Resin W is designed for use with wood and is not recommended for use with other materials. PVA paper glues are available in liquid form or as solid sticks like Pritt Stik, but are again recommended only for their intended purpose.

PVA glues are non-hazardous and child-safe. Any liquid adhesive spills can be removed with warm water. Set adhesive can be peeled of with a sharp knife.

Photo 1: A ferrite slab aerial joined in the middle using RS Components' cyanoacrylate gel.

Epoxy resins

Epoxy resins have been around for some time now. They made their debut during the Sixties in the form of Araldite. Epoxy adhesives do not depend on solvents. Instead, they come as two components that, when mixed, polymerise to form a hard solid with exceptional tensile and shear strength and excellent electrical properties.

Epoxy adhesives can be used with almost any rigid material except 'waxy' plastics. They are safe to moderately high temperatures, though continued exposure to very hot water will weaken the bond – so they are not suitable for gluing the handle back on your mug! The narrower the gap, the stronger the joint.

Epoxy resin is suitable for joining broken ferrite cores. But bear in mind that the magnetic properties will be changed, as a gap of 0·001in. has the reluctance of at least an extra inch of ferrite.

When epoxy adhesive is used both surfaces to be joined must be perfectly clean and grease free. The two components must be thoroughly mixed in the correct proportions before application to both surfaces, which should then be held together, using moderate pressure, until set. Make sure that you apply sufficient adhesive to fill the joint without leaving voids. Any excess can be removed before it sets hard. Heat speeds the setting and gives a stronger bond.

Epoxy adhesives are available in standard- and fast-setting types. Bear in mind that the latter still need up to 72 hours to attain full bond strength. Depending on brand, the set resin may be clear, translucent or straw-coloured. The closely related epoxy potting compounds are usually white or black.

The repair of printed-circuit panels seems to be a contentious matter. I have however successfully used epoxy resin to repair many glass/epoxy boards that have suffered from high-energy 415V flashover, leading to destruction of quite extensive areas. From experience, the most suitable material is inert-filled, flame-retardant potting resin (Araldite CW1302GB, UL94 rating V-0). This sets very hard, with a tenacious grip on the surrounding material. It has excellent dielectric properties and low flammability.

Epoxy resin and hardener are irritants in their unreacted form, so anyone who handles the material regularly should wear latex gloves and avoid breathing any vapour. Repeated skin contact can cause sensitisation, and hardeners are toxic when ingested. Any spillage on skin should be washed off immediately, using soap and hot water. Although they are inherently non-flammable, both unreacted and set materials produce highly toxic fumes when exposed to fire. Epoxy materials must be kept well away from foodstuffs and children.

Superglues

Superglues are perhaps the most widely used nowadays, because of their versatility and very short

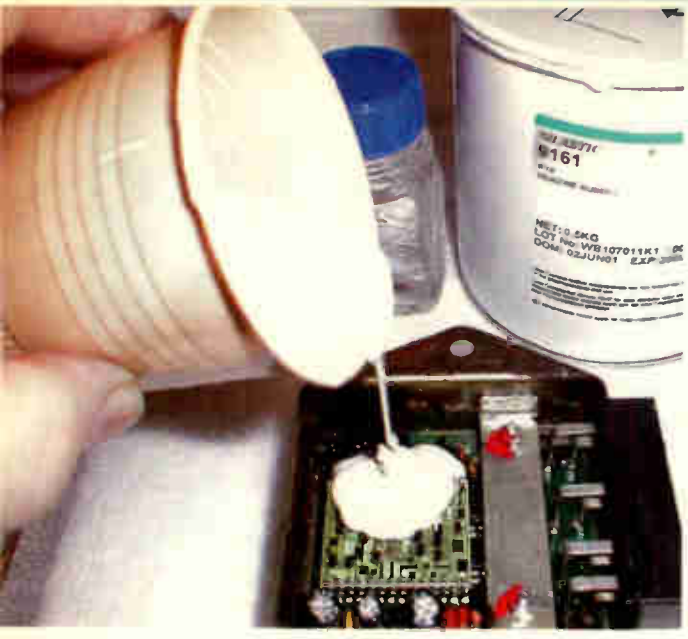

Photo 2: A motorcycle ignition unit being encapsulated with non-corrosive silicone rubber.

setting times. They are cyanoacrylate esters, an ester being an organic 'salt'. Cyanoacrylate adhesives are available in a wide range of specialised grades for specific materials, and are a spin-off from the so-called 'anaerobic' thread-locking compounds introduced by Loctite during the Sixties. Anaerobic means literally 'without air': anaerobic adhesives harden only in the absence of air. They usually need the presence of a catalyst to initiate polymerisation. This is why bottles of superglue and thread-locking compounds are supplied part-filled – the presence of air in the bottle discourages hardening.

Cyanoacrylate adhesives can join a wide variety of substrates, even the waxy polyolefin plastics as long as these are pre-treated with a special primer. Setting times vary, depending on the particular adhesive and the materials being joined. A particular adhesive may join paper, cloth and your fingers in a couple of seconds but, when joining metals and plastics, may take several minutes to set. Full bond strength is usually attained after about an hour. The initiator for most cyanoacrylate adhesives is water. There's enough ambient moisture to initiate polymerisation as soon as air is excluded by pressing the joint together. Only a minute amount of water is needed, so for best results the surfaces to be joined should be dry as well as thoroughly clean. Pre-treatment with an appropriate primer will speed the cure and ensure maximum strength.

Hot water weakens cyanoacrylate bonds, so superglue is another one that's not suitable for repairing mugs. Cyanoacrylate adhesives have solvent properties and will attack and mark certain thermoplastics, such as polystyrene and Perspex.

Cyanoacrylate adhesives are available in liquid and gel form. Whichever you use is a matter of personal preference, but gel may be the better choice for the average workshop. It's ideal for porous substrates, and stays put on vertical surfaces. Gel types will also successfully join ill-fitting parts where the joint gap can be up to 0·5mm (0·02in.). Superglue is excellent for joining ferrites. Photo 1 shows a ferrite-slab aerial in an old Philips transistor portable joined in the middle using RS Components' cyanoacrylate gel. This repair withstood the not inconsiderable pressure required to force the slab back into its mounting clips. A properly-made superglue joint should have quite high shear and tensile strengths.

Cyanoacrylate ester is highly volatile: in fact distillation forms the major part of the manufacturing process. This can lead to the problem of 'bloom'. Vapour condenses where it's not wanted, forming a whiteish deposit. Bloom also presents a serious eye hazard. Superglue bonds eye tissue almost instantly, and exposure to the vapour is as dangerous as the liquid adhesive. Any contamination of the eyes is a serious medical emergency that requires immediate hospital treatment, as there is a grave risk of blinding. While medical assistance is awaited, the affected eye must be gently sponged with warm water. Under no circumstances whatsoever should any attempt be made to open the eye forcibly. If close attention to a job is needed, it may be advisable to wear safety glasses – at a couple of quid a pair they are a good investment. Gel adhesives are generally less likely to bloom than liquids. Should fingers or any other parts of the anatomy become joined accidentally, soaking in warm, soapy water will break the bond and any residue left will eventually wear away. It goes without saying that all cyanoacrylate adhesives must be kept well away from children.

Always replace the cap on the container after use. The adhesive is a mixture of cyanoacrylate esters, some of which have relatively high volatility. If the container is left open the lighter components will evaporate, thickening the adhesive and eventually making it useless.

Structural acrylic adhesives

Structural acrylic adhesives are closely related to the cyanoacrylates. They are extremely versatile, and so reliable that they are used for gluing aircraft together – and I don't mean models! These are two-part materials: a pungent-smelling viscous clear adhesive and a spray-on liquid hardener. One surface to be glued is coated with a thin, even film of adhesive while the other surface is sprayed with hardener. As setting does not commence until the surfaces are pressed together, you have plenty of time to position the parts to be joined accurately.

Structural acrylics form a very strong joint, even between metals, and have very high shear and tensile strengths. They are heat resistant, so you can use an acrylic adhesive to repair your mug. For best results the surfaces to be joined should be clean and dry, but acrylic adhesives will actually stick in the presence of oil or grease. As always, thin joints are strongest, but structural acrylic has very good void-filling abilities. The adhesive takes about four minutes to reach handling strength, with full strength being attained after an hour.

Structural acrylic adhesives are not nearly as hazardous as cyanoacrylate types, but the fumes can irritate the nose and chest. They should be kept away from children.

Silicone rubbers

Though not strictly speaking adhesives, silicone rubbers deserve mention here. They are used mostly as sealants, but can be used to reduce noise from loose ferrite cores or windings. Most silicone rubbers are of the acetoxy type however, and release acetic acid during the cure. These are easily recognisable as they have a vinegary smell. They should not be used in electronic applications as the acetic acid readily attacks copper.

Non-corrosive types are available from Dow Corning and Servisol. Their tendency to slump is greater than with the acetoxy type, and their cure time is appreciably longer, but they are safe to use on all electronic assemblies.

In conclusion

This article has provided general information on the more familiar types of adhesive. The subject is highly specialised, and some esoteric materials are available for difficult applications.

It is advisable to have a broken plastic cabinet repaired by heat welding. This is a specialised job that a motorcycle workshop with facilities for repairing sportbike fairings should be able to undertake. ■

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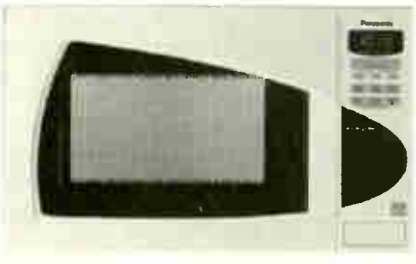

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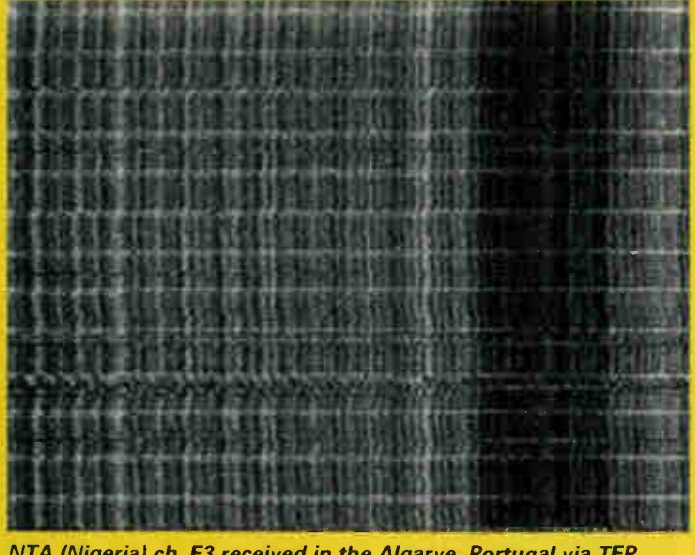
DX and Satellite Reception

Terrestrial DX and satellite TV reception reports. News on TV broadcasting and satellite band changes. WW2 TV from the Eiffel Tower. Roger Bunney reports



NTA (Nigeria) ch. E3 received in the Algarve, Portugal via TEP.

A The 2002 Sporadic E season has virtually come to an end. Taking into account the closure of several Spanish (TVE) Band I transmitters, I don't think it was too bad. But it certainly didn't provide the long-distance reception we experienced during the halcyon days in the early Sixties. Most DX enthusiasts seem to regard it as having been a poor season.

The winter period brings with it the possibility of F2-layer and evening-TEP (trans-equatorial propagation). In theory at this stage during the present solar cycle the sunspot count should be decreasing, but a graph in a recent report shows sunspot numbers over the range 90-320 in recent weeks, the solar flux with swings between 140-240 and overall activity rising. This DXLC solar report was produced by Skywaves (check www.dxlc.com), which provides an excellent updated graphical summary of solar activity. As an example of improving solar conditions, Hugh Cocks in Portugal reports evening TEP reception from NTA (Nigeria). The accompanying photograph shows the NTA cross-hatch pattern received in ch. E3 during late August.

A check at low VHF on September 26, at 1715 hours, showed that the North Atlantic path was open, with US communications in the 31MHz cordless phone band received. A farmer was commenting on his broken-down tractor at 33·163MHz while a pager system at 35·340MHz was being used by a garage repair truck. These were FM signals and are very encouraging signs so early in the autumn. Early-morning scanner checks at 49·75MHz (ch. R1 video carrier) have so far failed to detect any signal activity. A local curiosity heard at 49·450MHz FM consisted of paging tones with occasional voice announcements. This confirms that Southampton NHS Hospitals, about eight miles south from here, have moved from 31·750MHz.

Here's the SpE log for September:

3/9/02	RAI (Italy) chs. IA and IB; many unidentified signals in all channels during spells throughout the day.
15/9/02	Unidentified ch. E2 and E3 signals.
17/9/02	RTP (Portugal) E2. 3. 4.
20/9/02	TVE (Spain) E2 – Spain is still on air!
23/9/02	RAI IA.

An evening aurora, with no TV signals, was reported on the 10th.

The relatively settled high-pressure system over the UK during the second half of September produced enhanced tropospheric activity. Cyril Willis (King's Lynn) reports Band III reception from the Netherlands, Belgium, Germany, Luxembourg and Denmark, with similar though not outstanding results at UHF. I suspect that on the East Anglian coast Band III suffers much less from PMR activity than it does in the more heavily-populated areas along the south coast.

Satellite sightings

Last month I reported on the changeover at 21·5°W, where NSS K has been replaced by the much more powerful NSS-7. The initial problems seem to have been resolved. One unusual multiplex I mentioned, 'Nations 1, 2', has moved frequency several times since then. At the time of writing it's at 11·858GHz H (SR 6.515, FEC 3/4). RTS Senegal and RTNC Congo are still present here, the later with unwatchable quality on some evenings. A new channel has arrived, ORTM (Office de Radiodiffusion du Mali). French is generally spoken in this South Saharan country. Picture quality is relatively good. I sent an e-mail but this was returned as undeliverable. I am puzzled about the target audience for this multiplex.

There's a lot of activity at 21·5°W, but the digital

parameters differ considerably. Belmont Park NY horse racing appeared at 12·683GHz H, with SR 6,116 and FEC 3/4. BTNA Washington Stream 1 is at 11·629GHz H with 10,000 and 3/4, whereas Stream 3 at 11·622GHz H has 5,632 and 3/4. BT15 is often at 11·612GHz H with 2,637 and 3/4 and Reuters WNS (World News Service) at 11·606GHz H with 4,000 and 3/4.

Transatlantic communications are likely to become interesting commercially now that the newly-launched Atlantic Bird-1 has arrived at 12·5°W and is on test in Ku band. It should soon be available for leasing and short-term hire. With much surplus capacity, transatlantic satellite charges will probably fall to bargain levels.

Several NSS-7 transmissions carried programmes commemorating the tragedy in New York on September 11 2001. Ground Zero was the focus. President Bush met relatives of those who died, and the Stars and Stripes were hung from neighbouring skyscrapers. In particular there were two APTN feeds with camera shots from nearby rooftops.

When I checked Europe*Star-1 at 45°E on September 23 I found, at 12·636GHz V (6,116, 3/4), a feed with the service ident 'Non-cat Thailand'. It carried that evening's Pakistan TV news programme, from Karachi, ending with the Pakistan TV PM5544 test card.

Alan Richards (Nottingham) suggests checking at Eutelsat's SESAT (36°E) in the event of military action in the Gulf/Iraq region. Fox News is already present here, currently at 10·960GHz H (6,110, 3/4), with images up to 24 hours a day. He mentions that the US ABC News can be found at 11·162GHz H (4,950, 1/2) via Atlantic Bird-2 (8°W), often with a test card or a studio newsdesk shot. Alan has acquired, second-hand, an ex-SIS Racing 1·2m prime-focus dish which he has refurbished. After devising a means of tracking, he is able to receive from 50°E to at least 58°W, where he gets Ku band Cuban TV.

*Alan Richards (Nottingham) received Tellytrack, the South African racing channel, via Europe*Star-1 at 45°E.*

Broadcast news

UK: RSL-TV station Southampton TV plans to open on October 21, transmitting north from the Fawley Power Station chimney on ch. 29, with horizontal polarisation and 4kW ERP. Sister station Portsmouth TV uses the same channel with 1kW ERP, beaming SE from the HMS Dolphin diving tower at Gosport. Manx Television has applied for the Isle of Man TV licence. Its service would be called Chellveeish Vannin. A decision is awaited.

Russia: The main TV broadcasting networks are expected to be fully DVB-T (European standard) ready by the end of 2005. A satellite distribution system will be essential: six Express-AM satellites are to be launched for the purpose. An upgrading of the terrestrial land circuits will follow later. DTT tests are already being carried out in three main population centres.

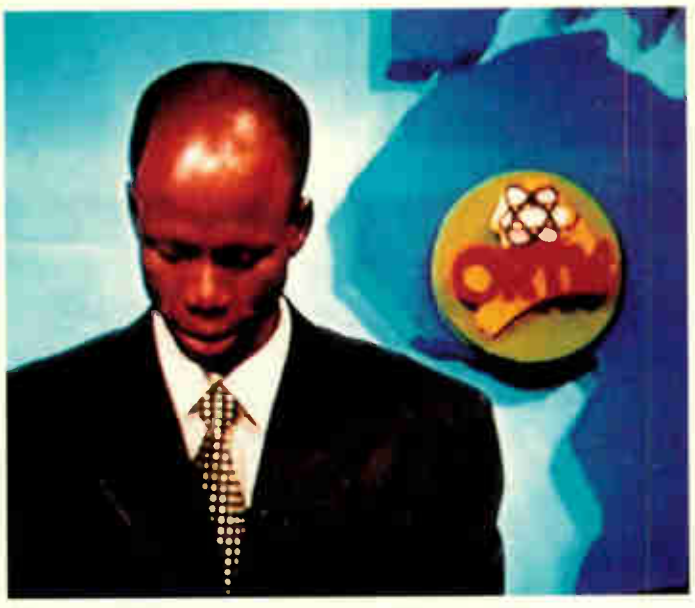
Ukraine: The dispute involving TV station 1+1 continues though it remains on air. It was often received by DXers during this year's SpE season.

Japan: The authorities have rejected the use of PLC (power line communications) at frequencies up to 30MHz because of the interference it would cause. Official users of the spectrum are listed as MF/HF broadcasters and their listeners, radio amateurs, long-distance HF aircraft communications etc. Good news!

Kenya: Christian broadcasting downlinked from the UK is being transmitted via a new ch. E27 station at Eldoret in the NW of the country, about a hundred miles from the Ugandan border. It covers much of the Rift Valley region. Sauti Ya Rehema Radio and TV Network uses English and Kiswahili.

Belgium: The following transmitters are currently running DVB-T tests: Antwerp chs. E59 and E65 vertical at 10kW ERP (VRT channel); Schoten chs. E59 and E65 horizontal at 20kW ERP; Oostvleteren chs. E49 and E55 vertical, power not known. Rotterdam ch. E60 is likely to start soon. DAB broadcasting within the DVB-T multiplexes instead of in Band III is being considered.

Italy: Gosta van der Linden reports that the following commercial transmitters are in operation in Band I: Tele+ 47·9640MHz, location not known; Tele-3 47·8730MHz Mt.



Mali TV (ORTM) is now available via NSS-7 (21·5°W).

A CNN news exchange via NSS-7.

Penice; Tele-3 48·2487MHz Napoli; Tele Alt Italia 48·25MHz Genova; Antena Blue TV 48·25MHz Granardo; TVA Napoli and TV 7 Palermo ch. IA; TLC Napoli ch. IC.

Satellite news

The Chinese channel CCTV-9 is available in several global areas. In early September the programme content changed. with all broadcasts solely in English and increasing news, scientific and educational content. CCTV-4 is now in Chinese only, with a news breaking on the hour format. This could well mean that the network origination of CCTV programming in digital multiplexes may change.

Atlantic Bird-1 has settled at 12·5°W and Ku-band test transmissions are being carried out. You might find that US users have moved here from the NSS position at 21·5°W.

For those with large C-band dishes (are there any out there?), there's news about Intelsat 805 at 55·5°W. A new contract has been signed with Radio Television Guatemala Canal 3, bringing seven new TV and ten new radio channels to the package that provides programming across Mexico. Costa Rica and Latin America generally. Intelsat 805 covers South, Central and most of North America plus Western Europe via various beams. ■

More on WW2 TV from the Eiffel Tower

Some time ago I mentioned the German TV service that was transmitted from the Eiffel Tower during World War II. The information was based on Michael Ockenden's excellent work *TV Pictures from Occupied Paris*. More recently the question has arisen as to whether the pictures received at Beachy Head (or elsewhere along the SE coast) could have been relayed to London via a radio link or coaxial cable for study by military intelligence. This aspect has been extensively researched by Andrew Emmerson, who has interviewed engineers and military personnel of that era. The conclusion seems to be that relaying the Fernsehender Paris pictures would not have been possible. Nevertheless if anyone reading this can throw any light on the matter I would like to hear from them.

In the pre World War II period Germany adopted a 441-line TV system. It was this system that was used for the Paris service that started in the summer of 1942 and continued until August 1944, when the Allied advance led to its close down. Much of the equipment, including the transmitter, was saved however.

In the early stages of the service technicians working with the Chain Home radar system noted signals in the 46MHz band and established that they were TV transmissions. A special receiving station was constructed at Beachy Head to monitor the output.

Andrew Emmerson's research has been into whether the signals were relayed to London from Beachy Head, possibly Swingate or elsewhere. One elderly person interviewed said he had monitored the French TV at a radar station in Kent. Another person interviewed confirmed that the signals were received at Alexandra Palace in London by BBC and RAF staff. There has also been discussion about the use of the repeater station at St. Margaret's Bay near Dover, Kent.

It's thought that radio linking between the channel coast and London would have been out of the question at the time, requiring several hops with the low-band VHF equipment then available. Balanced-pair (telephone) line working would not have been feasible over the distances involved. Long coaxial cable runs were then few, and none are known to have existed between London and the SE coast. A coaxial circuit was established in the Fifties between St. Margaret's Bay and London for Eurovision transmissions.

Andrew's research concludes with a letter from Reg Passmore who was involved with World War II radar. He writes that the St. Lawrence Chain Home reserve station reported 46MHz signals that were checked and confirmed as being from Fernsehender, Paris. The station was told about the Beachy Head operation and established its own monitoring site at Dover Hill near Folkstone – next to the Valiant Sailor pub!

Once again, if any reader can contribute any information on this subject, please write in.

Further information can be obtained from the following sources. The web site http://www.earlytelevision.org/raf.html contains an entry 'RAF Reception of German TV from Paris', a summary from John Swift's book *Adventure in Vision, the first 25 years of Television. After the Battle no. 39*, published in 1983, contains a section on 'TV Pictures from Occupied Paris' (pages 28-33). This publication is still available, at £3.25, from After the Battle, Church House, Church Street, London E15 3JA – phone 020 8534 8833 or fax 020 8555 7567.

AUDIO FAULTS

Reports from Geoff Darby and Robin Beaumont

We welcome fault reports from readers – payment for each fault is made after publiation. See page 108 for details of where and how to send reports.

Sony HCD-EP30

This unit wouldn't play CDs. When it attempted focus search, the intensity of the LCD backlighting went up and down. Checks on the CD 9V supply showed that this was a little low when the CD deck was doing nothing and substantially low when the backlighting dipped. So I checked at the CD 9V regulator Q308. Its input voltage was a little low, but when a scope check was carried out at the same point huge ripple was visible. This led me further back, to the power PCB, which remains in the rear of the cabinet when the unit is dismantled. I found that the reservoir capacitor for the regulator's input, C410 (2,200µF, 25V). was open-circuit. A replacement restored normal operation of the unit. **G.D.**

Sony HCD-EP50

There was no tape action with this unit. Neither the motor nor the solenoid worked. The cause of the problem was quickly traced to Q37 on the main PCB. It's the switch transistor for the deck supply. Checks on it showed that the base-emitter junction had gone high-resistance. A replacement restored tape operation. **G.D.**

Sony HTC-NX1

If you get one of these with the five-changer CD mechanism just sitting there doing nothing, though the display says the correct thing, e.g. "open 1", suspect a displaced disc in the works. This may not be apparent when you look into the top of the deck. Remove the disc clamp (four screws) and lift out the disc present. The chances are that there's another one underneath.

Any disc tray that's out can easily be fed back into its slot. It may however be necessary to rotate the loading motor on the right-hand side by hand – until the mechanism presents the empty slot in a position where the tray can be fed back in. When the unit is powered again the CD mechanism will reset. There should be no further problems.

I've had several of these units that were like this. It's hard to see how discs can get into the wrong place – unless they've been put there accidentally by the owner. **G.D.**

Technics CH7 system

The original problem with this system was a faulty audio IC. But when a replacement had been fitted and the system was reconnected to the mains supply another problem showed up. Because the clock wasn't set, a flashing E came up in the display. It was not a steady flash. more of a stuttery blink really. It you attempted to switch on at this point, the main power relay in the amplifier unit clicked and the system all lit up, then immediately shut down again. Everything worked fine if the system was left for another two minutes – until the next time it was taken fully off power.

The main power switching takes place in the SU-CH7 amplifier unit. It's controlled from the ST-CH7L tuner unit, where the on/off button lives. The cause of the problem was eventually traced to C702 (1,000µF, 16V). This electrolytic is in the tuner's personal power supply, which provides the standby supplies for the system. At room temperature C702's ESR was 31Ω. A spot of freezer sent this rocketing to over 100Ω.

A replacement and a long soak test proved that the problem had been cured. **G.D.**

Sony HCDCP33

This unit played CDs and MiniDiscs without problems, but new MiniDisc recordings tended to jump or stick. The cure was to use the service menu to reset the recording laser power.

Some of the set-up instructions in the service manual for this model are incorrect, because there's no AMS dial. Revised information can be found in the HCDMD33 manual.

Another of these units had a dark LCD display because the LEDs that illuminate it were intermittent. A Sony Technical Tip suggests a change of LED type and other modifications to make the display more reliable. **R.B.**

JVC UXT100N

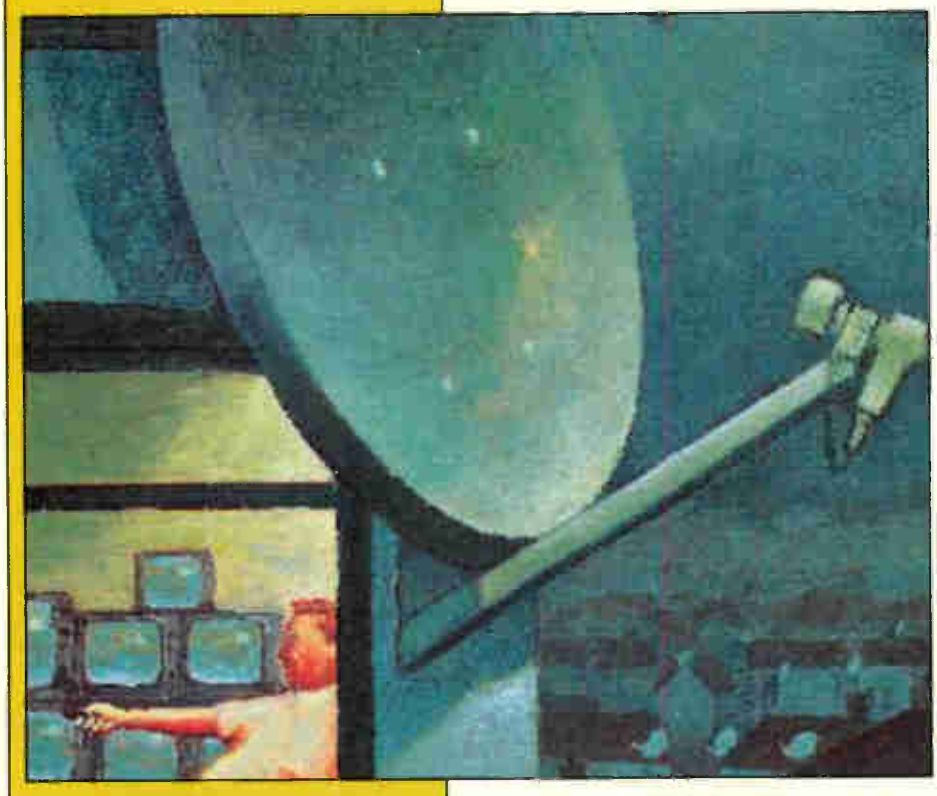
This audio system worked apart from its radio section: though the frequencies came up in the display, there was no reception. While checking around the LC72136N synthesiser chip I found that there were no clock pulses at the crystal. A new IC restored reception. **R.B.**

Pioneer VSAE07, VSX908RDS

These two impressive AV receivers are very similar in design. Both had identical problems – slow to come out of standby, and wouldn't always recognise digital sources. After studying the circuit diagrams for some time I sought help from Pioneer Technical. The advice I was given was to replace the digital audio processing board. This worked, but it seems a rather drastic solution for equipment that's less than two years old. **R.B.**

Panasonic SAFX1

This unusual audio system has a clam-shell style case with the power supply in an external box. Many functions had been lost because the flat cables between the upper and lower halves of the cabinet were partly open-circuit. Replacement was straightforward however. and there were no other faults. **R.B.** ■



SATELLITE NOTEBOOK

Reports from
Christopher Holland
Hugh Cocks
Michael Dranfield
and
Pete Haylor

Cable trouble

Mr Wykes phoned bright and early one morning to tell me about his problem. He couldn't receive Euronews (EPG no. 528) – the other channels were apparently OK. "It just says 'no satellite signal being received'" he added.

I'd had a problem like this before. "Go to the God channel" I said.

Mr Wykes said he never watched it but, when he selected EPG nc. 671, he got the same 'no satellite signal' message.

So I made an appointment to call round later that day.

When I arrived I found that Mr Wykes has a Grundig GDS200 digibox that's fed from a standard Sky dish via a fairly long cable run. This is where the problem lay. Euronews, the God Channel and some others are provided by Eurobird transponder D12S, at 11·680GHz. This is at the top of the LNB's low-band output, at an IF of 1,930MHz, the highest the digibox is expected to cope with. The highest Astra 2B transponder frequency is 12·480GHz, which produces an IF only slightly lower at 1,880MHz. But in general Astra 2B provides a stronger signal than Eurobird.

I suspected that Eurobird's lower signal strength, together with the ageing and very long cable, were the cause of the problem. New cable restored the signals.

Eurobird, at 28·5°E, is about 0·3°E of the Astra satellites, which are at 28·2°E. One might think that a larger dish would help. But its acceptance angle would be less. The result could be a lower signal from Eurobird than that provided by a smaller dish when, as should be the case, it's centred on Astra.

There are also a few degrees difference between the LNB skew settings for Astra and Eurobird, but not enough to worry about. **C.H.**

Digital channel update

The latest channel additions at 28·2°E are listed in Table 1 – where assigned, the EPG number is shown in brackets after the channel name. Transponder 2 (11·740GHz V) has been transmitting NTL colour bars with the digibox identification LGPO when added as an extra channel, see Photo 1. Eurobird transponder D2S (11·488GHz V) has recently been activated for the first time – tests are being carried out at the time of writing this.

The ESPN sports transmissions via transponder 33 ceased in early September: they were replaced with a test card (see Photo 2). Later in the month Reality TV started transmissions at this frequency.

UK Play, which was on EPG no. 217, finished at the end of September. EPG no. 217 has been removed but adding the UK Play banner, which is still present, as an extra channel from transponder 6 (11·817GHz V) shows a promotion for UK History (see Photo 3).

Sky Travel (EPG no. 145) and Sky Travel Extra (no. 146) have moved to transponder 31 (12·304GHz H). Sky Travel moved from Astra 2D transponder 55, Sky Travel Extra from Astra 2A transponder 4.

CNX, which started in mid-October via transponder 18, was transmitting a Snell and Wilcox test pattern earlier in the month (see Photo 4). **C.H.**

C-band reception

This month we'll take a look at the situation at 27·5°W, where Intelsat 605 resides. Some years ago this was a very

Photo 1: NTL colour bars transmitted via transponder 2.

Photo 2: The test card that replaced ESPN sports transmissions via transponder 33.

Photo 3: Promotion for UK History, via transponder 6.

Photo 4: Snell and Wilcox test pattern transmitted by CNX in early October via transponder 18.

Photo 5: The C-Span Parliamentary channel via Intelsat 605.

Photo 6: The distinctive sun logo used by RTP Africa.

Photo 7: MBI (Nigeria) via Intelsat 605 at 3·873GHz.

Table 1: Latest digital channel changes

Channel and EPG	*Sat*	*TP*	*Frequency (GHz)/pol*
BBC Radio 7*	2A	5	11·798/H
CNX (244)	2A	18	12·051/V
JML Direct (664)	2B	32	12·324/V
Reality TV (241)	2B	33	12·344/H
Simply Nostalgia (580)	2B	22	12·129/V
TV5 (825)	2A	8	11·856/V

*Tests.
TP = transponder. 2A = Astra 2A. 2B = Astra 2B.

active orbital position, with Argentina, Morocco and Saudi Arabia using C band and the pioneering satellite TV channels Screensport and TEN, together with the Children's Channel and the Premier film channel, using Ku band. Back to the present however.

US Worldnet broadcasts are at 3·715GHz with a symbol rate (SR) of 8,448 and a forward error correction (FEC) value of 1/2. All the signals mentioned here use right-hand circular polarisation. There are additional Worldnet transmissions at 3·762GHz, with SR 24,993 and FEC 3/4. Most of these transmissions are duplicated via Hotbird at 13°E. There are a large number of Voice of America radio feeds and both 525- and 625-line versions of the Worldnet signals. The C-Span Parliamentary channel is relayed for most of the time at weekends, see Photo 5. Be prepared for numerous listings in the receiver's EPG with the same vision signal but different VOA radio feeds in different languages: the radio feeds don't normally appear in the receiver's radio station list after a channel search.

RTP International (Portugal) is at 3·856GHz with SR 6,260 and FEC 2/3. This is a duplication of the analogue signal via Hotbird. RTP Africa is at 3·831GHz with the same SR and FEC: it uses a very distinctive sun logo, see Photo 6. The frequency between the last two, 3·843GHz, is used intermittently for RTP feeds to Africa. It's known as RTP NET and has the different SR 8,350 and FEC 1/2.

Photo 8: The Libya-based Africa Satellite Channel is being tested via Intelsat 605 at 3·910GHz.

The Nigerian broadcaster MBI is at 3·873GHz with SR 4,000 and FEC 1/2. Signals from MBI can be erratic, and it's sometimes off-air for extended periods. See Photo 7.

Tests of the Libya-based Africa Satellite Channel are being carried out at 3·910GHz, with SR 6,110 and FEC 3/4. See Photo 8. The Brazilian TV channel Record Internacional is at 4·048HGz with SR 7,000 and FEC 3/4. This is a 625-line transmission which is at times scrambled. See Photo 9.

Algerian TV transmits at 4·000GHz. This PAL signal is a duplication of what's available in Ku band via Eutelsat and Arabsat. Quite a large dish is required for good reception. Some narrow-band FM telephony carriers are located near the TV signal. They are similar to those mentioned last month in connection with Niger. **H.C.**

Pace 2200

This digibox worked normally for half an hour. Once it had warmed up however the picture and sound would periodically freeze for a split second. It had received attention elsewhere before coming to me, as I noticed that the STI3520L AV demultiplexer chip U320 had been replaced. A new VP217 AD converter chip (U404) cured the fault. **M.D.**

Amstrad DRX200

All this digibox did was produce the 'no satellite signal received' message. When I checked it I found that there was no LNB supply at circuit protector F100, because

Photo 9: The Brazilian TV channel Record Internacional via Intelsat 605 at 4·048GHz.

Q101 (TIP42C) had an open-circuit collector-base junction. **M.D.**

Pace 2200

This was one of those faults I hope I never come across again. The digibox was stuck in standby. A check at pins 66 and 67 of the DSP1675 modem chip U700 showed that the 29·491MHz clock signal was missing, the cause being a defective chip. When I fitted a replacement the 29·491MHz clock signal was present but the unit still wouldn't come out of standby. A check at pin 65 of U700 showed that the supply was low, at about 2·5V instead of 3·3V. In fact all the outputs from the power supply were low. This suggested a faulty UPC1944J adjustable zener diode, U4, which monitors the 3·3V line via the potential divider R22/R23 and R61. When a new UPC1944J had been fitted the 3·3V supply was spot on. I decided to make a cup of tea while the unit booted up. When I returned the power supply outputs were pulsing up and down.

This can be caused by diodes D1 and D2 in the snubber network. But the tripping continued when replacements had been fitted. A new optocoupler (U3) made no difference, and I then found that there was a low-resistance reading across the 3·3V supply. A short here reduces the optocoupler drive: the power supply then tries to increase the voltages on the secondary side of the circuit. When I checked the 3·3V supply rectifier diode D20 (MBRD835L) it produced an odd reverse leakage reading, so I fitted a replacement. The readings remained the same however. Now with D20 removed there's no 3·3V output and the power supply tries to increase the voltages on the secondary side, so you can't run the unit in this condition.

I removed D20 and fed the positive side of C20 from my Thurlby bench power supply. The power supply continued to trip, which suggested that the cause of the trouble was on the primary side of the circuit. I also found that the drain on the 3·3V supply was some 1·2A. When I compared this with a working unit I obtained a reading of 666mA. I noticed that the 208-pin ST20TP3 microcontroller chip was getting very hot. When I removed it there was no longer a low-resistance reading across the 3·3V rail.

I started to carry out some checks on the primary side of the power supply and found that the 47Ω surface-mounted resistor R7, which provides a 5·7V bias for the optocoupler, was open-circuit. This would account for the excessive voltages on the secondary side and the tripping. Pleased with myself, I replaced R7 and fitted a new microcontroller chip, then confidently switched the unit on again. Disaster! The power supply was still tripping.

Further checks showed that there was no voltage at pin 4 of the optocoupler. C9, a tiny 100nF, 25V surface-mounted capacitor, was dead short while R7 was again open-circuit. Once these two items had been replaced the unit powered up and all the voltages on the secondary side of the power supply were spot on. But there was no light from the standby LED, and the new microcontroller chip was red hot. When a replacement had been fitted the unit was once more stuck in standby.

The new modem chip I had fitted was red hot. But when I replaced it the unit still wouldn't come out of standby, this time because there was no quadrature output from the ZIF tuner. A new tuner enabled the unit to be brought out of standby, and boy was I glad to see the green LED come on! All was not well however. There was no sync, with the picture rolling both vertically and horizontally. Now I've had this fault before. It can be caused by either U900 or U901, both of which are type TDA8540T. I also know from experience that if you replace only the faulty one the other one will fail soon after. So I replaced them both. The unit was at last in working order! **M.D.**

Pace 2200

This digibox produced a sideways rolling picture, as if the TV set had no line sync, and the picture had no green content. U320 had the correct 15·625kHz horizontal-sync signal at pin 96 and the correct 25Hz squarewave was present at pin 97. So attention was turned to the lack of green problem.

The correct green analogue-signal input was present at pin 6 of U901 (TDA8540T), but the output at pin 1 was very distorted and of low amplitude. There were serial clock and data inputs at pins 18 and 19, and pin 13 had the correct 8V supply. A new TDA8540T chip cured both faults. I've had this problem more than once. **M.D.**

Grundig GDS200/2

This digibox wouldn't come out of standby at power up. If it was left on for ten-fifteen minutes it could be switched on, but the screen was a sea of coloured blocks. Channel changes with the remote-control unit changed the pattern. The cause of the trouble was the STI5512SWE BGA chip U16. To allow enough room around the chip for infra-red reflow you have to remove the top interactive card reader PCB. **M.D.**

Digibox fault summary

Table 2 summarises the digibox faults I've had during the past couple of months. Incidentally I've found another power supply layout in a Grundig digibox (see July 2002, page 551). The power supply is made by Samsung and has the identification PSSH370601B. If you want to test the receiver you will find that the other power supplies fit and interconnect. **P.H.**

Table 2: Digibox fault summary

Model	*Symptom*	*Cause*
Pace 2500B	Blocking when warmed up	ZIF tuner
Pace 2500S3	No downloading and going to standby	ZIF tuner
Pace 2400	No signal being received message	ZIF tuner
Grundig GDS200	Tripping after close lightning strike	Rebuild power supply
Pace 2200	Stuck in standby	ZIF tuner
Amstrad	No signal being received message	Tuner
Grundig GDS200	Switches to standby then dead	Liquid spillage on main PCB
Amstrad	No remote-control operation	Carry out a 'backup'
Grundig GDS310	No signal	Power supply capacitors
Pace 2500B	No signal being received message	ZIF tuner
Pace 2500B	Blocking	ZIF tuner
Pace 2500S3	Loss of signal when hot	ZIF tuner
Pace 2500B	No signal	ZIF tuner
Amstrad	No signal	Tuner
Pace 2500N	Frozen picture	ZIF tuner
Pace 2500B	No signal being received message	ZIF tuner
Grundig GDS310	No signal	Power supply capacitors
Grundig GRD200	Switching off	Power supply capacitors
Grundig GRD200/2	Loss of signal	Power supply capacitors
Pace 2500B	Stuck in standby	ZIF tuner
Pace 2500N	No signal being received message	ZIF tuner

NEXT MONTH IN TELEVISION

Guide to the Panasonic Z8 chassis

The basis of the Panasonic Z8 chassis is the Philips Ultimate One Chip (UOC) processor, which combines the functions of IF processing, colour decoding, video processing, scan generation, sound processing, RGB processing, AV switching, teletext operation, OSD generation and system control. Larger-screen models have an additional multi-sound processor. Brian Storm provides a guide to the circuitry and system operation.

Live-test ESR checker

Electrolytic capacitors are the cause of a large proportion of faults. To speed fault-finding, Ian Field has devised a way of checking them in circuit with the equipment in operation. This simple checker uses an AC-input optocoupler in the probe and a programmable voltage-reference chip that drives a LED for fault indication.

Sony's Cyber-shot digital cameras

Sony's latest digital cameras employ sub-miniature engineering without sacrificing image quality or functionality. The aim is to achieve speed and spontaneity in picture taking, using a super-compact sized unit. Ralph Buckstone describes the technology involved.

VCR CLINIC

Reports from
Eugene Trundle
C.A. Jackson
Robin Beaumont
Roger Burchett
J.S. Ogilvie
Michael Dranfield
and
Bob Flynn

We welcome fault reports from readers – payment for each fault is made after publication. See page 108 for details of where and how to send reports.

LG KE14U73

Sometimes a recording made by this TV/VCR combi unit would play back with the sound from a previous recording and coloured blobs all over the picture. The cause of this was the bias/erase oscillator, which was lazy in starting up. Diagnosis is very difficult here, because of access problems. So we checked that the supply voltage was present during the fault, then replaced Q304, T300 and capacitors C302/5/6/7. That fixed it! **E.T.**

Toshiba V726/727B

The fluorescent display was almost out – it was just discernible in the dark. Once capacitors CP041 (220µF, 10V) and CP051 (1µF, 50V) in the power supply had been replaced full brightness was back. **E.T.**

Sony SLV815UB

Was this one too old to repair? Maybe, with hindsight! As there was little visible head wear, a quote was given and accepted for replacement of the weeping, smelly electrolytic capacitors in the power supply section and a clean-up of the PCB there. The job was done, paid for and the VCR went on its way. A week later it was back, the complaint being intermittent hi-fi sound playback despite the fact that the stereo indicator lit up. I had to replace all the purple electrolytic capacitors on audio board HF9 – at no charge! – to restore correct operation. **E.T.**

Philips VR6547

Two of these came in at the same time after a power cut, both dead with no display, one with a blown mains fuse. Normal operation was restored once C12 (2·2µF, 63V), C31 (22µF, 63V) and C41 (22µF, 50V) in the power supply had been replaced – plus one fuse of course! **C.A.J.**

Panasonic NVFJ620B (Z mechanism)

This machine would not accept a tape because the loading motor didn't run. With this mechanism the loading motor driver is integrated into the capstan motor IC, so a new capstan motor was required. But when I'd fitted the motor and reassembled the deck the loading motor still wouldn't run. Resisting the temptation to panic, I checked through the circuit again and found that repeated dismantling during diagnosis had resulted in joint problems at the loading-motor connector on the main board. Some resoldering here cured the problem. **R.B.**

Philips 14PV163/05 (TVCR Beta range)

A common fault with this and similar TV/VCR combi models is that the unit goes to standby after running normally for a few minutes. Any problem that triggers the protection circuit can cause this, but I've found that D6513 (BAV21), the flyback boost diode in the field output stage, is often responsible. I usually uprate the diode, using a BYD33J or similar type. This provides a permanent cure. **R.B.**

Sanyo VHR279E

I had a couple of these machines in recently with similar problems: either the cassette would refuse to load or eject, or the mechanism would stick in the fully-threaded mode. In both cases the loading motor had to be replaced because it had a dead spot. Be careful to order the correct part, as there's a similar model with a wired-in loading motor. The VHR279E's motor has an integral plug connector. The motors are not interchangeable. **R.B.**

Philips 14PV164/05 (TVCR Beta range)

This unit was dead with the line output transistor short-circuit. It worked for half an hour after a replacement had been fitted, then stopped with no line drive – the new line output transistor was OK. Scope checks showed that the line-drive waveform that left the TDA8361 chip on the VCR board was of low-amplitude, the cause of this being the BC848B transistor Tr7205, which was leaky. A new BC848B cleared the fault. **R.B.**

Sony KV21V5U

The TV section of this combi unit worked normally, but the video section wouldn't accept a tape or respond to operation of any of the controls. I checked for power-supply problems and obvious mechanical faults, then decided to replace the system-control micro IC402. There was no change, so I had to look harder! One of the I²C bus lines between the main microcontroller chip and the system-control micro had leakage which reduced the signal amplitude. The cause was traced to a faulty 6·2V protection zener diode. Everything was OK once this had been replaced. **R.B.**

Ferguson FV205

This was a case of making incorrect assumptions. The call came late one Sunday evening. It was about a TV set that seemed to have AFC or AGC problems. I didn't ask the make, as the house was only a few minutes' walk away. As I gathered some tools together, I suspected a Sony set – I'd had a run of them with problems in the IF unit. The set was indeed a Sony, and I had the IF module out and the soldering iron on before the customer mentioned a cassette stuck in the VCR. A quick look revealed that it was a Ferguson FV205.

with a cassette visible (almost ejected) and no display. Hang on, but there was loop-through. Then the penny dropped. The TV set was OK but the VCR's power supply was in trouble.

Then I remembered the power cut on Saturday night. The TV set's IF unit was in fact OK, though I resoldered it nevertheless. I took the VCR back to the workshop and repaired it the following day. It's the same cased unit as in the FV80/1 etc, and the culprit was CP008 (100µF, 25V) which read just under 60µF when checked.

The moral is not to jump to conclusions. The customer got her IF unit checked over for free, but had to pay a premium for a Sunday evening call! **R.Bu.**

GoldStar GHV1296I

According to the customer all that happened was that the FF and rewind symbols in the display flashed. When I opened the machine I found that the loading mechanism was jammed by a steel pin which had worked its way from its mounting on the deck, next to the light tower. Removal of the pin and resetting the mechanism usually clears this fault. Best thing to do with the pin is to bin it. I can't see that it serves any useful purpose. **J.S.O.**

Matsui VP9605

If one of these machines damages tapes, check the back-tension band. It's usually stuck to the supply reel. A replacement band will restore normal operation. **J.S.O.**

Sanyo VHR777E

This VCR was dead, with the mains input choke melted and both windings open-circuit. It's not an item you would normally expect to find faulty. But in addition the surface-mounted mains bridge rectifier was short-circuit and the 2·5A fuse had blown. According to the customer this had occurred about ten minutes after reconnecting the machine to the mains supply after moving house. **M.D.**

Ferguson FV77HV

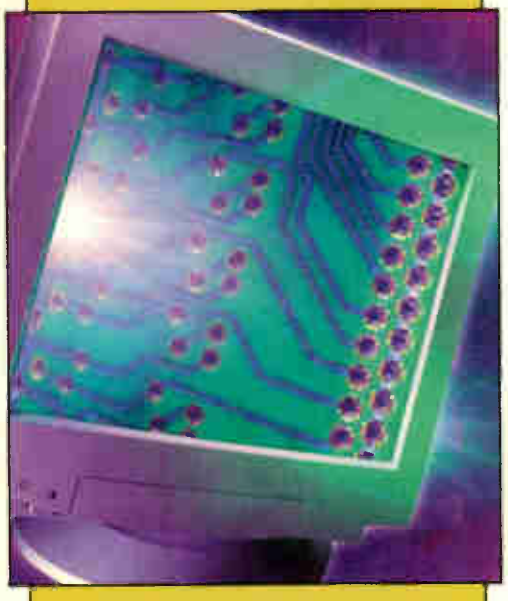
There was just a faint noise from the power supply and all the voltages on the secondary side were low. As there were no faulty fusible resistors, I decided to replace all the known troublesome capacitors – CP11 (220µF, 25V), CP19 (22µF, 63V), CP26 (1µF, 50V), CP28 (47µF, 50V) and CP35 (100µF, 25V). After that the power supply worked normally. **B.F.**

Mitsubishi HSM37

This VCR came back every couple of weeks with a tape stuck in the fully-loaded position. The normal cause of this is hardened grease around the pressure-roller mechanism or on the two sliding plates underneath the deck, but these points had been attended to. The only clue was that the loading motor had to be rotated a few times to released the mechanics rather than, when grease is the cause, giving it a slight touch. I assumed that the mode switch was faulty and replaced it. The machine has not been back these last six months. **B.F.**

Aiwa HVGX350K

The customer reported that this VCR stopped playing then all the display symbols lit up. When I tried it out in the workshop it was dead. Four capacitors in the power supply give problems, CP11 (33µF, 25V), CP19 (1,000µF, 10V), CP21 (47µF, 50V) and CP25 (100µF, 10V). Once these had been replaced all was well. **B.F.** ■



MONITORS

Fault reports from Ian Field

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

Reports can be sent by post to:

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

or e-mailed to:
tessa2@btinternet.com

Elonex/AST TE1464G

The customer brought me this monitor after taking it to another service company. It was dead with the BU2520AF line output transistor Q513 blown. Once I'd fitted a replacement I decided to carry out a good all-round resolder, which is always advisable with these monitors. During the course of this C409 (4,700μF, 25V) in the frame output stage fell out! So I assumed I had found the original fault. The monitor worked all right once it had been reassembled.

Incidentally I find that the AST version of the chassis seems to have a better specification. **I.F.**

Elonex MN022 (Philips chassis)

The reported fault with this monitor was intermittent frame foldover and/or frame roll. Someone had already spent a lot of time resoldering the surface-mounted components around the TDA4800 frame output chip. They had also bent the CRT's control grid pin out of the way because there was a fault in the G1 shunt-stabiliser circuit, with transistor Tr7413 (BF423) cut off. The G1 voltage measured about −125V and, when the G1 pin was straightened, the CRT was cut off.

I decided to deal with this fault first, and found that Tr7515 (BC847C) was short-circuit base-to-emitter. It's driven by pulses from the line output stage. What was left of them affected the DMM, which produced inconclusive readings. The short-circuit became obvious only when a scope was used to view the input and output waveforms. Once a new transistor had been fitted the tube produced a display and it was time to turn to the fault originally complained about.

This was very elusive, and also varied in its nature. It sometimes occurred with slight PCB movement, while at other times severe flexing of the whole chassis was required to produce the symptom. The symptom itself also varied, from rapid frame roll to cramping with severe side distortion as well. Sometimes both these symptoms were present. After resoldering almost everything, I took the main PCB out and gave all the wire-ended components, including the wire links, a slight twist. This seemed to cure the fault, but further flexing showed that it was still present.

After a second, more thorough resoldering operation the fault was permanently present. In fact the top half of the display was missing, so the cause had to be something to do with the frame flyback generator. When I examined the 2·2Ω, fusible resistor R3429 I saw that it had a brown ring around it. So I fitted a new resistor and also replaced C2406 (100μF, 35V) and D6401 (1N4003). After that there was no further problem with the frame scanning. **I.F.**

Royal 14in mono VGA Atari monitor

This chassis has come in with various guises, including Atin Electronics AM148 and Target X1448, usually converted to provide an Atari 'high-resolution' display. I had two of them in. The first had a short-circuit line output transistor, type BUT12 (400V, 8A). I didn't believe that this was the correct type, but a look in the other one showed that it was. The cause of its failure was dry-joints around the MC/LM1391N line generator chip and in the following driver stage circuitry.

The vertical shift resistor was directly under the chip and had contributed to the failure of the soldering. On previous occasions I've glued this resistor to the underside of the PCB to avoid the ugly melt damage it can cause to the bottom of the case. This also spreads the heat dissipation area if silicon sealant is used. In an earlier version this resistor is attached to the same tag as the green wire on the scan yoke. In this position the resistor is free to convect where it will do no harm. Wherever this resistor ends up, its dissipation will be reduced slightly by fitting a UF4007 instead of a 1N4007 diode in series with it.

The second monitor had a blown-up power supply, with a short-circuit BUT12 chopper transistor and a blackened fuse. Now the use of a 400V transistor at a collector voltage of 320V in a flyback chopper circuit doesn't seem to me to be wise. Most manufacturers use a device with a rating of at least 600V, more usually 850-900V. After a fruitless search for something suitable in a TO220 package I decided to adjust the leads of a larger BUW12A, which has the same current rating but a voltage rating more like the latter.

As always with bipolar-transistor based self-oscillating chopper circuits, it's wise to check the associated components, especially the emitter resistor, the base control transistor, the optocoupler and its supply reservoir electrolytic. The emitter resistor is a hefty 2W, 1·5Ω wire-wound type. It had taken the failure without even 'breaking into a sweat'. But the BC639 base control transistor had been severely damaged.

There is no point in quoting component reference numbers. There's no printing on the track side, and a combination of cramped conditions and 'brown glue' make it difficult to read the component-side markings. My solution is to scribe component symbols on the track side,

using the tip of a scalpel – it takes only about five minutes to do the power supply.

The optocoupler was, surprisingly, OK, also the assorted resistors and diodes in its current path. Its 10μF, 50V supply reservoir capacitor produced an ESR reading of 1Ω, which is reasonable for the build quality, but it showed signs of 'recovery' with the heating induced by the test waveform. I doubt whether it had anything to do with the failure, but fitted a replacement and a parallel 0·47μF, 63V non-electrolytic capacitor to reduce ESR-loss self-heating.

Since there are so few components on the primary side of the circuit, I checked everything. But when power was applied nothing happened! The chopper transistor's collector was live, and I'd checked the 150kΩ start-up resistors, but there was no sign of activity in the primary side of the circuit.

The cause of the trouble was the 34V supply rectifier on the secondary side of the circuit. It's a large, glass-bead diode, with an apparently house-code part number. In the past a UF5408 has proved to be satisfactory, but when I run low on stock I try other things. A BY329-1200 works but runs hotter than a UF5408, despite having twice the current rating. It seems that switching speed is the important point here. As the circuit works in the forward-conduction mode, the flyback voltage is much higher (170V). So a blocking voltage of at least 200V is required. In theory a UF5402 should suffice, but UF5404s are much more common and it's worth paying the extra to have a happy customer.

The point about switching speed is easily proved by fitting a Schottky-barrier rectifier, which runs stone cold. Unfortunately gallium-arsenide Schottky rectifiers rated at 180-200V are expensive. The alternative is to use 40V or 60V silicon Schottky diodes in series. These are still more expensive than normal silicon rectifiers, but if needs must! The clamping action of Schottky diodes means that they can be strung in series without need for any voltage-equalising measures.

Having found that a UF5404 is adequate in place of a UF5408 however I decided to fit this type – and keep my limited supply of Schottky diodes safe for a while yet! **I.F.**

CTX 1465D

The report with this monitor said "dead, no LED, no ticking". The fuse was intact, so I checked for voltage across the most accessible rectifier near the edge of the PCB. The checker I use for tests of this sort is basically a pair of inverse-parallel LEDs in series with a 'zero thermal-inertia' PTC thermistor. It gives a useful indication of the presence of voltages between 4-450V. With a high-frequency chopper power supply the peak voltage across a rectifier is sufficient, in both directions, to light both LEDs! But the brightness is asymmetrical, indicating that the diode is conducting in one way and not the other. The difference was not as great as usual, but the positive indication proved that the power supply was running.

As it happened, when I checked the rectifiers on the secondary side of the power supply it was the one I'd used for the initial test that turned out to be short-circuit. It's a BYV96E. I could find only a BYM26E, but a check with the data tables showed that it is some four times faster at about 75nsec with every other rating either identical or better, so in it went.

While working on this monitor I noticed that the deposits around the CRT's anode cap looked different. Unlike the usual exhaust-particulate deposits, there was a thin, dark 'film' that even cellulose thinners failed to remove. When some aluminium-oxide abrasive grit was added to the rag dipped in thinners the film came off quite easily, leaving a dark-blue stain on the rag. It appears to be some form of metal oxide that had crept outwards across the surface of the glass until it bridged between the anode cavity and the edge of the Aquadag coating.

When I powered the monitor the screen was very bright, with flyback lines. There was a perfectly-contrasted display when I reduced the setting of the first anode control. Whether this misadjustment had been perpetrated by a previous 'repairer' while attempting to increase the brightness, and whether the deposits had loaded the EHT and eventually been the cause of the rectifier failure, are things I'll probably never know! **I.F.**

Elonex MN022 (Philips chassis)

When this monitor was switched on its green LED lit but little else happened. The line output and chopper transformers were amongst the first items to be eliminated, by substitution. The start-up resistors and numerous electrolytics were replaced, all to no effect. I eventually discovered that unplugging connector M707 from the CRT base panel produced a marked change. The degaussing system then made the usual 'grump' sound at start-up, and the LCD backlight lit, which it didn't do before. Unsoldering pin 7 (+12V) of M707 had the same effect, except that the CRT now lit up as well. In this condition the outputs from the power supply were all correct. In the no-start condition the outputs were all at about half the correct level. This also applied to the 7812CT 12V regulator IC7525, whose output fell to about 6·24V. Checking relevant components failed to produce any clues. The CRT base panel was eliminated by fitting one from another monitor. All very strange!

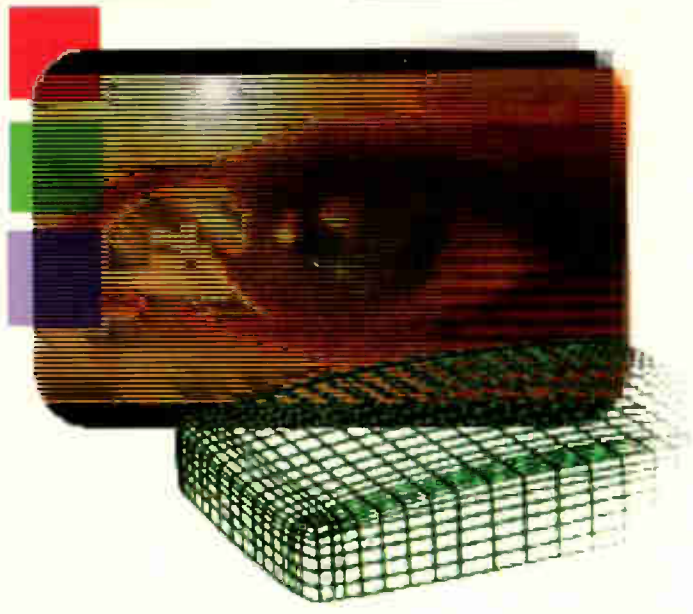
I then found that the monitor could be started by switching it on and off a few times, and that after it had run for a while and warmed up it would restart again if it was switched on very soon after it was switched off. Heat from a hairdryer also produced reliable starting. The thermal nature of the fault was beginning to look like an electrolytic capacitor failure. In an attempt to discover which one, I decided to resolder the electrolytics and switch on after each one had been resoldered, while it was still warm. This also failed to produce a diagnosis.

When I tried the same approach with the ICs I found that the NE5532N chip IC7523 was the cause of the trouble. Once a replacement had been fitted the monitor would start up without preheating!

During subsequent testing and adjustment I noticed that the screen gradually darkened until it was completely black. It took about five minutes to do this. The tube's control grid voltage was found to be on the move, shifting from about –39V to nearly –70V. Tr7413 (BF423), which acts as a shunt regulator for the G1 supply, was being cut off because Tr7409 (BC847C) became leaky as it warmed up.

I had two of these monitors in at the time. This enabled me to note what appear to have been some production changes. In the later version R3103 is 150kΩ instead of 220kΩ, C2113 is 10μF, 50V instead of 4·7μF, 50V, and C2109 is 1,000μF, 16V instead of 470μF, 16V. C2109 is the positive feedback coupling for the self-oscillating chopper transistor. If its ESR is high there is inefficient transistor switch-on, with increased dissipation. The chopper transistor will run cooler if a new low-ESR replacement is fitted, and cooler still if an 0·47μF Mylar capacitor is added in parallel. C2113 also assists the switch-on, by driving Tr7104 (BC638) which provides additional chopper transistor base current from the optotransistor's supply reservoir capacitor C2111 (the measured voltage at C2111 was 4·03V).

If there are signs of electrolytic ageing, C2111 should also be replaced as it can cause regulation failure and massive destruction! **I.F.** ■



TV FAULT FINDING

Reports from
Michael Dranfield
Robin Beaumont
David Smith
C.A. Jackson
Les Mainstone
Eugene Trundle
Philip Salkeld
Gerry Laidler
Dave Husband
and
Dave Gough

We welcome fault reports from readers – payment for each fault is made after publiation. See page 108 for details of where and how to send reports.

Tatung V25NEFO (E series chassis)

There was an unusual fault with this set. It was OK until it was switched to standby using the remote-control unit. In standby the red LED flashed and a pumping noise came from the speaker. The set would sometimes switch itself back on. I found that pin 10 of the ST6385 microcontroller chip IC701 was pulsing on/off: it should be low for on and high for off. So a new microcontroller chip was ordered and fitted. but needless to say the fault was still present.

Now pin 10 of IC701 is also connected to a circuit that reduces the HT voltage in standby, the main items involved being transistors TR802-5. There was nothing amiss here however. What I did discover was that the HT voltage didn't fall when the set was switched to standby. The cause of the trouble was traced to TR801 (BF422) in the control circuitry on the primary side of the power supply. It was leaky. Once a replacement had been fitted the 150V supply fell to 69V in standby and the fault had been cured. **M.D.**

Amstrad CTV3128N

If the set is dead with no light from the standby LED, check R103 (47kΩ) which is on the primary side of the power supply. Also watch out for sets that sometimes won't come on. The cause of this is always a faulty on/off switch. You may hear it arcing when the set is on. A switch left in this condition could catch fire. **M.D.**

Hitachi C2114T (G7PS chassis)

This set was owned by a housebound customer who had it on from morning to night. He said it would sometimes switch to standby when remote-control unit buttons were pressed. This would happen when the set had been on for about eight hours. He said he could tell when the fault was going to occur because if he pressed channel 8 on the remote-control unit channel 9 would come up on the set.

I found this hard to believe, but sure enough when I keyed in channel 8 towards the end of the working day the OSD brought up channel 9. On pressing another button the set tripped to standby. A new TMP47 series microcontroller chip (IC001) cured the fault. **M.D.**

Sony KVM2511U (AE1 chassis)

I was led a dance by this set. The HT was too high and the preset on the primary side of the power supply seemed to do nothing when it was turned from one end to the other. Eventually, after checking and/or replacing most of the components in the power supply, I noticed that the silk-screen print next to the preset I had thought was for setting the HT level said "standby HT set". The one that adjusts the HT voltage when the set is running is right next to the field output chip, and can be mistaken for the height control! **M.D.**

Philips 24PW6324/05R (A8.0E chassis)

When search tuning was carried out this set always settled with the tuning slightly high in frequency. As a result there was patterning on saturated colours. Manual fine tuning would always correct the problem. The AFC feedback is generated by the TDA8843 jungle chip, which was faulty. **R.B.**

Philips 28PW6515/05 (A10E chassis)

This set's picture jumped about as the height and width varied at random. A previous dealer had decided that the cause of the trouble was on the plug-in small-signal panel, by carrying out a substitution check. The TDA8885H jungle chip on this board is responsible for picture geometry as well as many other things, but was not guilty on this occasion.

I connected the set to the Compair diagnostic computer interface. By putting the set in the 'Compair mode' I was able to stop the picture jumping. In this mode the I²C bus between the microcontroller chip and the jungle chip goes into a pause state. As the fault was not present in this condition it seemed likely that the jungle chip

had been receiving instructions from the microcontroller chip to alter the geometry and was itself working correctly. Previous experience suggested that the 'painter' microcontroller chip was likely to be the cause of the fault, and a replacement confirmed this diagnosis. **R.B.**

Sony KVA2942U (AE2B chassis)

This set would sometimes stick in standby. Dry-joints at regulator IC681 appeared to be the cause, but the fault remained when they had been dealt with. During subsequent testing I found that the plug-in board K1 was the cause of the trouble. It carries the power amplifiers for the centre and surround channels. Two new TDA2052 ICs were required.

In this chassis the chopper circuit provides ±22V supplies for the audio amplifiers. The centre tap of the relevant winding on the transformer is returned to chassis via a 22Ω fusible resistor, R627. If this resistor goes open-circuit the ±22V supplies can wander, muting the power amplifiers. **R.B.**

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

This set tripped when it was brought out of standby. I checked the TDA1521 audio output chip first and found that it was short-circuit. **R.B.**

Hitachi C2976TN (A5 chassis)

At switch on sparks jumped all round the tube base panel for a few seconds then the set went to standby. I found that the line output stage tuning capacitor had burnt up and damaged the PCB. Unusually, the excessive EHT had caused no other faults. A new capacitor and print repair were all that was required, but to avoid future problems I replaced the usual carbon resistors in the power supply. This would ensure reliable starting and a stable HT voltage. **R.B.**

Philips 28PW6515/05 (A10 chassis)

When the set had been running for several hours it would go to standby and remain in this state until it was switched off at the mains. The cause of the fault was the microcontroller chip IC7064. **R.B.**

Goodmans 2580 (Ferguson TX92 chassis)

Loss of sound was caused by failure of the BC848B surface-mounted transistor TS90. It's the audio muting switch. **D.S.**

Sony KV21M3U (BE4 chassis)

This set came in with field collapse. R814 (0·47Ω) in the 24V supply was found to be open-circuit. Use the proper type from Sony, as it's an improved version. **D.S.**

Ferguson 14D1 (TX85 chassis)

The symptom with this set was intermittent field collapse. I found the cause by scoping pin 3 (field drive) of the TDA4501H IF/timebase generator chip IC2. A replacement chip cured the trouble. **D.S.**

Sharp 51DS03H

This set was stuck on one channel (ITV). The cause was R704 (68kΩ) which had gone high in value. It's advisable to replace R705 (also 68kΩ) as the set can be stuck in standby when it goes high-resistance. I used 1W metal-film hi-stability resistors in these positions. **D.S.**

Naiko N2897

This 28in. Nicam stereo monster was dead except for a whining power supply. On investigation I saw that C134 had been arcing where it was dry-jointed to the PCB. After a clean up and resolder I discovered that the line output transistor was short-circuit. A replacement got things going, but started to overheat gently after about ten minutes.

R196 in the supply to the TDA4950 EW correction chip IC18 was shedding its skin. A replacement stopped the line output transistor overheating, but there was some width overscanning. A new TDA4950 chip completed the repair. **C.A.J.**

Bush 2871NTX/Goodmans GTV288 (11AK19 and similar chassis)

We've had the following situation with a number of these sets. The initial symptom is crackling and a noisy picture. At this stage the customer rarely switches off but waits to see if the fault will clear. The raster size then decreases, ending up with severe lack of width and EW bowing, while the line output transformer begins to heat up. In nearly every case I've had, the following action has provided a complete cure.

Remove the chassis and carry out a blanket resolder between the line output transistor and the transformer. This will cure the basic cause of the trouble, which is very poor soldering between most of the capacitors (C611/610/626/613/630) and the print. Then replace Q603, type BUK444 or its equivalent, plus R629 (2·7Ω), which is usually open-circuit. Replace diodes D611/612 even if they appear to read OK. C630 (430nF) must be replaced, as I've found that it has nearly always changed value.

The set should now work correctly but, as a precaution, a new line output transistor will ensure a lasting cure. **L.M.**

Sharp 51CS03H (CS chassis)

If the set takes an increasingly longer time to start up or switches itself back on from standby, replace C714 (1,000µF, 10V) on the secondary side of the power supply. It will probably have fallen in value. The positioning of the capacitors on the secondary side is poor, as they collect most of the power supply's heat dissipation. I blanket solder the power supply and surrounding PCB. It seems that Sharp TV sets suffer more than most from poor print and solder connections. **L.M.**

Mitsubishi CT21M5BT (EE4 chassis)

While the sound continued the picture would randomly disappear, leaving a blank screen. Sometimes there was no picture for several minutes from switch on. The cause was 'invisible' bad soldered joints at the TEA5101B RGB output chip IC650 on the tube's base panel. **E.T.**

Sanyo 25BN2

The complaint with this set was that it would switch itself off at completely random, and rare, intervals. We didn't see the fault during a week's soak test, but we did find a dry-joint at the collector of Q611 in the power supply. After dealing with this we returned the set – and haven't heard anything since. **E.T.**

Hitachi C2556TN2

The problem with this set was spasmodic loss of sound and vision, though the standby LED remained on. The cause was intermittent loss of the 5V supply, because all three legs of the L7805 regulator chip IC951 were dry-jointed to the PCB. **E.T.**

Bush 2866NTX

A common symptom with these sets is dead with a ticking noise. You will find that the BY228 diode in the EW modulator network is short-circuit. When it fails it takes with it Q579 (BD237) on the small subpanel next to the line output transformer. **P.S.**

Sharp 56FW-53H (DA50W chassis)

We've had a number of these fairly new sets with EW faults. The item to check is C613 (560nF, 250V) in the line output stage. It goes open-circuit. **P.S.**

Decca D28NT92S

The customer said this set went off with a crackling noise while he was watching it. When I switched it on I noticed that RD17

(4·7kΩ, 1W) and RD06 (10kΩ, 1W) were burning and that there was arcing in the neck of the CRT. Fortunately the set was still under warranty. I seem to be getting a number of CRT faults of one sort or another. **P.S.**

Toshiba 2805DB

This set came in dead. I normally check the ON4408 line output transistor first and, as expected, it was short-circuit. Toshiba supply an alternative. Further checks showed that the 2SC3182 EW driver transistor Q422 (part no. A6358055) and D440 (BY228) were also short-circuit. Replacements restored the set to life. **P.S.**

Sony KVE2932U (AE2 chassis)

Picture flashing is a fault I've had before with these sets. The culprit is the SBX1692 comb-filter chip IC1301 on the small board B1. It's easy to replace (part no. 8-741-692-01) but at over £62 plus VAT the repair is expensive. **P.S.**

Philips 28PW6816/05S (A10E chassis)

This TV/DVD combination set came in because the eject button was broken. It's becoming a common fault. The part no. is 3139 137 91461. **P.S.**

Beko NR30128T

Failure of the line output transformer is a common fault with these sets. SEME can supply it under part no. LOPTX35228P. When the transformer fails R118 (10kΩ, 0·5W) always burns out. Note this value, as service manuals are not easy to obtain. **P.S.**

Sony KV21LS30U

This set produced a bright raster with flyback lines. The picture returned when the setting of the A1/G2 control on the line output transformer was reduced. The focus control had the same effect. A new transformer, part no. 1-453-345-11, cured the problem. **P.S.**

Grundig GT2103 (G1000 chassis)

If one of these sets has a bright screen with flyback lines the cure is to replace R315 (10Ω), which is near the line output transformer. It's in the rectifier circuit for the supply to the RGB output stages. We've had this fault several times now. **G.L.**

GoldStar KI14U71

The customer complained that this TV/video combi unit wouldn't tune. It played tapes all right. As I'd no circuit diagram I started to check the voltages on the secondary side of the power supply and found that the 9V supply at pin 13 was virtually non-existent. A check on the associated safety fuse F853 produced a reading of 1·7kΩ. The two other fuses, F851/852, produced readings of less than 0·5Ω. A replacement cured the fault and a check on the current showed that it was only 140mA. There was no further trouble during a long soak test. **G.L.**

Roadstar CTV552/ Goodmans Compact 110

These 10in. mains/battery colour portables are popular with caravaners and we see quite a few of them at certain times of the year. A common problem is failure of CP22/CP30, which are both 100µF electrolytics. They live a hard life, being next to high-wattage resistors. While the power supply is apart it's a good idea to replace RP04/RP05 (both 180kΩ), as I've had them fail when the capacitors go low in value. QP01 (2SA1012) often fails: a BD244C works well in this position. And the 6·8V zener diode ZP06 may well have died.

When ZP06 has gone short-circuit I always check RV01 (4·7Ω) and ICV1 (TDA3653). I've often found them faulty. **G.L.**

Alba CTV3458

I had three of these portables in during the course of one week, all with the same fault – dead. In each case the cause was RP4 (330kΩ), which had gone open-circuit. **G.L.**

Finlux 3024F

This set produced a snowy raster with an off-air signal but was fine with a scart input. Checks in the tuner section led me to IC11 (SDA3203-3) where the voltages were incorrect. A replacement cured the fault. **G.L.**

Goodmans 215N (Daewoo CP365 chassis)

This set produced a dark picture. The EHT crackled and the whole picture fluttered. Fearing major damage, I switched off quickly and carried out some checks in the chopper power supply, which is of the TDA4601 type. Once C811 and C813 (both 100µF, 50V) and C812 (1µF. 50V) had been replaced the HT was stable, but the picture was still dark and fluttering.

In this job it sometimes pays to just look. I saw that C414 (22µF, 160V) in the line output stage was in a very sorry state. It's the boost capacitor, and read virtually open-circuit when checked with a meter. A replacement restored normal operation, but I also had to replace C304 (220µF, 35V) and C303 (1,000µF, 35V) which are near the AN5515 field output chip I301. They were close to 'popping' their tops, because of the earlier high HT. **G.L.**

Bush 2872NTX (11AK19 chassis)

I thought I knew all the faults with this chassis. This one was dead with the fuse intact. The 22kΩ start-up resistor R806, which has been mentioned before in these pages, had gone open-circuit, this time because pin 1 (supply input) of the MC44604 chopper control chip IC802 had gone short-circuit to chassis. **D.H.**

Goodmans 2575 (F11 chassis)

This set produced little other than a faint whine. First things first: from memory I decided to carry out a visual check on the lower side of the PCB. This confirmed that, as usual, one of the legs of C134, which is in the line output stage, was hanging out. After a clean/resolder the next port of call was the S2055N line output transistor, which was short-circuit. A replacement restored normal operation. **D.G.**

Philips 28PW6324/05R

The customer complained that this widescreen set had a very nasty picture. I found that it was green-tinted, with flyback lines. Adjustment of the first anode voltage didn't improve matters, nor did visual and meter/scope checks reveal anything amiss. As a last resort, good old workshop practice came to the rescue. I resoldered the line output transformer, even though it looked fine. After that there was a good, tint-free picture. **D.G.**

Matsui TVR161

This TV/video combi unit was dead with no sign of life whatsoever. Cold checks in the power supply revealed that R506 (820kΩ) was open-circuit. So the 2SK2056 chopper FET Q500 was suspect, and was indeed faulty. It's also good practice to replace to replace C515 (1µF, 160V), C504 (47µF, 25V) and R504 (330kΩ). Once these items had been replaced the unit worked perfectly. **D.G.**

Ferguson T51F (TX91 chassis)

This set would run for a while then shut down. Visual checks revealed a dry-joint at pin 1 of the line output transformer. Resoldering this cured the fault. **D.G.**

Toshiba 2101TB

This set had a nasty green screen. The culprit was Q505 on the CRT's base panel: one leg was dry-jointed. The AN5515 field output chip IC303 was also in need of resoldering, being almost loose on the PCB. There was a nice picture after the resoldering. **D.G.**

Sharp 66DS03H

The customer said there was field collapse then the set went dead. Visual checks soon revealed the culprit. The polymer capacitor C613 had a leg burnt out of its socket. A clean and resolder restored normal operation. **D.G.** ■

Most microwave oven faults are straightforward and should cause no problems for the TV/video technician. They can provide a useful extra revenue stream.

Bench Notes

Adrian Gardiner provides helpful workshop hints and tips

This month we'll start on a new topic: microwave ovens. Are they white or brown goods? It's a question that is often raised when servicing is needed. They have traditionally been the responsibility of TV/electronics workshops, but many domestic appliance engineers now seem to take them on. Basic microwave ovens cost less than £40 nowadays, so they are not worth repair on the bench. But higher-end combination units can cost several hundred pounds. As repair is relatively straightforward, these are worth the effort. They can provide useful extra income.

Basics

Microwave ovens are based on the use of a magnetron, a type of valve that emits radiation at a frequency of about 2·5GHz. The magnetron is housed in a metal case, surrounded by strong magnets and a heatsink. The magnets direct the radiation into a stream that passes through a small hole in the case into the oven cavity. Atoms in food placed in the cavity vibrate at the magnetron's frequency, the result being heat that cooks the food.

As with any valve, the magnetron requires a low-voltage heater supply, typically 6·3V AC. In addition a –2kV supply is required to activate the device. While microwave radiation is dangerous – use a detector to check for leakage – the biggest danger is the high-voltage supply, which is designed to provide about 500mA. Under fault conditions several amperes can be delivered at 2kV. This could cause a lethal shock.

Fig. 1 shows the basic magnetron circuit. The transformer's low-voltage winding supplies the magnetron's heater. D1 and C1 form a half-wave rectifier that provides a supply at about –2kV. The value of the capacitor varies from model to model – a typical value is 0·9µF. Most modern capacitors for this purpose contain a parallel bleed resistor. But don't assume that this is incorporated. Always discharge the capacitor before testing. The diode has a much larger forward voltage rating than most, requiring about 7V before it conducts. So don't expect to be able to check it with your normal multimeter.

HV troubleshooting

Begin by listening! Place a plastic beaker full of water in the oven. Set to full power for two minutes, then set to operate. You should hear a thump as the transformer kicks in, followed within a couple of seconds by a buzzing sound as the magnetron starts to operate. If there is no thump at all, the chances are that the HV section is OK. Check for 240V AC at the transformer's primary winding.

If the magnetron does start, allow the unit to complete its cycle. In two minutes the water should be very hot. If it's only lukewarm, the magnetron has reached the end of its life and a replacement is required. Transformer failure is usually obvious: a faulty transformer will smell very badly as its windings break down and burn.

Some ovens have a high-voltage fuse in series between the transformer and the capacitor. If this has failed, check the various HV components for a short-circuit. If the capacitor and diode are OK, the magnetron is probably breaking down under load. The HV fuse, if fitted, is a critical safety component: the correct replacement must always be used.

LV section

Fig. 2 shows, in simplified block diagram form, the low-voltage arrangement in a typical microwave oven. A PCB houses the components used for control etc. F1 is the mains supply fuse while F2 is a temperature fuse. The board controls all operations, switching the fan and turntable motors and the cavity lamp, usually via relays. The two series-connected switches S1 and S2 are mounted at the top and bottom of the door. Switch 3 is called the interlock switch. This is normally open when the door is shut. It serves as a safety switch to ensure that the door is properly closed.

Fault-finding in this area is very straightforward. A blown fuse usually indicates an overload in the HV section, so start there. Failure of the temperature fuse often indicates that the fan isn't cooling properly. Most fans use a simple induction motor. It's easy to strip this down to clean and lubricate the bearings.

Door trouble is perhaps the most common problem, with one or more of the switches operating incorrectly. This in turn causes complete shutdown. If the switches appear to operate normally, replace them as corroded contacts can cause this fault. Otherwise, carefully loosen the door catch and adjust the door. The bottom switch should close first, then the interlock switch should open. Finally the top switch should close. After retightening the door, check for microwave leakage with a good-quality detector. The maximum permissible leakage is 5mW/cm^2. Any leakage over 2mW should be investigated however.

In general

The interior of the oven should be given a good general inspection. Pay particular attention to the mica waveguide cover, which is over the magnetron. A burnt cover must be replaced: it often means that there's a magnetron problem. Door latches should be inspected for cracks. Be sure to check the unit's earth bonding. If you have a PAT tester, use this to test the unit.

Microwave oven spares are readily available from most suppliers, including CPC, SEME and AWI.

The purpose of this article is to provide a basic guide to the simple arrangements used in typical microwave ovens. I'll follow up next month with fault-finding flow charts and some specific faults.

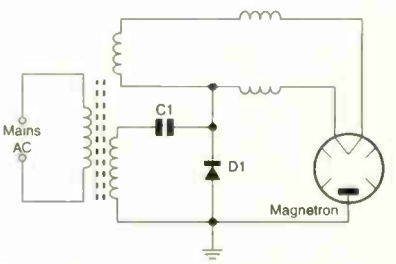


Fig. 1: The basic magnetron circuit.

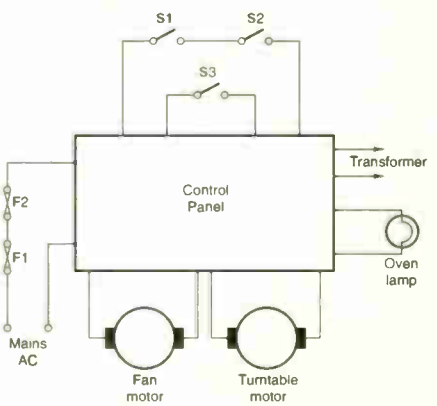


Fig. 2: Block diagram of the LV/control section.

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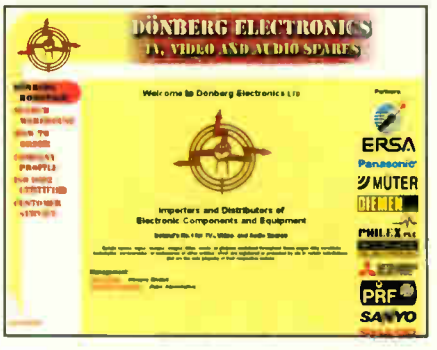

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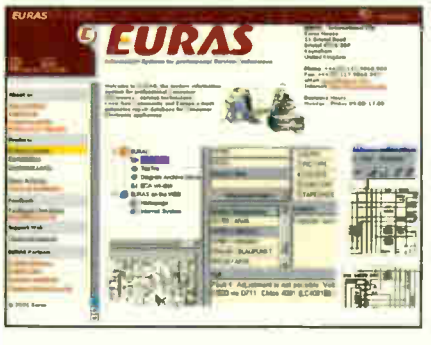

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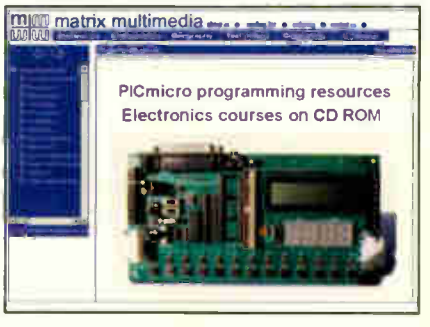

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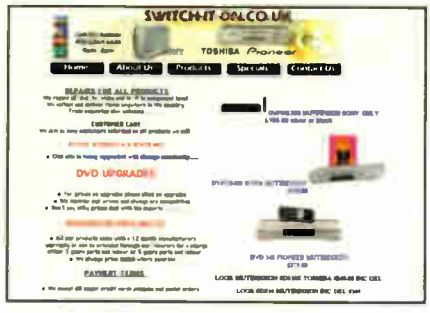

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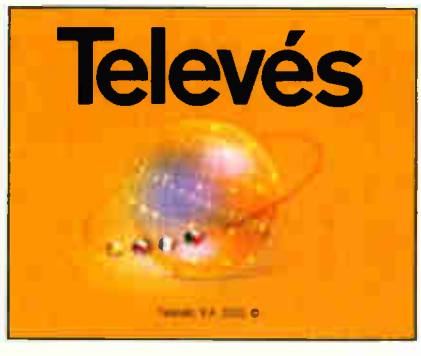

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WEEE looms closer

Enforcement of the EU directive on the disposal of waste electrical and electronic equipment has taken an important step forward. It will involve important legal obligations for the trade and industry. William Dell outlines the present situation and considers some of the implications

Agreement on the texts of the EU directives on the disposal of waste electrical and electronic equipment (WEEE) and the related restriction on hazardous substances (RoHS) has now been reached by the European Parliament and the Council of Ministers. They have still to vote on final approval, but this is usually a formality. Once it has been completed, the directives will be published and implementation by member states will follow.

According to the Industry Council for Electronic Equipment Recycling (ICER), one of the hottest issues in implementing the WEEE directive is that of individual versus collective producer responsibility. In other words, whether producers will have to pay for dealing with their own-brand equipment at the end of its life or for a share of the total costs of the waste stream.

To help those responsible for making the decisions in the UK, as they consider the national regulations to be introduced, ICER is gathering views on how producer responsibility is to be assigned. It's looking into the concerns and preferences of ICER members in different product sectors, and is drawing on the expertise of members from the recycling and waste industries to establish the costs and practical implications of different options.

A collective approach, sharing the costs for old (or historic) products, is favoured at European level. But there are different viewpoints with regard to equipment produced after the directive comes into force.

There has been pressure from the European Parliament for individual producer responsibility to be adopted as an incentive to improved environmental design. It's felt that if producers have to pay for recycling their own products they will tackle the problem at the design stage.

Some sectors of the industry favour this approach, on the basis that it will give them greater control over costs and what happens to their products. Others are concerned that the overall costs of recycling will be increased if all types of equipment have to be sorted by brand to establish the responsibility of individual producers. There is also the question of who pays for brands produced by companies that are no longer in business.

Legal timetable

Implementation of the directives by member countries should in theory take effect within eighteen months of final EU approval. So the WEEE directive could be in force in the UK by about September 2004, with a date in late 2005 for the financial aspects of producer responsibility. The RoHS directive would follow a bit later, but not much. It will bar the use of many materials – the heavy metals lead, cadmium, mercury and

hexavalent chromium, also the flame retardants PBB (polybrominated biphenyls) and PBDE (polybrominated diphenyl ether).

The UK government, along with governments in several other member states, is keen to retain flexibility to decide on many issues at national level. ICER is assisting by providing data and co-ordinating views from different sectors.

Impact

Industry across Europe has contributed to a business impact assessment of the WEEE directive, which will affect a very wide range of electrical and electronic equipment. The aim is to harmonise equipment design requirements across the EU and improve the design of products, reducing their environmental effects throughout their life cycles.

The business impact assessment looked at the consequences for a range of those involved, including materials suppliers, manufacturers (large and small) of equipment and components, retailers and distributors, the waste and recycling industry, environmental organisations and the governments of member states.

For retailers – and servicing organisations – the most important question is how electrical and electronic equipment is to collected at the end of its life. According to ICER director Claire Snow the presumption in the directive is that this will be the retailer's responsibility. But this is not mandatory – it's up to the government to make the decision in the UK. RETRA and BRC (the British Retail Consortium) lobbied hard at European level to prevent compulsion in this respect. Both organisations are to continue to campaign to ensure that the cost impact on retailers is minimised. Local authorities are likely to be given the task of collection. But the situation remains uncertain.

The CRT problem

One example of how things are developing in the area of electronic recycling is to be found in recent ICER research on removing the lead from CRT glass to leave a usable silicate. The research, funded under the DTI Recycling Programme, was carried out in conjunction with Glass Technology Services and a company called Precious Metal Industries. It could provide one option for dealing with the growing pile of waste TV sets and computer monitors. Further research into other solutions is being conducted. It has been estimated that 100,000 tons of computer monitor and TV CRTs are currently going to landfill sites each year in the UK. Solutions for recycling CRTs are needed urgently, because the WEEE directive sets challenging targets for this type of equipment.

The research found that the lead content of the glass could easily be decreased by fifty per cent by smelting with small amounts of reducing agents. With further additions, it could be reduced to below one per cent by weight. Reaction times are short: less than two hours.

ICER director Claire Snow comments "although this could be one way to deal with CRT glass, more work needs to be done. It's important to consider the overall commercial viability and environmental impact of any approach. These issues are being considered in the final stage of this DTI funded project. We now need to take the research further and explore the possibilities of reusing the leaded glass in other applications."

The ICER

ICER membership is open to environmentally-responsible companies and organisations. Those interested in joining, or who want further information, should contact Claire Snow at ICER, 6 Bath Place, Rivington Street, London EC2A 3JE, phone 020 7729 4766. The e-mail address is icer@icer.org.uk ■

Or you can check the website at www.icer.org.uk

LETTERS

Send letters to "Television", Highbury Business Communications, Anne Boleyn House, 9-13 Ewell Road, Cheam, Surrey SM3 8BZ or e-mail tessa2@btinternet.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.
Please send ONLY text intended for the letters page. Correspondence relating to subscriptions and other matters must be sent to the office address given above.

The mains voltage problem

It's my opinion that mains voltage fluctuations contribute to many faults. Electrical and electronic equipment is manufactured to operate with a 230V AC supply, but the mains voltage is actually 240-250V+ AC. As a result there is increased stress on power supplies and heating elements. Normal electric-light bulbs are rated at 240V.

Should manufacturers be made to return to the 240V standard, or should the power-supply companies be made to turn down the supply voltage? The problem with the first course would be the bureaucracy involved – EC directives and so on. The problem with the second approach is how would several thousand transformers be changed overnight, and who would pick up the bill? Should every household have to fit an isolating transformer at the premises? The situation is a bit of a mess to put it mildly.

Things seem to be getting worse rather than better. Because of a relaxation on voltage control the mains supply is now 219-253V RMS. The supply here is 240-250V and goes higher at times. After about 11 p.m. the load is reduced: the lights then brighten quite a lot as the voltage rises to 250-255V. Since my last move about three years ago I have had to replace over sixty bulbs. We also suffer a great deal from light flicker and dimming, with power cuts and many surges.

Is it any wonder that TV set power supplies blow up? They are rated to cope with a non-existent 230V AC supply.

I would be interested to hear from others who suffer from this problem, in particular as I want to compile some statistics to present to the Department of Energy.

Ian Johnson,
6 Heathfield Crescent,
Kidderminster, Worcs DY11 6PF.

How long?

How much should staff be expected to know about the products they are selling? The question is prompted by a recent experience when I enquired about the availability of some professional audio tape. "What's the availability of quarter inch and half inch BASF 468 recording tape on 10·5in. reels and hubs?" I asked.

The assistant typed some instructions into his computer, then replied that there were "ten half inch reels in the warehouse – I can get them here tomorrow". When I asked about hubs, this seemed to cause a bit of confusion. He went across to a shelf stocked with Ampex 456 tape and brought a reel over. After a bit of discussion we sorted out what was meant by reels, hubs and pancakes. "But I prefer BASF tape" I commented. "I find that it archives a lot better. When I buy a tape I want to be sure that I can take it from the archive in ten years' time and know that it will still be OK."

"Oh, you're not meant to keep tape more than ten years" came the reply.

"Why ever not?" I asked.

"Because it goes sticky and gungy!"

"Well I've not had the problem with BASF tape" I replied, "though I have with some others. As a BASF distributor you should know about that."

I left the shop puzzled. Tapes supposed to last only ten years? Well maybe, if you don't select the right sort.

So how long should things last? The question arose again when I was asked to look at a TV set that had "a funny picture". It turned out to be a Granada set with a dim red display. There could have been a problem with the decoder chip or on the tube's base panel, but the tube was also suspect. It was a seven-year old regunned tube.

I carried out some checks on the decoder chip, which was underneath an inch of filth, and on the tube's base panel. These were inconclusive, but I noticed that there was an incredible number of dry-joints in the power supply and line output stage, with the print completely discoloured. The customer then told me that he had had the set for seven years, "with no trouble until last week".

I decided to take a short cut and connect a 4·7MΩ resistor between each cathode and chassis, one at a time. There was no blue or green, but dim red. The tube was finished.

It transpired that during those seven years the customer had never switched the set off. Not at night, nor when he went on

Heater-cathode shorts

In the November letters page Martin McCluskey suggests the use of a mains transformer to power a CRT's heaters in the event of a heater-cathode short. The trouble with this is that a mains transformer introduces capacitive loading of a video output transistor's high impedance, the result being a smeary picture. I've tried to overcome the problem, without success, by adding chokes of various styles and inductances. Even a sophisticated constant-current DC supply added too many puffs. I found that inverting a TV set and tapping the CRT neck for a minute or so produced a cure which lasted for about a month. A workable solution to the problem would be very welcome.

Chris Cory, Tekelex,
Thatcham, Berks.

Editorial note: Martin McCluskey used the transformer in a Sony set fitted with the FE1 chassis, which has emitter-follower transistors in the RGB output stages. The outputs are therefore at low impedance, so the capacitive loading effect may not be too noticeable.

holiday. He didn't know that it had an on/off switch. At least I now know how long a tube will last, if nothing else!
Peter Graves,
Clapton, London.

Dangerous stuff

The Innovations company is offering "Remote Control Ariel" (www.innovations.co.uk). One wonders how this biological washing powder is controlled remotely, and why it's considered to be so dangerous that this is necessary. Does the packet say "pour powder into tray then stand well back"?!
Martin Pickering, B.Eng.,
Sandbach, Cheshire.

Sharp DS chassis. Freemans' models

I feel that I should clarify a point relating to my fault report on a Sharp Model 66DS-03H in the July issue. The cause of the fault was line output transistor failure because of a dry-joint at an associated capacitor. I fitted an S2000AFI as the replacement transistor. In the September letters page Nick Beer correctly says that a BUH515 is the official transistor type here. But in practice both types of transistor are found in this position. Neither has an internal damper diode. There was no danger to the set in fitting an S2000AFI, which has in fact continued to function satisfactorily.

The editor queried a Toshiba model number, 21S04B, in one of my fault reports in the October issue. It's certainly not what one would expect from Toshiba, but is correct. The set concerned was supplied by the Freemans catalogue organisation. It seems that some manufacturers are supplying 'exclusive' models to Freemans. This sort of thing certainly makes price comparisons difficult. I've recently come across a Sharp Model 28HW-53H, which is something I'd not encountered before. Once again it came from Freemans.
Philip Salkeld,
Newcastle upon Tyne.

The asbestos danger

Those of us who have been repairing radio and TV receivers for several decades are becoming aware of dangers we didn't know anything about at the time. Chemicals we once used daily are now classified ed as dangerous, while metals and materials that middle-aged or retired engineers handled in the Sixties seem to be producing health problems. We have all heard the horror stories about back injuries, from which most of us in the trade have suffered at one time or another. And there is the emphysema (lung) problem caused by solder fumes. Recently another lung problem has come to light, mesothelioma (lung cancer) caused by asbestos. This material was used in some older radio and TV sets, usually around the dropper sections, either as sleeving over the wires or as part of some types of dropper. Sheets of asbestos were sometimes used around dropper sections to provide heat insulation and thus protect the cabinet. Even valves and CRTs contained asbestos, as paint on the electrodes. Broken valves could thus have provided a risk of exposure. Apprentices would often use a hammer when scrapping valves.

Mesothelioma caused by asbestos has been acknowledged as a problem in various trades. It is now apparent that radio and TV servicing is also affected. One of the first radio/TV engineers to be diagnosed as having the disease is only 49 years old. How many others have unknowingly been exposed to the danger? It normally takes 20-25 years for the disease to develop and for the symptoms to begin to show.

Many stories and findings about the hazards of asbestos are to be found on the internet. We need to know more about the sets that could be involved, dating from the 1950-1970 era. I would appreciate it if anyone with information would write in to the magazine, which will forward it to me. Which brands and models contained asbestos? A few have already been identified. Information on components would help, for example types of heat-resistant sleeving. What did it contain? Was it asbestos, as it always turned to a dirty-white powder? The fibrous white washers fitted at the bottom of dropper sections as insulators always disintegrated. Does anyone know the make-up of the PCBs and cabinet backs used in early monochrome and colour TV sets? Any information on such matters would be welcome.
Name and address supplied.

Magic past

My first experience of TV was as a ten-year old, when my father completed assembly of a View Master kit. I will never forget the day he got the thing going, with its 9in. tube, ex-RAF EF50 valves and TRF circuit. I don't think anyone of today's generation could imagine the magical feeling of first seeing a TV picture.

At fourteen I was attempting TV repairs. Then, at sixteen, I got a job at Philco as a final test inspector, checking the latest Codenta system monochrome sets with their PL81 and PY81 valves in the line output stage. Sadly the job didn't last, as Philco withdrew from the UK and the brand was acquired by Thorn.

I moved on and worked at a government building laboratory at Doddinghurst, Brentwood. At the time I was constructing a Mullard type C valve amplifier, and was well aware of the need for special valve bases to avoid microphony problems. This knowledge was put to good use in modifying an oscilloscope at the laboratory, where Marconi valve telecommunications receivers that drove ink-pen recorders and teleprinter machines were in use. The DC amplifiers in the output stages of the receivers had to be set up using a special DC oscilloscope, also valve of course. But the first Y amplifier stage suffered from instability. After much investigation I came to the conclusion that a modification was necessary, and used an anti-microphonic mounting (grommets to you) for the valve concerned. Hey presto, a magical cure! It gave me my fifteen minutes of fame. Great days!

After five years I left and joined the TV rental trade, something I'd always wanted to do. This was in the BC (before colour!) period. And until recently I found that the job gave me all the work satisfaction I needed.

But now, as I see it, the magic has gone. There's much grief, agro is rife and real money is just not there. The hours are long and the job is a kind of torment, with nearly all the manufacturers trying to avoid any form of co-operation. It's very demoralising.
Phil Avis,
Hornchurch, Essex.

Passing thoughts

The following thoughts come to mind after reading the October issue. Can anyone explain why a TV projector, which seems to be a combined TV set and magic lantern, costs thousands of pounds? Many people were happy to watch home movies in the dark, so brightness need not be a problem. And why are the people on the front cover watching projection TV on an expensive screen when they have a larger white wall behind it?

Why is all this money being spent on DTT? Instead, satellite decoders and dishes could be offered where required at the changeover time.

The leader on the software bug problem says that while software is often incompatible this is not the case with hardware. Oh yes it is! You have only to look at the FAQ sites for many pieces of hardware to find that there are lots of problems with hardware which is supposedly IBM compatible. Even IBM brought out a new PC model only to find that it was not 'IBM compatible'!
Brian Gilbert,
Hampton, Middx.

WHAT A LIFE!

Some TV troubles. Saga of an electric kettle with an inaccessible element. Donald Bullock's servicing commentary

Some things can give you quite a turn. I suffered from one yesterday. While I was in the shop I glanced through the glass door and saw approaching us what looked like a little television set surrounded by a sackful of cats. As it loomed closer I saw that it was Mrs Magrow, in her best clothes. She was carrying a Minato TV set and had her unruly pair of small twins spinning around her. They were sucking at toffee-apples, and by this time I could hear her voice.

"Kip still you pair" she bawled, "else you'll 'ave me on the ground."

By this time they were entering the shop. There was a set awaiting collection on the floor and, as one of the boys danced up on to it, the other one started kicking at the counter. Then Paul walked over and they both started jabbing at his pullover with their toffee-apples.

"Stop doing that" Mrs Magrow bawled, "you'll get hairs all over yer toffee-apples." She put the set on the counter and looked at me. "You don't get no younger" she said.

I adopted my fish-eye look of severe hurt. "What's the matter with the set then?" I asked.

"You tell me" she replied, "you're the one who's Mr Smarty."

I scrawled 'rabble' on the card and suggested that she call or phone back later.

No start-up

When Paul had sponged his pullover he had a look at the set. Model ST1411 it said. Paul switched the set on and found that it was dead. He soon had it apart and started to take some readings. As there was plenty of voltage across the mains bridge rectifier's reservoir capacitor the start-up resistor seemed a likely culprit. It turned out to be R502 (100kΩ). There was HT at one end, nothing at the other. In fact it was open-circuit. Once a replacement had been fitted the set was OK.

Mr Moss and his Hitachi

Meanwhile Arthur Moss had drawn up outside in his old but spacious car. It took him an age to get out and come in. He's not exactly youthful. But once he'd made it he gave us a cheery wave and a smile.

"Nice to see you again" he said in his quiet voice, "though I wish I didn't have to. It's my television you see. Gone wrong again. I have it in the boot."

As Paul went out to get it I pulled over a job card and wrote his name on it. "What's your number, Mr Moss?" I asked him.

He looked at me, puzzled. "I haven't got a number, Mr Bullock" he replied, "only a name."

"Er, your telephone number I meant" I said.

"Ah, yes, Much-Cackling 298" he continued.

I wasn't sure of the dialling prefix so, with my pen poised, I asked "what's Much-Cackling?"

He'd been doing up his coat, but stopped and looked at me. "How do you mean 'what's Much-Cackling" he queried, "do you mean where is it?"

"No, what do I dial before 298?" I said.

"Oh, 861" he replied.

"Ah, spot on" I exclaimed, writing it down.

This stopped him again. "I'm not sure, what do you mean by 'spot on'?" he asked.

"Sorry, Mr Moss" I replied, "all I meant was thank you."

When he'd departed I looked over at Steven, who was checking the set. "I really must be careful what I say when he comes back" I said, "he's always been the same: takes everything literally.

"What do you mean 'literally'?" Steven said in a voice similar to Mr Moss's.

The set was an Hitachi Model C2556TN. We heard the rustle of EHT when it was switched on, but it decayed at once and the set then reverted to standby, leaving a pronounced afterglow on the screen. A check on the HT showed that it was too high at 190V, so the over-voltage circuit had done its duty and come into operation. Some checks in the regulator circuit showed that R950 had risen in value from 68kΩ to 85kΩ. Another resistor replacement job then. Once this repair had been done the set came to life with the usual high-quality picture we've come to expect with this model.

A troublesome Philips G90AE

Buck Starr, our next customer that morning, is a burly fellow. He strode up to the counter then, with his feet apart, tapped a finger of one hand against the palm of his other hand as he spoke.

"Set failed last night. 'Right', I said to the missus, 'it's over to Mr Bullock's with that 'un in the morning'. And here I am, like I said. Gollim in the car." Then he paused, as if wondering what to say next.

"Shall we bring it in then?" Paul asked.

Buck nodded and they collected it from the back seat. It was a Philips set, Model 21GR2550/05B, which is fitted with the G90AE chassis.

"We was watching BBC News 24 when he died away" Buck continued, tapping his palm. "It was probably all their endless adverts. Them noisy, flickering messes they keep putting on about their programmes. It's anything to be like ITV now, ennit?"

"True enough" I said. "I never thought I'd see the BBC sink so low.

I wish Lord Reith would come back and clear the whizz-kids out, then find some grown-up staff with standards. And do away with all the electronic noise equipment and the oafs who use it."

"And BBC radio ain't no better" continued Buck, tapping away. "Where they get their crazy noises from I can't imagine."

This is all true enough. In September, to make its Ten O'clock News more 'populist' and competitive with ITV's news, the BBC replaced its excellent and sober veteran newsreaders Michael Buerk and Peter Sissons with the allegedly more photogenic Huw Edwards and Fiona Bruce. And in answer to that ITV kicked out its ITV News Editor Nigel Dacre, who had done an excellent job for eighteen years, for "failing to maintain the populist standards" of their bulletins. In other words, for improving the quality. He was replaced by David Mannion because he has "proved populist news instincts". Then ITV started to move its news about, just to be thoroughly unhelpful. And there you have it: the BBC and ITV vying with each other for ratings instead of quality.

I feel better now!

Buck's set was stuck in standby. Paul checked the line output transistor and was not surprised to find it short-circuit. As he couldn't find anything else wrong he fitted a replacement and then switched the set on again. The new transistor died at once. After disconnecting the set from the mains supply Paul felt the line output transformer's overwinding, which was very warm. An HR7503 transformer was installed, along with another transistor. Then Paul tried the set again. This time it came on, but was stuck on channel 6, with all functions locked up and F7 displayed on the screen.

"Right" said Paul, "where's the 5V line? Wish I could read Philips' circuits."

"So do I" I replied. "There was a time when they were among the best in the trade. Everything from Philips was easy to mend if you had the relevant Philips manual. I'm thinking of the ones with grey soft-card covers. They even contained line drawings of the chassis to show how the components were wired together."

By now Paul had found the 5V line he was looking for, the one that supplies the microcontroller chip (IC7800) on the teletext panel. It is derived from an 8·3V supply that's produced in the line output stage, via a 5V regulator. A scope check on the 8·3V supply revealed the presence of a king-sized ripple, which was caused by loss of capacitance in the reservoir capacitor C2843. This 16V capacitor had fallen in value from 220µF to 150µF. As a result of the ripple, IC7800 was locked up. A new capacitor put matters right.

A sad event

I have a sad event to report. Some of you will recall the cheap (£8.95) Cookworks electric kettle which Greeneyes and I decided to give a whirl. Well, after a brief series of minor illnesses it departed this life last week, when its element went short-circuit to earth.

"The Clockwork kettle has failed" Greeneyes had announced.

After a few skilful questions to find out what she was on about, I brought Plan A into action and applied my razor-sharp mind to the problem. To start with I tried first-aid. The element seemed much like a standard jug-kettle one, so I decided to replace it. The trouble was, I could find no way of getting to it.

Then I saw that there were two little embossed circles, set an inch or so apart, just beneath the switch. Were they the heads of plugs, or bungs? If so, they would be hiding a pair of cunning screws, or so I thought. I tried to ease them out gently, using a watchmaker's screwdriver. But I couldn't get the blade between them and the body of the kettle. After a while the little man hammering inside my chest induced a burst of anger and made me push at them. They slid down half an inch into their holes but would move no farther, in or out.

Accepting Greeneyes' unasked for comment that the appearance of the kettle had been spoilt, and ignoring her claim that she would now have to have an expensive stainless-steel replacement, I decided to explore afresh. I got the idea of trying to pick out the little orange pilot light lens to see if there was anything beneath it. I managed this, and found two little Phillips screws. When these had been removed I could swing out the upper part of the kettle's handle. But it was hinged at the bottom with a metal strap, and I could see no way round that. After a while I came to the conclusion that the element would have to stay where it was.

So we had to have a little funeral. After that I was led out, by the ear, to buy Greeneyes an expensive Kenwood stainless-steel kettle.

DVD

Fault reports from Geoff Darby and C. Bowers

We welcome fault reports from readers – payment for each fault is made after publication. See page 108 for details of where and how to send reports.

Panasonic SAHT80

This home-cinema system failed to play DVD discs about half the time. When it did play a DVD disc the jitter figure was unacceptably high at over 15 per cent. This figure is displayed when you press the front-panel Stop button plus the remote-control unit's 5 then Play button. The reading was JIT 155, which means 15·5 per cent.

Experience has shown that the cause of this is almost always a defective laser block rather than misalignment. When a replacement laser was fitted the unit played discs every time and produced a jitter figure of 8·2 per cent initially, rising to 8·8 per cent farther into the disc. I have found these to be typical values with a correctly working unit, though Panasonic literature suggests that 10-12 per cent is the figure to expect, and that problems won't occur until the figure rises to 15 per cent. **G.D.**

Technics SLDV250

This DVD player is part of an otherwise conventional four-piece stacking hi-fi system. The complaint was no composite video output from the rear panel phono socket. When I checked I found that this was so, though S-video was present.

A look at the circuit diagram showed that S-video and composite video come from the same source, IC3301 on the decoder board. Y and C signals were entering this chip at pins 2 and 15, and emerged at pins 5 and 12. But there was no composite video output at pin 11. The IC itself seemed the most likely bet. A new one was ordered and fitted, providing a complete cure. **G.D.**

Hitachi HTDK150E

The problem with this home-cinema unit was one of those you would probably never be able to suss out unless you had help from the manufacturer. When I received the unit it powered up but wouldn't come out of standby. There was only a red light at the on/off switch, and no display.

The cure was to replace the operating system EPROMs which, once the unit's cover has been removed, are clearly visible on the left, mounted in sockets. The part number for the ICs, which come as a pair marked HI and LO to correspond with the originals, is AFA0053C001. The official description is "IC EPROM 1-pair HI and LO".

When the replacements have been fitted the remote-control handset won't work and its coding will have to be changed. This is done by moving a diode and a wire link inside the handset. A note with the replacement EPROMs explains the procedure. There is however a version of the handset that doesn't have the link. In this case, lift pin 9 of the IC and separate it from pin 8, then link it to pin 12. **G.D.**

Kenwood RXD-DV50

This is another of those three-player carousel hi-fi units that's actually a DVD player. It sometimes refused to open the tray. On other occasions it would open the tray and take in a disc then refuse to play it. Sometimes, when the unit was first powered, the laser would shoot to the far end of its track and the motor would stubbornly try to push it farther. At other times, when the unit was switched back to standby, the spindle motor would rotate at high speed backwards.

All this suggested a problem in the power supply. I found that some improvement could be obtained by pushing on the PCB hard: the unit would then sometimes work normally. It's a major operation to get the power supply out, but there seemed to be no alternative.

Having finally removed it, I examined it minutely under a powerful magnifier. But I couldn't see any obviously bad joints. I was convinced that there had to be one somewhere and, as the unit can't be run when dismantled, the only possible course of action was to carry out a blanket re-sweat of every joint on the board.

As it turned out, this didn't take too long. Better still, once the unit had been reassembled it worked correctly – and continued to do so during an extended soak test. **G.D.**

Sony DAV-S300/HCD-S300

This unit had no display illumination. When I took the top cover off and looked at the power supply I saw that coil L930 and capacitor C933 were a burnt brown instead of the normal orange colour. Resistance and capacitance checks proved that there was a fault, and a quick call to Sony Technical confirmed that there can be a problem with L930 and C933. It's just a case of replacing them. The display was OK once I'd done this. **C.B.** ■

Solution to Test Case 480

– page 79 –

What a lot of questions! Cross-modulation can occur when there's excessive amplification, perhaps where a high-gain aerial and amplifier, two signal 'boosters' integral with equipment, and a distribution amplifier are in use. As a result, the RF amplifier in a TV set or VCR can be pushed beyond its linear gain range and the signals interact. The result is patterning, buzz, sound-on-vision etc. Nasty!

The interference experienced with Tom's piped satellite signals was caused by a clash between the set-top box's output frequency and a signal that came via the new wonder aerial. It was cured by resetting the STB's modulator to provide an output on a 'quiet' channel, and tuning all the TV sets to this.

Now for the DVD player. It would have been possible to use a standalone UHF modulator. Various types are available, including 'RF-through' ones. It's simpler and cheaper however to connect the player to the VCR's second scart socket and select AV2 there for DVD playback via the VCR's modulator: the fact that simultaneous tape recording and disc playback would not be possible was of no consequence to Tom.

Next the remote-control extender. The Sky Eye gadget can control only the digibox. A Powermid IR system, though a bit more expensive, is able to control all the equipment.

Finally, the DECT phone trouble was cured by moving the base unit two metres away from the Sky box. As Tom said, sorted!

NEXT MONTH IN TELEVISION

Guide to the Panasonic Z8 chassis

The basis of the Panasonic Z8 chassis is the Philips Ultimate One Chip (UOC) processor, which combines the functions of IF processing, colour decoding, video processing, scan generation, sound processing, RGB processing, AV switching, teletext operation, OSD generation and system control. Larger-screen models have an additional multi-sound processor. Brian Storm provides a guide to the circuitry and system operation.

Live-test ESR checker

Electrolytic capacitors are the cause of a large proportion of faults. To speed fault-finding, Ian Field has devised a way of checking them in circuit with the equipment in operation. This simple checker uses an AC-input optocoupler in the probe and a programmable voltage-reference chip that drives a LED for fault indication.

Sony's Cyber-shot digital cameras

Sony's latest digital cameras employ sub-miniature engineering without sacrificing image quality or functionality. The aim is to achieve speed and spontaneity in picture taking, using a super-compact sized unit. Ralph Buckstone describes the technology involved.

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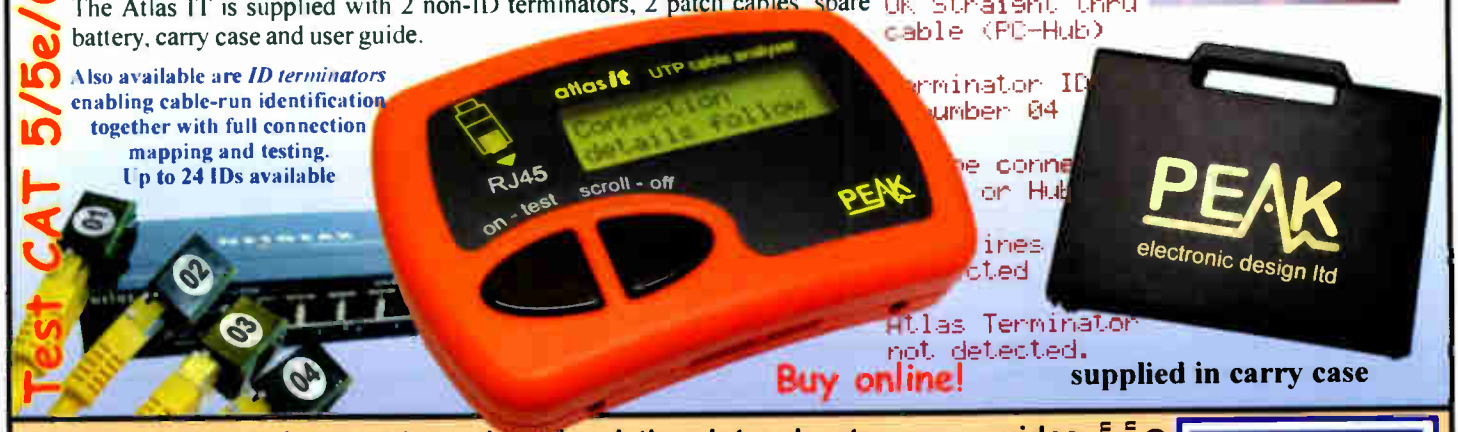

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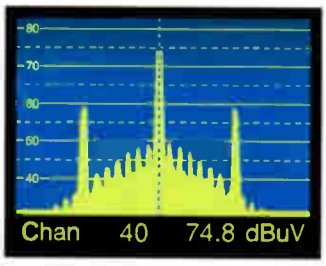

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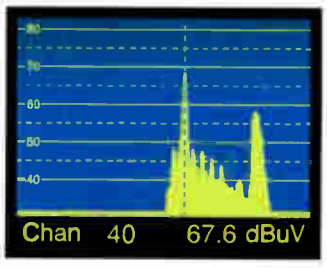

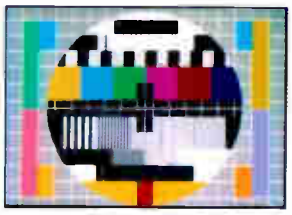

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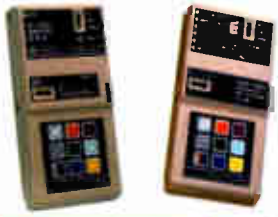

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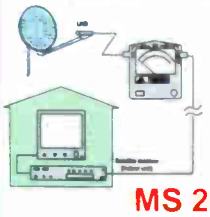

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