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Playback Function	Playback - forward reverse Fast Forward Fast Reverse Forward one frame Zoom in
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Companies that wax and wane

When I was young large companies seemed to me to be pretty permanent fixtures – despite the depression and war years. After all, they owned giant mills, steel plants, Atlantic liners, coal mines or what have you: not the sorts of things one might expect to come into and out of use over a relatively short period of time. Yet the mills have closed, UK steelmaking has declined dramatically, the liners have long since given way to aircraft, and the pits are no longer active. The fields of electrical and electronic manufacturing are similarly affected by change. Who, back in the Seventies, would have thought that the mighty Thorn Electrical Industries would fade away? Once Sir Jules departed it seemed to do just that. Interestingly, Philips has proved its survival capability to date, though the going has been tough at times. More recently we have had the extraordinary business of the internet company bubble. Some of these companies shot up to a huge size on paper only to shrivel away within months.

Boards, when they are not busy fiddling the books, can have a very difficult time. Companies have to evolve to maintain a role in the ever-changing economy. Sometimes they succeed brilliantly, sometimes they make disastrous mistakes – Marconi springs to mind as an example of the latter.

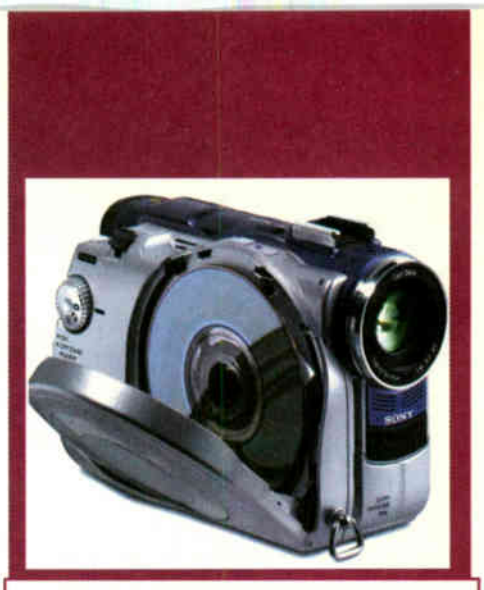
Recent reports suggest that several well-known companies may be faltering. Nokia, the world's largest mobile phone maker, has announced a restructuring. The company has an unusual background – it started off in the forestry industry, then evolved into electronics. Forestry has long since gone, and since 1992, when the mobile phone boom started, the company has concentrated on this area. But mobile phones have become cheap, commodity items, and sales have been flagging. The industry is now placing increased emphasis on data services. So Nokia is to be reorganised, with three divisions: mobile phones and networks, multimedia and 'enterprise solutions'. The latter will target business customers. Multimedia will concentrate on imaging, gaming and entertainment services, including camera-phones – the company is about to launch the N-gage portable gaming unit, which has wireless connectivity (bluetooth) built in so that interactive games can be played. Nokia's mobile phone-PC combination comes under enterprise solutions. This may provide some sort of indication as to the way in which things are going.

Motorola's problems appear to be more serious – its chairman and chief executive Chris Galvin has just resigned. So have other major company officers. Motorola was founded in 1928 by Chris Galvin's grandfather Paul, and was for many years famed for its car radios. In the early days of ICs it became a major manufacturer of chips for consumer electronics. It is still heavily involved in the semiconductor field, but this part of the business has been lossmaking for some time. More recently it has concentrated on mobile phones, but has found it hard to compete with Nokia – its market share has dropped from 26 to under 15 per cent. Other, more successful divisions include wireless services and products. There have been delays in introducing new mobile phones and phone-cameras, some with colour screens, including the V810 clam-shell phone-camera that's intended as a leading new product, marking a shift of emphasis from engineering to design. There have been suggestions that the company might be broken up. It has cut 56,000 jobs, about a third of the workforce, in recent years.

Eastman Kodak, for long synonymous with photographic film, aims to reinvent itself as a giant in the digital imaging field – after making a rather belated start. The example of Polaroid, inventor of instant prints, is not helpful: it became bankrupt in 2001. Kodak will have its work cut out to succeed in fields that are dominated by the likes of Canon, Sony, Olympia, Nikon, Xerox, Hewlett-Packard and Epson. But it has launched several initiatives, including digital cameras, the Ofoto internet site, and a joint flat-panel display venture with Sanyo.

Intel has already had one narrow escape when, in the eighties, it moved from D-RAM to microprocessor chip manufacture, a field it has come to dominate. Since the early nineties it has grown in size by a factor of ten. But the semiconductor industry has been through huge upheavals during the last decade and Intel's chief executive, Craig Barrett, feels that the coming decade will bring "major, major dislocation", with Asia as the centre of this convulsion. Intel is responding by moving much of its R&D work overseas. As Craig Barrett has put it, "essentially all PC and handheld design work is now done in Taipei (Taiwan), so I put my engineers where the action is".

Is nothing sacred? How about Microsoft and IBM? The latter has had its problems in recent times, while Microsoft is facing increased competition from the likes of Linux. Its proneness to email viruses has not done it any favours. But we shall see. One thing is certain: free markets are fearsome taskmasters.



Cover: Our cover photographs this month show some of the highlights of IFA 2003 (see page 12), including Pansonic's DMR-E100H combined DVD-RAM recorder with 80GB hard disk and an SD Memory Card slot, one of Sony's DVD-RW/R camcorders and a Philips LCD TV Model 42PF9965.

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TELETOPICS

The European HDTV system

An official statement on 13 September announced that Europe's first high-definition service, Euro 1080, will start broadcasting on 1 January 2004. Transmission will be via satellite, to households and theatres. Programming will include the European and the World Soccer Championships and the Olympic Summer or Winter Games. The first programme, scheduled to start at 11 a.m., will be the New Year's Concert from Vienna.

Some 2·5m HDTV sets are expected to have been sold in the US during 2003. Japan is ever farther ahead, with more than 6m households being able to watch HD television. Many broadcasters throughout the world are currently transmitting HDTV, including NBC, Channel 7 Australia, NHK Japan, Korean BS, China CTV and TV Globo Brazil. Europe lags behind in sticking with standard-definition TV, despite having developed the HD-MAC system back in the Eighties.

Euro 1080 will launch with two channels, the Main Channel and the Event Channel. The former will broadcast free-to-air via satellite to households and small venues (sports bars, hotel chains, airports etc.) a four-hour rolling programme consisting of live and delayed live content, the footprint extending from Norway to Portugal and Greece, covering more than thirty countries. The latter will distribute event programmes to 'Event Cinemas', i.e. theatres equipped with an electronic projection system and a 5.1 surround sound system. Content will range from big events to specific regional programming. Euro 1080 will co-produce HD content with public broadcasters, production houses and record companies, and also exchange programmes with HDTV services worldwide. It also plans to acquire rights from owners of major events.

Anyone with a 60cm dish pointed at the satellite will be able to receive the Euro 1080 signal. Viewers will also have to purchase an HDTV set-top box and display in order to see the pictures at their best. There have so far been no announcements of prices or manufacturers of such equipment. Connections will involve linking the new STB to the dish with the existing satellite receiver linked to an IF loop output. The HDTV STB will provide component, composite and S video outputs.

It will also be possible to distribute the HDTV signals via a coaxial cable network, with the cable service operator being able to include the digital HDTV stream with any existing data stream. Cable operators who have upgraded their networks to carry DVB TV can multiplex the HDTV transport stream with other channels.

The HDTV multiplexed signal occupies a 7MHz channel bandwidth and uses QAM 256 modulation with a bit rate of 40Mbits/sec. The display parameters are 1,920 pixels x 1,080 lines, with 50Hz interlaced frames.

Central play-out and post-production for the service will be located at Hove, Belgium. Euro 1080 is using Panasonic D5 HD and DVCPRO-HD as tape formats for production, post-production and content recording. Other equipment such as cameras, vision mixers and video servers is being supplied by Thomson. Sound will be available in Dolby Digital form.

Test transmissions are already taking place and can be viewed, as Hugh Cocks reports in Satellite Notebook (see page 54).

LG.Philips has introduced two new TV picture tubes, the Cybertube+ SuperSlim range. Depth has been reduced significantly to make them competitive with flat-panel displays.

The 32in. tube is the world's first real-flat widescreen, slim-line CRT, measuring just 35cm from front to back (see above). This has been achieved by increasing the deflection angle to 125°. The photo shows the significantly shallower profile of the glass envelope over much of its rear surface area. The tube will enable manufacturers to produce sets with the cost and performance advantages of CRT technology while being little deeper than a plasma model. Only minor chassis modifications are required to cater for the new tube.

The other tube in the range is a 21in., 110° real-flat 4:3 screen type that uses a hybrid coil. The 38cm depth knocks 13cm off that of a conventional 21in. tube.

The company has also demonstrated a 36in. real-flat widescreen high-definition picture tube that uses its unique HF rectangular deflection yoke and an improved high-resolution gun.

Flat TV update

Sony has announced that it will boost its flat-panel TV range substantially and is aiming for a 30 per cent share of the market. The company is reorganising its Japanese manufacturing facilities and plans to increase its flat-panel range from seven models last year to 27 in time for the Christmas sales season. Sony has held talks with Samsung about a joint venture to produce LCD panels – at present Sony relies on Hitachi and LG.Philips for its supplies. Sony does not have its own LCD production technology.

Samsung forecasts that global sales of flat-screen PC monitors will exceed those of CRT models for the first time next year, while sales of flat-screen TV sets could outnumber those of CRT sets within five years. "Explosive" growth is expected next year as prices fall: the price of a 32in. Samsung LCD set is forecast to fall from about $4,000 by the end of this year to something like $3,000 next year as increased production leads to economies of scale. At present the price of an LCD TV set is on average about five times that of a CRT set.

Sharp, the world's leading LCD TV manufacturer with a market share of about 60 per cent, forecasts that demand will double from 1·4m sets last year to 3m this year and 8m in 2005, when the company is to cease producing CRT sets. It forecasts that in 2007 fifty per cent of the TV market will consist of flat-panel sets, with 37 per cent LCD. The company is rapidly converting its European TV centre at Barcelona from CRT to LCD TV production and has plans for a second European plant.

Taiwan's largest LCD manufacturer, AU Optronics, is to invest US$2·35bn in a sixth-generation manufacturing complex, the first phase in an expansion plan that will involve over US$5bn. AUO will be producing 32, 37 and 42in. TV-suitable LCD panels in the new plant, which is scheduled to come on-line late next year.

DisplaySearch Taiwan forecasts that the LCD TV market will take off strongly in the second half of next year, doubling from 4·2m units this year to 8·4m in 2004. Another market report suggests that sales will reach 30·7m units by 2007. There has already been a warning of future over-supply and price wars.

Dell has announced that it might enter the TV market with LCD sets.

Business news

Last month we reported that electrical/electronics retailer PowerHouse had been placed in administrative receivership. As we went to press it was announced by the administrators that the chain has been sold to a New Zealand retailer, Pacific Retail Group, which will buy the 142 PowerHouse stores, infrastructure and brand, saving over 2,000 jobs. PRG has a 33 per cent share of the NZ market and has branched out into lingerie retailing.

Parts of BoxClever, the TV rental group, have been placed in administrative receivership, including Endeva which provides servicing and logistics back-up, including call-centre support. Endeva employs most of BoxClever's 4,000 staff and runs its 160 outlets. The aim seems to be to restructure the loss-making units and sell them on.

Annual results from Dixons were better than expected, with turnover up from £4·888bn to £5·761bn for the year to May 3 and pre-tax profit only marginally down at £279m compared to £282m. The company reports strong sales of laptop PCs and digital cameras and camcorders during the 18 weeks to September 6. Sales of extended warranties have stabilised after a big fall last year, the result of bad publicity arising from the Competition Commission probe. Margins on extended warranty sales are higher than on actual product, and Dixons is the market leader in this field.

Amstrad returned to profit (£3·8m) during the year to June 30 as a result of increased sales of digiboxes to BSkyB. The Em@iler business (Amserve) continued to make a loss but is expected to break even this fiscal year, following a halving of the price of the unit last Christmas. Over 255,000 Em@ilers have now been sold: the bigger the user base the greater the possibility of generating significant revenue, which comes from phone and on-line charges and advertising.

Audio developments

Warner Music, in conjunction with Sony, intends to launch combined CD and DVD music-video discs early next year. They will have a music album on the CD side and DVD music-video material on the other side. The technology is being supported by Universal Music, EMI and BMG.

Toshiba has developed the Gigabeat G20, a compact audio player based on a 1·8in., 20GB hard disk that can store over 300 hours of music recorded at 128kbits/sec – equivalent to 5,000 four-minute pieces of music or 500 CDs. The unit weighs just 138g. A small lithium-ion battery provides more than eleven hours of continuous playback between charges. The player is compatible with two types of software: Windows Media Audio 9, which is now pre-installed in new Windows PCs; and Toshiba Audio Application, which comes with the player. WMA, MP3 and WVA format audio can be stored and played. A CD compressed to 60MB can be downloaded in approximately 30 seconds via the USB2 connector.

NEC has developed a working prototype mobile phone that can receive terrestrial digital TV transmissions. It uses a portable aerial and incorporates a UHF tuner and an OFDM decoder chip that was developed for wideband CDMA mobile phones. Its disadvantage at present is battery life while in the TV mode. This is about an hour. NEC considers that a life of one hour talk-time and one hour TV time will be required for the product to be a viable commercial proposition. The company is working on improvements that include better receivers, lower power consumption and the development of digital TV/mobile internet applications. The prototype was demonstrated at Telecom 2003, which was held in Geneva during October.

Sharp's wireless TV

Sharp has launched the world's first 'wireless TV'. The Aquos Mobile Model LC15L1E is a 15in. LCD set that can operate completely free of cables and leads. It uses a 2·4GHz spread-spectrum video/audio transmission system with a range of 30cm as a link between the screen and other equipment, to source DVD, VCR and broadcast TV material, and has a battery that provides over two hours' operation. It also has two scart sockets and an aerial socket. The price is about £1,200.

Sharp Microelectronics Europe has launched a megapixel CCD sensor module that can be used to add a camera feature to a slimline mobile phone. The LZOP3721 is claimed to be the smallest and slimmest of its type, measuring just 13·5 x 11 x 9·7mm.

Video recording

Samsung has launched a range of camcorders, Models IT Cam 5, 7 and 9, that use a 1·5GB hard disc as the storage device. Use of MPEG-4 compression enables several hours of video to be recorded on the disc. Top of the range Model IT Cam 9 has an LCD screen for monitoring and playback, a Memory Stick slot and a USB2.0 connector for fast downloads to a PC. Prices range from £500-£700 depending on specification.

Thomson has launched a hand-held video recorder, Model RD2780, that can record video material, MP3 music or JPEG files on a 20GB hard disc and has a 3·5in. colour screen. It can record directly from a TV set. Use of MPEG-4 compression enables up to 80 hours of video to be stored on the disc. Price is about £500.

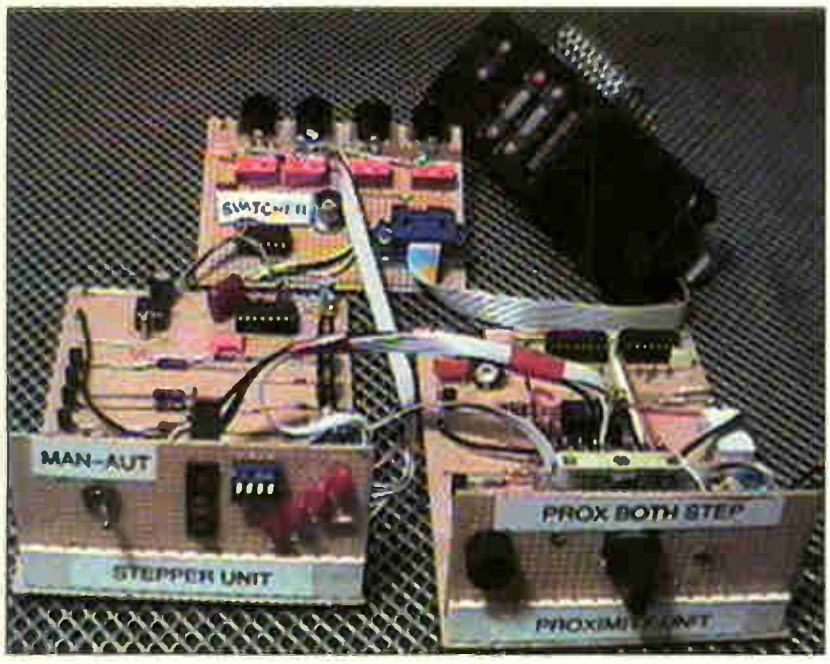
Kane Wireless has launched the Vision Station, which consists of a TV tuner for installation in a PC and software that enables programmes to be recorded on memory cards that can be played back via a PDA such as an iPaq or XDA. Use of compression technology from Essential Viewing enables programmes to be stored on the PC's hard disc in a very small space. The system is on sale at Argos and Carphone Warehouse for about £300.

DAB update

The world's first 5.1-channel surround-sound broadcasting system is being tested in a six-month trial in the central London area. Capitol Radio is using Microsoft's Windows Media Audio 9 format, which can compress 5.1 audio into a 128kbits/sec internet protocol stream. NTL Broadcast is providing the trial multiplex, in the L band (1·4GHz). Reception involves use of a PC. RadioScape and Imagination Technologies (Pure) are providing receiving equipment. The RadioScape receiver consists of two PCI-bus cards, while the Pure Model DRX-702ES can feed 5.1 sound to the PC via its USB socket.

Earlier this year RadioScape, NTL and Microsoft demonstrated video via DAB. UK digital radio company Perstel has demonstrated a prototype receiver with a 7in. colour LCD screen. There is so far no broadcaster commitment to DAB video in the UK, but German broadcasters have expressed interest in transmitting the 2006 Football World Cup in this format.

Sony has announced that it will launch portable DAB radio receivers early next year.



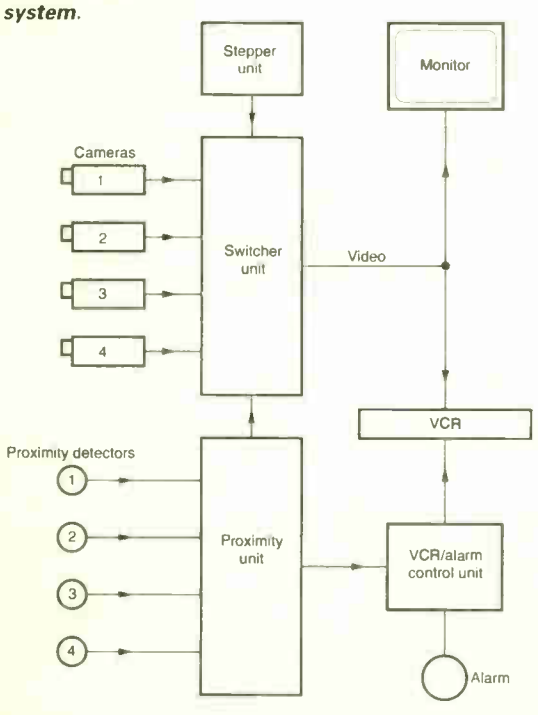
Simple inexpensive off-the-shelf CCTV kits are readily available but lack individual expansion capabilities and flexibility. Ian Rees has devised a system that should fulfil the needs of small-to-medium sized installations, with some added innovations found only in dedicated PC or professional systems

A flexible CCTV system

Simple, inexpensive off-the-shelf CCTV kits are widely available from DIY stores. The cheapest domestic systems consist of a small CCD camera, 20m of multicore cable, a power supply and a scart plug for connection to a TV set or VCR. Multi-camera switching systems with a monitor can be purchased for use with larger domestic or small commercial premises. Some systems include a PIR detector that can trigger a domestic VCR. The main disadvantages of these kits are their lack of individual expansion capability and flexibility.

This article describes a flexible CCTV system that should fulfil the needs of most small-to-medium sized installations, with some added innovations found only with dedicated PC-based or professional systems. It features a complete integrated control system, but individual circuit sections can be made to operate alone. In its basic form it can accept inputs from two-thirty cameras for splitting and viewing with one-three independent video monitors.

Fig. 1: Basic block diagram of the flexible CCTV security system.



Basic block diagram and operating modes

Fig. 1 shows the complete system in block diagram form. It's built using inexpensive and readily available parts. No rocket science is involved, so the system is simple to understand and readily adaptable. For simplicity, only four cameras and proximity detectors are shown in Fig. 1. There are three possible modes of operation: automatic stepping, proximity control and manual switching.

The stepper controls the switcher unit so that the camera outputs are fed in sequence to the monitor and VCR. The automatic stepping sequence has variable dwell times for each camera. If required, individual cameras can be deselected from the sequence. The proximity unit allows better site monitoring by using proximity detectors that are mounted in the field of view of the cameras. Proximity detectors 1-4 can be pressure mats, active/passive infra-red, VOX or gate switches etc. A short audio warning alarm is sounded when the VCR records an event under the control of the proximity unit. In the automatic mode sequential and proximity camera switching can be done independently or together. When done together the sequence switching continues until a proximity sensor is activated. The associated camera is then selected, triggering the alarm and VCR. After a preset time the VCR is turned off and the sequenced switching continues.

The ability of the proximity unit to follow activity from camera to camera can be a considerable advantage in comparison with sequence-only systems. The proximity unit can be used with a domestic VCR. Because only the event is recorded, not the periods in between, a domestic VCR can record large amounts of action in the long-play mode. The short beep tone produced by the audio alarm when an event is detected is very useful. The alarm sound relieves an observer from the need to watch the monitor(s) continually. It can be used even if no recordings are required, to draw attention to activity on the site.

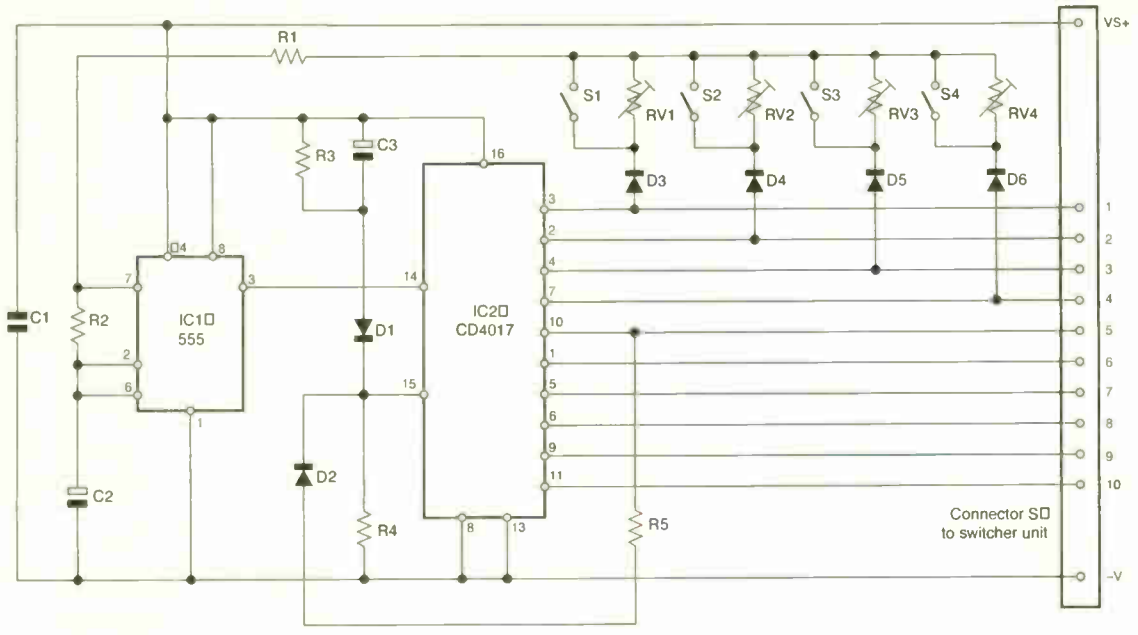


Fig. 2: The stepper unit circuit.

The stepper unit

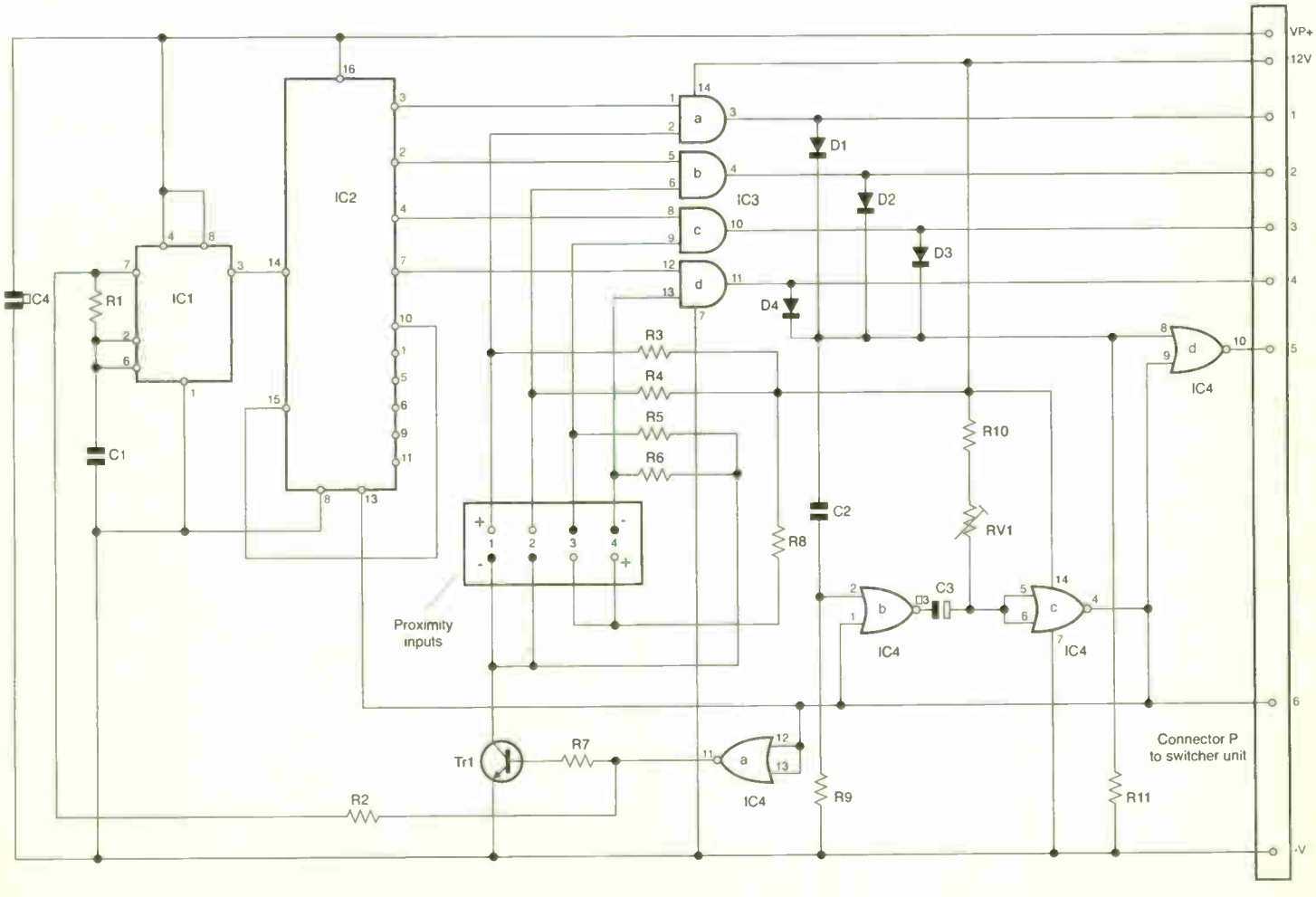
Fig. 2 shows the stepper unit circuit. It generates a sequence of outputs that's used by the switcher unit to select the cameras. The 555 timer chip IC1 and CD4017 decade-counter chip IC2 produce timed switching pulses that are continuously adjustable up to 250 seconds at each step by presets RV1-4.

When closed, switches S1-4 bypass the relevant timing step: they are used to move quickly across an installed camera that may not be required at the time.

When the supply (VS+) is connected to the circuit C3 charges and IC2 is reset, as pin 15 is taken high. Pin 3, the first in the count chain, provides an output at pin 1 of connector S to a relay driver transistor in the switcher unit. All the other outputs, at pins 2-10 of connector S, are low. The timing cycle is set by RV1 and the associated components.

The first clock pulse from pin 3 of IC1 moves the counter along one. Pin 2 of IC2 is then high, providing a drive output to the relay driver transistor connected to pin 2 of connector S. Pin 3 and all the other out-

Fig. 3: The proximity unit circuit.



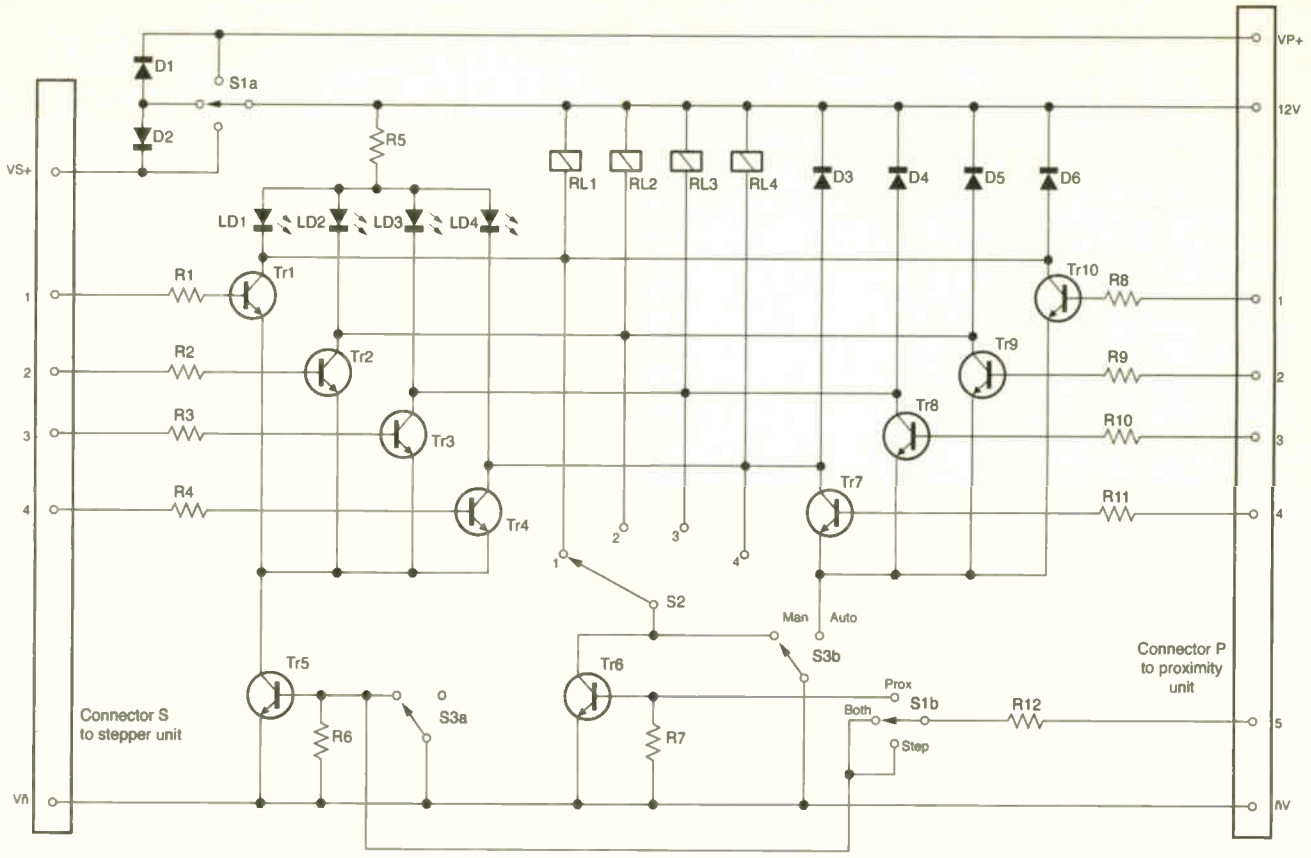


Fig. 4: The switcher unit circuit.

put pins of IC2 are now low. RV2 now provides the adjustable dwell-timing period and thus the relevant camera output on time.

Up to ten sequential outputs can be obtained from the CD4017 decade-counter chip, after which it will automatically recycle. In the four-camera version shown, a reset is forced at the unused fifth step by connecting pin 10 of IC2 via R5 and D2 to pin 15. A 2-9 drive sequence can be set up by using this forced-reset method.

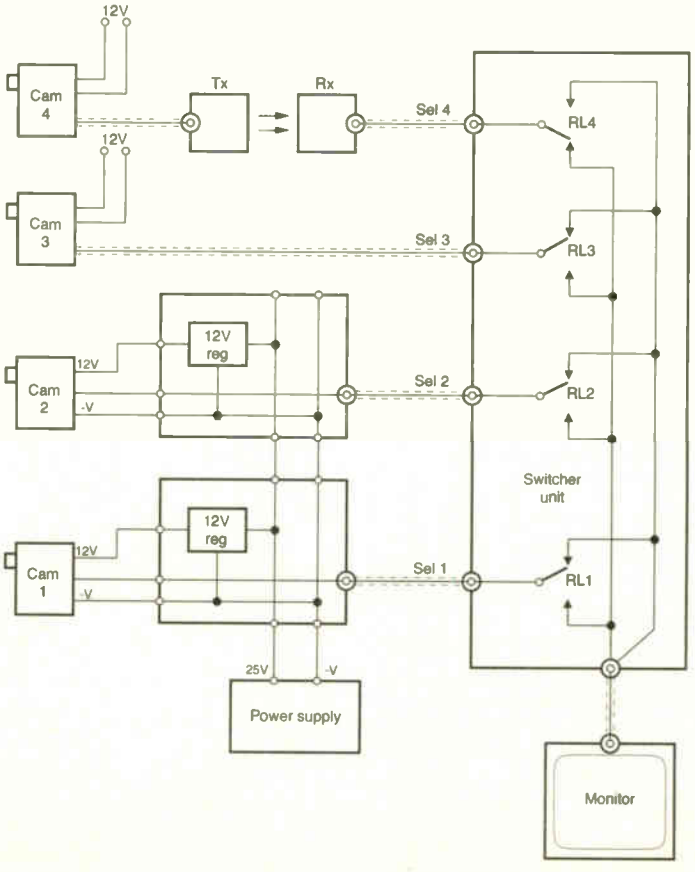


Fig. 5: Video switching with a four-camera system.

The proximity unit

The proximity unit circuitry, shown in Fig. 3, can also control up to ten inputs. But to simplify matters only four inputs are shown. The clock chip IC1 and counter IC2 use a similar circuit arrangement to that in Fig. 2. The 555 chip runs at about 500Hz. It drives pin 14 of the counter chip whose outputs are used, in conjunction with the and gates in IC3, to scan the proximity detector inputs.

As shown, proximity inputs 1 and 2 are configured for normally-closed detectors such as infra-red beam-break or PIR units. Pressure mats and gate/door switches can be used with the normally-open inputs 3 and 4. A check with Table 1 shows that a high output is obtained only when both inputs of an and gate in IC3 are high. When the cycling output from IC2 coincides with a high from the proximity input, the output from the relevant and gate goes high. The rising edge of the high is passed via D1, D2, D3 or D4 and C2 to trigger the monostable timer formed by IC4b/c. The timer turns off Tr1 and freezes the scan of IC1, IC2, holding a high output to the switcher unit from IC3 via connector P. The relevant relay driver in the switcher unit then selects the camera associated with the proximity input. The dwell-time is adjustable between 10-60 seconds by RV1. With Tr1 turned off, the normally-earthed ends of the proximity inputs go high for the duration of the timed period. This

ensures that IC3 continues to provide an output after the proximity input stops.

Nor gate IC4d produces a low during this period. It's used either to turn off the stepper unit or default camera of the proximity unit depending on the position of switch S1a/b in Fig. 4. Audio alarm and VCR switching are controlled by IC4's complimentary outputs at pins 5 and 6 of connector P. At the end of the timing period IC4b/c revert to their original state, returning control to the stepper unit or proximity default. Only one camera is selected at a time, and any new proximity inputs received during the freeze period are ignored. The same process occurs whichever proximity input is triggered.

Take care when wiring the proximity inputs, and note that the '–' terminals are above chassis earth potential (–V) when Tr1 turns off. If the '–' terminal is accidentally shorted to –V earth none of the proximity inputs will select and hold. Simultaneous proximity triggers that might cause more than one camera to be selected are automatically sorted by the scanning action to provide a single output.

The switcher unit

I always feel that I should use solid-state devices in my circuits, but make no apologies for using relays in this part of the system. Miniature relays are simple, robust and reliable. They have not got the extended service life of solid-state devices, but fitting them in sockets can ameliorate this. I have in fact never had to replace any electromagnetic relays in long-standing systems where they have been employed.

Fig. 4 shows the switcher unit circuitry, which receives inputs from the stepper and proximity units. Two sets of driver transistors control the four relays. This may seem a bit unnecessary, but the arrangement works very well and makes function switching simple.

The three-position function switch S1 enables the cameras to be controlled by the stepper or proximity unit or both together. When proximity is used alone and not triggered a default camera needs to be selected, otherwise the monitor screens will be blank. Selection is done by Tr6, which works in conjunction with the manual switch S2. When Tr6 is turned on at the end of a proximity freeze cycle (S1a/b in the prox position) S2 selects the default camera. With S1 set at its centre (both) position the stepper and proximity units run together. As long as there are no proximity inputs the cameras will be controlled by the stepper unit. If a proximity input is received, the proximity unit takes over, interrupting the stepper cycle by turning off Tr5 (through the gate action of IC4d in Fig. 3) and switching on the required camera as described above. The stepper action continues once the proximity unit's freeze period has been completed.

LED indicators L1-4 show which

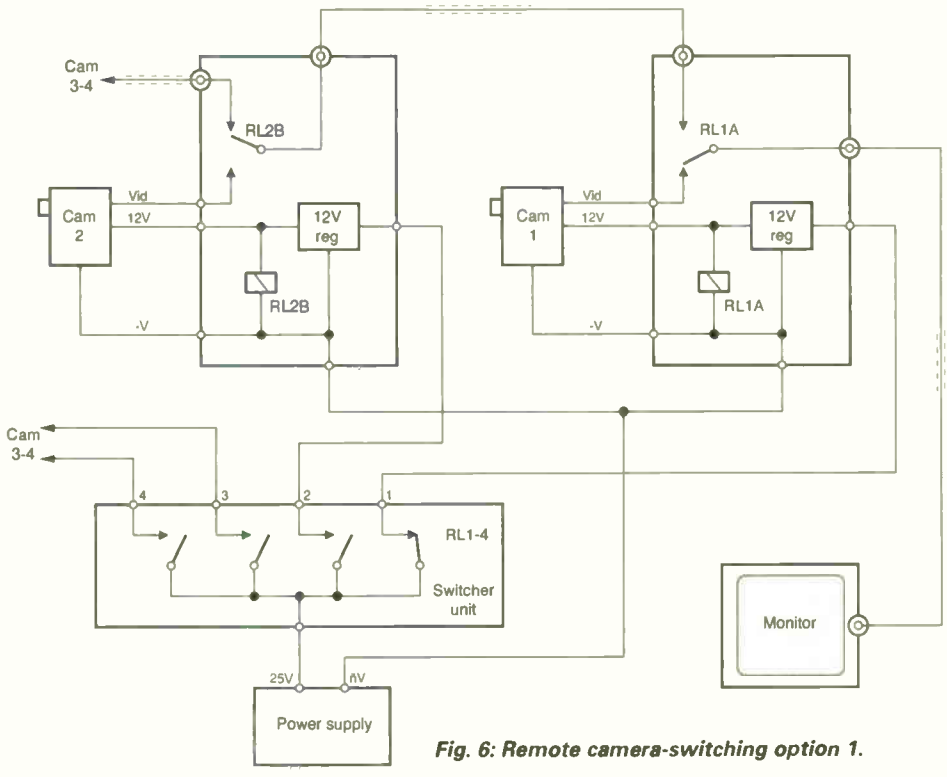


Fig. 6: Remote camera-switching option 1.

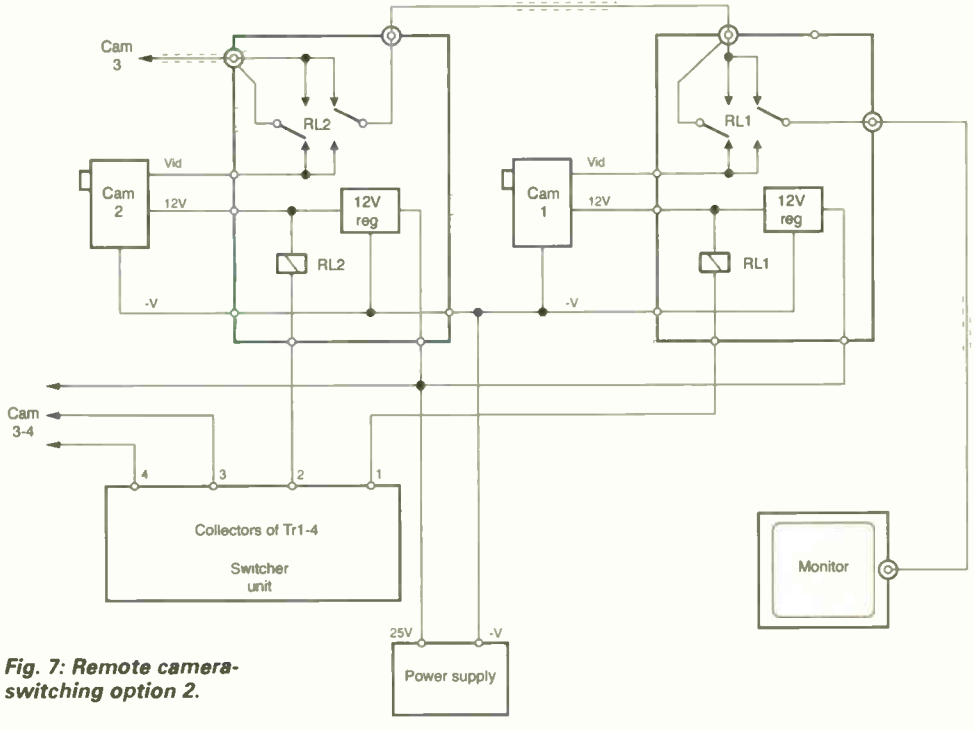


Fig. 7: Remote camera-switching option 2.

Table 1: Truth tables for IC3 and IC4 (Fig. 3).

And gate IC3			*Nor gate IC4*		
Inputs		Output	Inputs		Output
a	b		a	b	
L	L	L	L	L	H
L	H	L	L	H	L
H	L	L	H	L	L
H	H	H	H	H	L

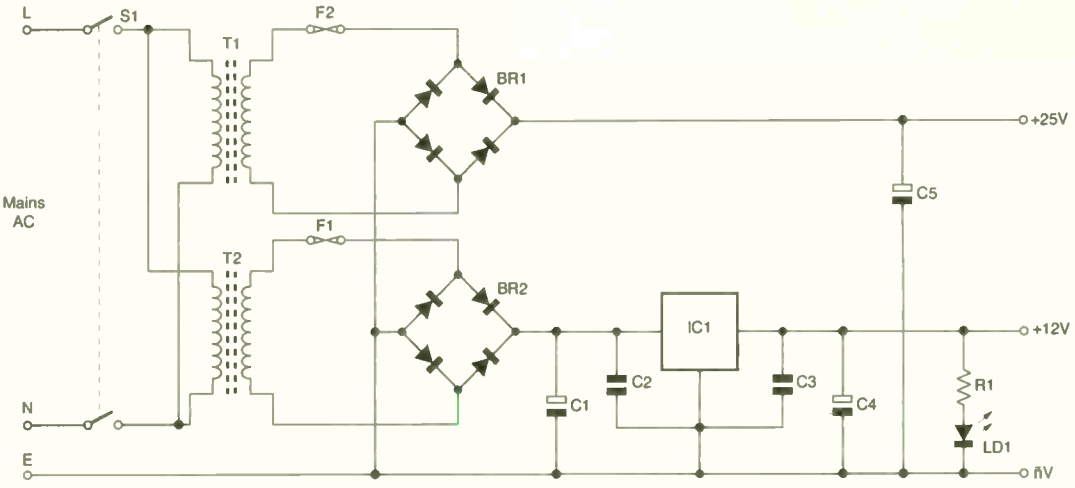


Fig. 8: The power supply circuit.

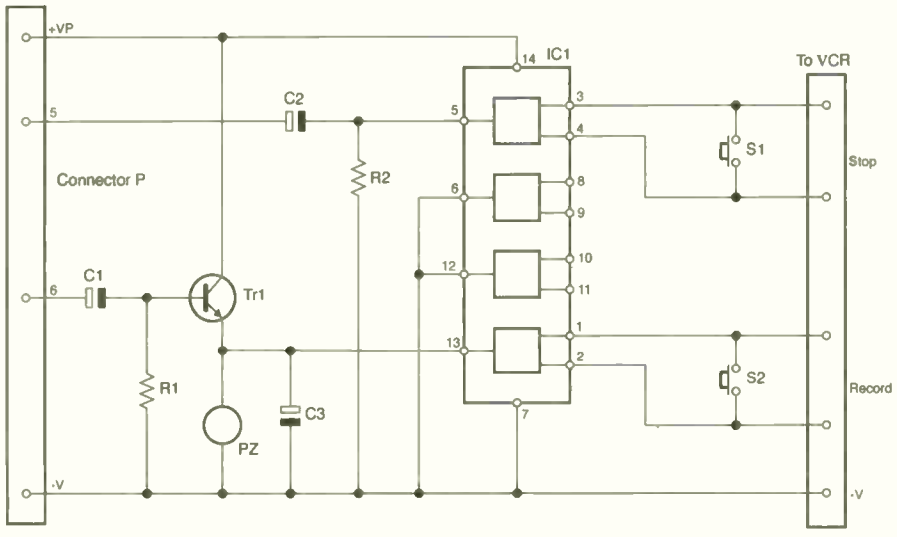


Fig. 9: The VCR control and audio alarm circuit.

camera is activated. With the auto/manual switch S3 set to manual, cameras can be selected directly using switch S2. Note that if the relays have suppression diodes built-in, D3-6 will not be required.

Signal switching

The supply of power to the cameras and sending images to the monitor(s) and VCR(s) can be carried out in a variety of ways. Fig. 5 shows how a four-camera system using a variety of camera types can be selected for video signal only.

A 25V DC line from the power supply feeds cameras 1 and 2. Assuming that the CCD cameras are 12V DC types, local L7812 12V IC regulators reduce the supply for these cameras. This method compensates for the voltage drop along the DC supply cables. Camera 3 is shown using its own 12V power supply derived from the mains. Where a location is difficult to cable, a 2GHz RF link can be used, as shown for camera 4. Composite video outputs are selected by relay contacts RL1-4. Unselected video inputs are muted to prevent crosstalk between cameras. Reed relays are best, but sub-miniature mechanical types have proved to be satisfactory.

The disadvantage of this cabling arrangement is the large number of coaxial lines that have to be run individually and terminated at the switcher. If they are many in number they can be difficult to conceal. The position of the security room or office is never at a convenient location, so a considerable amount of time and energy may be required to expand or modify the system later.

A good way of simplifying the problem is to use remote switching, as shown in Figs. 6 and 7. Remote switching uses one video feed daisy-chained via the cameras in the system. One additional multicore telephone-type cable can supply both power and control to the cameras.

In Fig. 6 switcher unit relays RL1-4 now supply the switched 25V DC feed to the selected camera. Each camera has a local routeing relay (RL1A, RL2B etc.) connected to the output from its L7812 12V stabiliser. When one of these relays is selected, its contacts connect the camera's video output to the coaxial line. All cameras on the feed line other than the one selected are then isolated. The line down to the monitor(s) is maintained via the normally-closed contacts in the de-energised relays in the video line. As only one camera at a time is switched on, minimum power is drawn by the system and crosstalk is eliminated.

An irritating problem with simple systems is the time taken for the monitor's field scanning to roll into lock when cameras are live-switched. Careful adjustment of the monitor's field hold can minimise but not eliminate the problem. Methods usually employed with better cameras and systems are not always available with cheaper CCD units. Some systems use signal blanking at changeover, increasing the time available for the monitor's field timebase to lock. The short time required for a camera to produce a picture when first switched as in Fig. 6 can give a similar if inferior effect, masking the field-sync problem by turning a shortcoming into an advantage. Ensure that any cameras used in this way are able to produce a viewable and locked image quickly at cold switch-on.

If supply switching is not practical because of the cameras used, the arrangement shown in Fig. 7 can be used with the cameras powered all the time. The switcher unit relays RL1-4 are now located at or near the camera. Each relay coil is connected directly to the switcher unit via the control cable. The relay contacts connect the signal from the selected camera to the coaxial feed and mute signals from the unselected cameras. Miniature double-pole relays are used, the second pole muting unselected signals farther along the chain. Depending on line transmission, mismatching and other losses, muting may or may not be required.

In practice a mixture of remote and local camera control can be used for optimum flexibility.

Power supply

The power supply requirements are simple, see Fig. 8. It is best to use separate supplies for the cameras and control electronics. Transformer T1 and fuse F2 are selected to match the current requirements of the cameras in the system. One of my early installations that used a single power supply started to malfunction when an extra camera was fitted – the increased current drain reduced the voltage just enough to upset the stepper-unit timing. Fortunately it was possible to power the camera locally from the mains, which corrected the problem.

It is important to include capacitors C2 and C3 in Fig. 8. They must be soldered as close as possible to the input and output pins of the regulator IC1, to prevent instability. Instability in IC1 will usually result in low output when the stabiliser is on load. It's best to solder the capacitors carefully to the legs of the IC. Although not shown in Figs. 5, 6 and 7, similar capacitors should be fitted to the stabilisers here.

The upper input voltage limit of the stabiliser specified is 30V DC. A heatsink may be required if it runs hot. Overheating will make it shut down. The lower input voltage level should not be less than 15V if stabilisation is to be efficient. The L7812 is rated at 1A. If more current is required (up to 2A) an L78S12 should be used.

VCR control and alarm unit

Slow-scan VCRs are currently still expensive at about £400 while domestic ones are available at less than £50. This system's ability to record short bursts of event action triggered by proximity detectors makes the use of a domestic VCR very attractive. With a standard three-hour VHS tape used in the long-play mode and the proximity dwell timing set to 60 seconds, 360 event recordings can be made before tape rewind (60 x 60 x 6 = 21,600 seconds/60 = 360 events). Even allowing for false triggering, this is still a considerable recording period. A four-hour tape would increase the recording time, but these are prone to damage and tangling in cheap VCRs.

The employment of staff to watch one or more video monitors continuously is not practical with a small installation. Use of the proximity unit to trigger an audio alarm immediately draws attention to the monitor(s) when an event has been detected.

Fig. 9 shows the circuit of the control/alarm unit. IC1 is a CD4066 quad bilateral switch chip that's used to control the VCR record and stop. The rising edge of the trigger output from the proximity unit charges C1 and briefly biases Tr1 on. This transistor then supplies voltage to the piezo-sounder PZ and pin 13 of IC1. With a positive voltage at pin 13 of IC1, the impedance between pins 1 and 2 changes from high to low. This change is used to operate the VCR's record function. A hardwire connection can be made across the record-button switch on the VCR or the remote-control unit. When the timed-record period ends, pin 5 of connector P goes high charging C2. Pin 5 of IC1 then briefly lowers the impedance between pins 3 and 4 and the VCR stop function operates, in the same way as for record. Press-button switches S1 and S2 are included to check the VCR link and provide a convenient means of checking or setting the record and stop functions.

Hardwiring directly to a VCR is usually simple, but connection to a remote-control unit can be tricky and requires care. If you don't want to modify the remote-control unit supplied with the VCR, a cheap universal type could be bought. The only solderable connection points likely to be found will be at the control IC. Trace the print back from the record and stop button pads to the IC. A good light, optical magnification and a fine-pointed soldering iron are required for this task. A four-way flat ribbon cable is best for the link. Leave the remote-control unit powered by its own battery.

Next month

In Part 2 next month we'll consider cameras, proximity detectors, system expansion, construction and installation. ■

Components list

Stepper unit

R1	470Ω
R2	1kΩ
R3	470kΩ
R4	2·2kΩ
All 0·25W 5%	
RV1-4	1MΩ linear presets
C1, C4	0·1µF 100V ceramic
C2	100µF 25V electrolytic
C3	1µF 25V electrolytic
IC1	555 timer
IC2	CD4017
D1-6	1N4148
S1-4	1-pole 1-way switches (4-way DIP switch OK)

Proximity unit

R1	1kΩ
R2, R10	100kΩ
R3-6	10kΩ
R7	18kΩ
R8	6·8kΩ
R9	15kΩ
All 0·25W 5%	
RV1	1MΩ linear preset
C1, C2	47nF 100V Mylar
C3	100µF 25V electrolytic
C4	0·1µF 100V ceramic
IC1	555 timer
IC2	CD4017
IC3	CD4081
IC4	CD4001
D1-4	1N4148
Tr1	BC547B

Switcher unit

R1-4	18kΩ
R5	1kΩ
R6, R7	2·2kΩ
R8-12	18kΩ
All 0·25W 5%	
D1, D2	BY133
D3-6	1N4148 (see text)
Tr1-10	BC547B
LD1-4	5mm red LEDs
RL1-4	12V 700Ω relays (see text)
S1	2P 3W switch
S2	1P 4W switch (see text)
S3	2P 2W switch

Power supply

R1	1kΩ 0·25W 5%
C1	1,000µF 40V electrolytic
C2, C3	0·1µF 100V ceramic
C4	47µF 16V electrolytic
C5	2,200µF 40V electrolytic
IC1	L7812 (see text)
BR1, BR2	3A bridge rectifiers
LD1	0·5mm LED
T1	240V/16V mains TX (see text)
T2	240V/16V 1A mains TX
F1	500mA 20mm fuse
F2	See text
S1	DP mains on/off switch

VCR control and audio alarm unit

R1	3·3kΩ
R2	22kΩ
Both 0·25W 5%	
C1	33µF 25V electrolytic
C2	22µF 16V electrolytic
C3	1µF 16V electrolytic
IC1	CD4066
PZ	12V piezo buzzer 2·7kHz 10mA
S1, S2	Normally-open momentarily-close push-button switches

at the Internationale Funkausstelung

The 2003 IFA featured the latest developments in digital TV, flat screen technology, DVD players and recorders, camcorders with various storage systems and domestic networking. George Cole was there to report for us

The Internationale Funkausstelung (IFA) is held in Berlin every two years and has become the world's largest consumer electronics show. Unlike most other electronic shows it's open to the public. So the exhibition halls are full of people interested in the latest developments in consumer electronics. At this year's show there were 1,007 exhibitors spread over 160,000 square metres of floor space. Major attractions included flat-screen TV sets, DVD recorders and networked products.

Digital TV

On August 4 Berlin and Brandenburg became the world's first DTT-only region when the analogue TV transmitters were switched off for the last time. The digital switchover took place just six years after Germany's first DTT tests were carried out and eighteen months after a Memorandum of Understanding was signed between public and commercial broadcasters and the Media Institution of Berlin and Brandenburg, which co-ordinated the switchover. The German government aims to end all analogue TV transmissions in 2010.

The Panasonic TX32DTX30C is the company's first IDTV set released in Germany for free-to-air (FTA) transmissions. Its features include a 32in. Quintrix 16:9 CRT, 100Hz scanning, a 500-page teletext memory and three scart sockets. Pioneer unveiled an FTA digital set-top box, Model DBR-TF100GB, and plans to launch an IDTV set for Continental markets. The DBR-TF100GB has two scart sockets, an RF loop-through/modulator module and a newly designed user interface that Pioneer plans to adopt across its entire range. Nokia's MediaMaster Models 260S and 260T are digital STBs for satellite and terrestrial reception respectively. They include an 80GB hard drive on which up to 40 hours of TV programming can be recorded: it's also possible to transfer to it more than 3,000 images from camera-phones using a

The Panasonic TX32DTX30C is the company's first IDTV set released in Germany for free-to-air (FTA) transmissions.

The Pioneer DV565A is a versatile player that can also handle DVD-Audio and SACD discs and JPEG images stored on a CD.

wired or a wireless Bluetooth connection.

Pace's digital STB offerings included Models DC210 and DS201. They use Pace's new common hardware system that enables a cable, satellite or terrestrial front-end to be added as required. The Puma is an integrated dual-decoder and twin-tuner satellite STB with an optional 20GB hard drive that enables it to be used as a personal video recorder (PVR). The Samsung SPVR-7400CI is a digital PVR with 80GB hard drive and two common interface (CI) slots. Humax showed the PVR8000, a PVR with a smart removable hard drive, making it easy for owners to upgrade to a larger-capacity drive.

The German market is also a target for Multimedia Home Platform (MHP) products. MHP is a specification developed by the Digital Video Broadcasting (DVB) project to add features such as interactivity and internet links to digital TV broadcasts. Sony had a large display of MHP sets, all with CRTs, including Model DVP-NS430S which includes a slot for a Memory Stick card. The Humax CI8140 in an MHP-compliant STB that also includes a Dolby Digital optical output socket. Samsung and Nokia also showed MHP set-top boxes.

TV sets

On some stands, for example Philips, it was hard to find a CRT model. Philips will have launched thirteen non-CRT TV models by the end of the current year, with ten screen sizes. They include five models (50PF9965, 42PF9965, 37PF9965, 32PF9965 and 30PF9965 – the first two digits indicating the screen size) that incorporate the company's Pixel Plus technology. Model 30PF9965 has an LCD screen, the other models having plasma screens. Pixel Plus is a digital processing technology that provides enhanced resolution. Philips held an interesting demonstration that compared Pixel Plus with rival digital-enhancement technologies developed by Sharp, Sony, Panasonic and Samsung. Both LCD and plasma products were compared and certainly, on the evidence, Pixel Plus provided the best pictures from a subjective point of view. But the demonstration also highlighted how difficult it can be to make definitive comparisons, as the sets may have different display rates, e.g. 75Hz or 100Hz and interlaced or progressive scanning. Philips also showed two small-screen LCD sets and three portable LCD models, with screen sizes from 13 to 20in.

Sony's offerings included for LCD Wega models, KLV-15SR2, KLV-21SR2, KLV-17HR2 and KLV-23HR2 – the latter has a Memory Stick card slot. The SR2 models provide XGA (1,024 x 768) resolution while the HR2 models feature WXGA (wide XGA, i.e. 1,280 x 720) resolution. All models include a composite/component video processor that converts an analogue signal to digital form then processes it to reduce noise. A digital comb filter improves Y/C separation while Sony's Digital Reality Creation (DRC) technology provides enhanced resolution.

Panasonic displayed a number of LCD TV sets including the TX-22LT3F, a 16:9 model with integrated tuner. It uses Panasonic's Real Mach panel technology that provides a contrast ratio of 400:1. Sharp's massive stand was heavily populated with LCD sets. One of the highlights was Model LC15L1E (Aquos Mobile), a TV set that operates without a TV aerial or a power socket. The 15in. LCD set uses a lithium-ion battery for power and an AV transmission system to pick up and deliver sound and pictures. Samsung had on show a 54in. LCD TV with a contrast ratio of 800:1: the TFT-LCD module is only 2in. thick.

JVC's LCD TV sets included Models LT32C31, LT26C31, LT23E31 and LT17E31, which all incorporate the company's DIST (Digital Image Scaling Technology). Grundig was showing its Tharus range of LCD and plasma sets. The company also offers the Megalogic system, a TV guide and teletext function to the 2.5 specification, and Teleweb that enables teletext pages to be surfed as if one is using the internet instead of the conventional approach of entering combinations of page numbers.

There were also lots of plasma screens around, including the Pioneer Models PDP-504HDE and PDP-434HDE (the first two digits indicate the screen size in inches) that incorporate the company's Pure Digital image-processing technology. The images I saw certainly looked clean and sharp. Both models incorporate a multimedia viewer that can read JPEG images stored on a memory card. Thomson showed a 50in. plasma set, Model 50WB03, which uses the company's Hi-pix technology to multiply the number of pixels per line by 1·5 to create a sharper picture. Panasonic's plasma Models TH42PA20E and TH37PA20E feature the company's Real Mach technology. Model PD42V31 from JVC includes DIST technology and a 3D sound system.

Samsung showed a 70in. plasma display panel with 2·07 million pixels (1,920 x 1,080 scanning), twice the resolution of today's panels. It expects this to be used for public display systems rather than the living room. The LG stand displayed 71 and 60in. plasma displays and a 52in. TCD TV set.

Other TV products of interest included the Thomson Model TW610S, a 61in. projection set with a built-in DVD player, and a TV recorder from the German company Metz. The latter has a 160GB hard drive that can store up to 200 hours of programming and functions such as live pause. In addition by subscribing to a special service users can set the TV's timer via the internet.

Philips gave a glimpse of the future with a PolyLED display. The company's research stand showed a 2 x 3in. full-colour prototype with a resolution of 176 x 220 pixels. Unlike a TFT display, PolyLED doesn't require a backlight and thus consumes less power. Construction basically consists of two glass plates that sandwich the PolyLEDs. Philips envisages

Philips DVDR 70

that the technology will be used initially in portable products such as mobile phones but also has plans for in-car systems. The two biggest problems at present are scaling up production and increasing the lifetime, which is currently a few thousand hours – the target is 8,000 hours by 2005. Philips also showed its Mirror TV. This combines a 17-30in. LCD screen with polarising technology that enables almost 100 per cent of the light to be passed through a reflective surface. The screen can therefore be flipped between a TV display and a mirror. Philips sees considerable potential in the hotel market, and the demonstration room was set up like a hotel living room and bathroom. You could shave while watching the morning news in a corner of the mirror. A domestic version is expected possibly in 2005.

DVD

It was hard to spot a VCR on any of the stands: DVD is fast becoming the format of choice for watching video material at home, with more than half of European homes (53 per cent) now having a DVD layer. This has been helped by the falling cost of DVD players. In a keynote speech Gerard Kleisterlee, president of Philips, pointed out that in 2001 DVD players were at the cutting edge of technology and commanded a fair price premium but, since then, the price has fallen by a factor of ten. In some cases DVD players are given away free with other products, such as large-screen TV sets. The good news is that manufacturers are still developing DVD products with added features.

The Pioneer DV565A is a versatile player that can also handle DVD-Audio and SACD discs and JPEG images stored on a CD. It reads CD Audio, Video CD and Super VCD discs, and DVD-R and DVD-RW discs recorded in the Video Mode.

The Samsung Model DVD-HD935 is claimed to be the world's first HDTV-compliant DVD player. It uses scaling-up technology to increase the video resolution to 720 x 1,080 (lines). Faroudja's DCDi de-interlacing picture technology improves movement within the picture and sharpens outlines.

Star Media showed an interesting player, Model DivX5000. DivX is a form of video compression that's widely used on the internet. It's based on MPEG-4 technology and enables up to two hours of video to be stored on a CD-R disc. DivX picture quality is surprisingly good. The system is also used by some digital cameras and camcorders to record video clips that can be sent over the internet. Star Media emphasised that the DivX5000 can play DVD discs from all regions. The company also showed DVD players with progressive-scan PAL outputs.

The Thomson Model DTH7500 is a combined DVD player and 80GB hard drive that can store up to 80 hours of video. Other features include live pause, a front USB connection, a generic memory-card reader and JPEG reader: digital photos or MP3 music files can be transferred from a PC to the DTH7500's hard drive.

The LG Latrion is a combined 29in. TV set, DVD player and VCR.

There was a stand devoted to DVD-Audio, with a selection of players and discs. The format seems to have a higher profile in Germany than in the UK. I came across a number of DVD-Audio (and SACD for that matter) discs in record shops. According to the DVD-Audio Council, whose members include JVC, Panasonic, Sharp and Toshiba, there are not more than 500 DVD-Audio titles available worldwide.

DVD recorders

If IFA is anything to go by, it looks as if consumers, retailers and service engineers will have to learn to live with several recordable DVD formats. There is little sign of the market consolidating, and there were giant stands devoted to all the major recordable formats and their respective associations. Many companies that support one format are also members of a rival DVD association however. So it's no surprise that there is much consumer confusion over recordable DVD.

The DVD+RW Alliance, which has more than sixty members including Philips, Sony, Thomson, Dell, HP and TDK says that 80 per cent of the consumer DVD records sold in Europe are +RW machines. A new x8 recording speed was announced for +R discs.

Sony announced two new dual-format DVD recorders, Models RGR-GX7 and RGR-GX3, which record on both DVD+RW and DVD-RW discs. Sony has also developed two DVD-RW camcorders – apparently because the -RW specifications were finalised first.

Philips launched five new DVD recorders, the DVDR70, 75, 77 and 80 separates and the LX9000R, a DVD recorder and home-entertainment system – it includes a 5.1-channel speaker system with Dolby Digital, DTS and MPEG multi-channel sound. Model DVDR77 provides an 8-hour recording time on a single disc and has a memory-card feature that can read almost all the types of memory cards used by digital cameras, enabling JPEG images to be transferred to DVD discs. Another feature converts JPEG images into DVD-compatible slide shows that can be played by almost all DVD players and PC DVD drives. The DVDR80 includes the Guide Plus+ on-screen guide, which enables users to make a timed recording simply by selecting the programme from an on-screen menu and pressing a button.

Yamaha's Model DRX2 plays all types of DVD discs except DVD-RAM, and also plays CD-R/RW discs. It offers six recording modes that provide recording times between 1-6 hours, including linear PCM audio in the two-hour mode.

Benq, a company with manufacturing operations in the Far Easy including Malaysia and Taiwan, had on show what is claimed to be the world's slimmest DVD recorder, Model JH300, which is just 5·9cm high. It's a DVD+RW machine that includes a progressive-scan output. It will be launched in NTSC markets first.

The Humax Model DRP560, a sleek silver box with an orange trim, is a DVD+RW recorder that can also play back DVD-R and DVD-RW discs (the latter in the video mode). It has six recording modes.

The RW Products Promotion Initiative (RWPPI) represents the DVD-RW and DVD-R formats. It has 58 member companies, including Prioneer, Samsung, Sony, LG and NEC. Pioneer is the main driver behind the -RW format, so it was no surprise that the company's press event had a lot to say about the format. Evidence that DVD-RW has better compatibility with standard DVD-Video players was quoted. The DVD+RW Alliance had made

The JVC DR-M1 DVD-RAM recorder is also compatible with DVD-R and DVD-RW discs

the same claim for its format less than half an hour previously!

Pioneer's flagship product is Model DVR-5100H-S, a DVD recorder with an 80GB hard drive that can store up to 102 hours of video programming. It has four modes, Fine (17 hours), SP (34 hours), LP (68 hours) and EP (10-2 hours). The company's previous recorder, Model DVR-77H, used eleven LSI chips. These have been replaced with a single LSI chip that has four million gates. A high-speed copying system can transfer EP recordings on to a blank disc at x24 speed. Once a DVD-R/RW disc has been formatted in Video Mode, the DVR-5100H-S creates a menu of thumbnail images that show what has been recorded on the disc. Pioneer was asked why it had launched a DVD burner that can also record on DVD+RW discs. A company spokesman explained that Pioneer makes a lot of drives for OEM manufacturers, who have demanded that the DVD drives are compatible with a variety of recordable DVD formats. He stressed that the company has no intention of launching a consumer product with DVD+RW operation.

The Sharp Models DV-HR350S and DV-HR300S are combined DVD-RW and hard disk recorders.

The Recordable DVD Council (RDVDC) is an association of more than ninety companies, including Panasonic, Toshiba, Hitachi and Samsung, that support the DVD-RAM format. To add to the confusion there's yet another group, the RAM Promotion Group (RAMPG), whose members include Hitachi, Panasonic, Toshiba and JVC. Using the slogan 'Real DVD', the RDVDC had much to say about the compatibility of DVD-RAM products with other types of DVD discs. But this compatibility is essentially one-way, as almost all DVD-Video players can't play DVD-RAM discs, even ones without a protective caddy. This is because DVD-RAM uses a different recording format, land-and-groove with zoned constant linear velocity (ZCLV). While this enables DVD-RAM to provide hard-disk type features such as random access, the price paid is lack of compatibility.

Panasonic released a brochure listing all the European DVD products that are compatible with DVD-RAM discs, but only five are consumer DVD-Video players – four from Panasonic and one from JVC. The Panasonic DMR-E100H is a combined DVD-RAM recorder with an 80GB hard drive. It also has an SD Memory Cared slot. The Panasonic SC-HT1000 is a DVD-RAM home-theatre system with 5.1-channel sound and DVD-Audio compatibility.

The JVC DR-M1 DVD-RAM recorder is also compatible with DVD-R and DVD-RW discs. It incorporates a block noise reduction circuit and Hadamard noise reduction for reducing 'mosquito noise'. Other features include a progressive-scan PAL output, a timebase corrector and on-disc timer programming. The latter writes timer data on disc, enabling the timer to be set simply by inserting a programmed disc. The DR-M1 is also part of JVC's QP-ES9AL home-theatre system.

Panasonic has developed a range of camcorders that record on an SD Memory Card. The D-snap range consists of Models SV-AV100,

Blu-ray

I found a number of Blu-ray recorders at the show. This format could be the next step after recordable DVD, using a blue laser and 27GB discs that can store up to two hours of high-definition video. Philips and JVC had prototype Blue-ray recorders on their stands while Sony and LG showed production recorders, Models BDZ-S77 and BD-VDR respectively.

Camcorders

A number of tapeless camcorders were shown at IFA. The Hitachi Models DZ-MV350E and DZ-MV380E, also the Panasonic Model VDR-M30, use 8cm DVD-RAM and DVD-R discs. The Sony Models DCR-DVD100 and DCR-DVD200 use 1·4GB DVD-RW and DVD-R discs that can store up to 60 minutes of video. They also have a x10 zoom and a high-speed USB 2.0 connection for transferring images to a PC.

One product that turned a lot of heads was the Samsung ITCAM7, which incorporates a 1·5GB hard drive to store moving video, still images, music and data files. It can thus be used as a camcorder, digital camera, portable MP3 player or even as a portable hard drive. Video is compressed in MPEG-4 form and can be played back at 25 frames/second with VGA (640 x 480) resolution. You can connect it to a TV set, VCR or PC.

Panasonic has developed a range of camcorders that record on an SD Memory Card. The D-snap range consists of Models SV-AV100, SV-AS10 and SV-AV20. They record both MPEG-2 and MPEG-4 video and can store up to 20 minutes of MPEG-2 video on a 512MB card. The following recording modes are available with the D-snap range: MPEG-2 fine mode at 6Mbits/sec and standard mode at 3Mbits/sec; and MPEG-4 super fine (320 x 240) at 1Mbits/sec, normal (176 x 144) at 30kbits/sec, or economy (176 x 144) at 100kbits/sec.The SD Memory Card has a maximum data transfer rate of 10Mbits/sec – 1GB cards are under development.

As the D-snap range uses an SD card instead of tape or a disc, the camcorders are extremely small. Model SV-AV100 measures 3·32 x 8·89 x 6·49cm (credit-card size) and weighs 156g. Model SC-AS10 weighs just 56g, making it lighter than a pack of cards. How do you go about servicing such a tiny device? When a D-snap camcorder is placed in a base station images can be transmitted to a TV set or sent via a USB link to a PC.

Home networks

Home networking and system convergence were major themes at this year's IFA. Many companies showed systems that are designed to link various domestic entertainment devices to each other and/or the internet.

LG's home network involved a living room, kitchen and study, with a wall-mounted plasma screen as the main display. Philips has extended its Connected Home concept. This involves a broadband internet connection to a 'Connected Planet' which uses WiFi wireless technology to distribute digital content such as music and video around the home. Users thus have access to information and entertainment anywhere and anytime via various devices.

Philips' new products included the Streamium MX6000I, a DVD home entertainment system with WiFi access to content stored on a PC or on-line. In fact there were quite a few WiFi hotspots dotted around the IFA, and people were using laptop PCs to log on to the internet from a variety of places. Philips' Portable Blue is a tiny optical disc about the size of a 10p piece: it can store up to 1GB of data, using blue-laser technology.

Thomson's Oz server stores music, video and images and distributes them around the home using 5GHz RF technology. JVC also demonstrated a 5GHz home-distribution system.

The Broadband Box, a Swedish company, demonstrated a product with the same name. It's a combined PC, DVD recorder, digital TV recorder, audio library, radio, photo album and internet terminal, all contained in a large silver and maroon box, with a broadband connection for downloading digital content from the internet. It's an impressive product. But whether consumers will want to put all their digital eggs in one basket remains to be seen. ■

The TETRA problem

TETRA is an international standard for digital mobile communications. The police and other emergency services in the UK are gradually adopting TETRA systems. They are high-powered, and can cause UHF TV interference problems. Bill Wright describes the problem and the remedies that can be used

Photo 1: TETRA 'tyre marks' on a TV screen. Reception was with a vertically-polarised log-periodic aerial and a single-stage UHF/VHF masthead amplifier, 3km from the TETRA mast which was 15° off-axis from the TV transmitter. The TETRA field strength was 15dB stronger than that of the analogue TV channels.

TETRA stands for TErrestrial Truncked RAdio. It's an international standard for digital mobile communications and, in the UK, the police and other emergency services are gradually adopting TETRA systems. TETRA bears some resemblance to the digital mobile phone networks, but the cells are generally larger and the transmission powers higher.

The introduction of any new transmission system is likely to cause some degree of interference to existing services. But the problems that TETRA is causing to TV reception seem to be much more widespread than anyone anticipated. There are deep political issues involved with the implementation of TETRA and, in many districts where a TETRA mast has appeared, there is local feeling that the Home Office, having committed billions to the scheme, is riding roughshod over responsibility for TV interference problems. This is not the place to go into that, so I will simply describe the technical problem and suggest remedies.

The frequencies allocated for police and fire service TETRA use in the UK are 380-385MHz (mobile) and 390-395MHz (fixed). The company that operates TETRA, O2 Airwave, is building a network using these frequencies – the process should be more or less complete by the end of the year.

TETRA and TVI

There is nothing particularly pernicious about these transmissions. TETRA interference has become noteworthy simply because the transmitters are new, quite high-powered, and are often in residential areas. Most of the normal TVI (TV interference) remedies apply when dealing with TETRA interference. But, as the interfering signals are digital, some familiar TVI symptoms such as audio breakthrough will not be present. And as the base stations transmit continuously the interference does not stop and start like, for example, TVI from a taxi base station. Apart from these points, my comments here about TETRA interference apply equally to any strong interfering transmissions, especially to those between 300-450MHz.

TETRA interference problems are most likely to arise when one of more of the following conditions apply:

(1) The TETRA mast is within a few km.

(2) The TV aerial is vertically polarised.

(3) The TV aerial is of the group A (chs. 21-35) or wideband type.

(4) A masthead amplifier, particularly a two-stage one, is in use.

(5) The TV field strength is poor.

Since TETRA transmitter aerials are flat panels that are designed to radiate most power towards the target area, the field strength in areas very close to the mast might be rather less than expected. But areas on high ground 2-3km from a mast, on the other side of a valley for example, can be pretty well swamped with signal.

Interference problems are uncommon when the TETRA field strength is relatively low, unless a masthead or distribution amplifier is in use. At locations where the field strength is very high however interference is quite common, even where the TV field strength is good and the aerial is connected to the TV set directly, with no signal amplification.

If the interfering field strength is very high, the unwanted signal can enter either via the aerial or directly into the TV set or VCR. This is really an EMC (electromagnetic compatibility) shortcoming with the TV set or VCR. The symptoms can be very peculiar, and may not look like TVI. More or less anything is possible, though a common symptom is faint patterning – even when the TV set is working with a scart input. I'm generalising from experience with only a small sample, but the very cheap 'supermarket special' TV sets seem to be more susceptible to the problem than others. If you come across a set that works perfectly on your bench but persistently misbehaves in the customer's home, have a good look around the immediate neighbourhood for a transmission mast. Since TETRA often shares a site with cellphone and other transmissions, the mast will probably not be new. Look for new panel arrays. These will often be mounted below the cellphone panels, on arms that position them away from the mast. Some TETRA transmission sites are atop blocks of flats, so TV sets on the higher floors

of adjacent high-rise blocks may be in a very strong interfering field (the occupiers *will* be as well – there are contentious health concerns about this).

TETRA transmissions are properly engineered of course, and the out-of-band radiation should be minute. Nevertheless the second harmonic coincides with UHF TV ch. 60. So, if you encounter strange problems with this channel, TETRA could be the culprit.

Masthead amplifiers

Normally it's the fundamental frequency that causes the trouble, because 400MHz is well within the passband of most aerial amplifiers. Thus the vast majority of problems arise when some sort of aerial amplifier is in use. If you think about it, use of a masthead amplifier means that the TV signals are likely to be on the low side, so a fairly-close TETRA transmitter could produce a field strength 30-40dB higher than that of the TV signals. Even allowing for the fact that the aerial is pointing at the TV transmitter rather than the TETRA mast, and isn't designed for 400MHz reception, it is quite likely that the masthead amplifier will be presented with enough input signal to cause overloading. In its resulting non-linear condition, the amplifier will add interference to TV channels that have no obvious relationship to the interfering frequency.

The effects vary. DTT (Digital Terrestrial Television) often withstands this interference surprisingly well, and remains unaffected when the analogue channels are quite badly affected. But reception will be impossible beyond the point where the DTT carrier-to-noise ratio falls off the edge of the 'digital cliff'.

Because the TETRA signal is digital, the familiar telltale signs of breakthrough are not present with analogue TV reception. The word 'breakthrough' implies that the interfering carrier's modulation is visible or audible in recognisable form at the TV set, and this doesn't happen with TETRA. There are no disembodied voices whispering "you go round the back while I watch the front" or suchlike police chat coming from the customer's TV set. Interference to analogue reception can be mistaken for that caused by an oscillating masthead amplifier, but a closer examination of the screen will often suggest the real cause of the trouble.

The appearance of the patterning varies a great deal, depending on the relative strength of the interference, but Photo 1 is fairly typical. The distinctive white horizontal bars, each made up of diagonal stripes, have given rise to the description 'tyre marks'. This effect is presumably the result of the pulsed nature of the TETRA signal. There may well be cross-modulation, with one TV channel appearing faintly behind another.

In a really severe case TETRA can wipe out the TV signal completely. But the first time I encountered TETRA interference the symptoms were much less dramatic. There was slight cross-modulation, and some rather vague patterning on the screen. At first I wondered whether the masthead amplifier had some weird fault. When I connected the aerial lead to the spectrum analyser I saw, as expected, a huge spike some way below the UHF TV band. Thinking that the amplifier was oscillating, I disconnected its power supply as a check. This should kill any such oscillation of course. But to my surprise the spike, though greatly reduced, was still present. When a small screwdriver was used as the aerial the spike was very tall. I climbed on to the roof and soon found that the signal, at 392MHz, came from the direction of an innocuous-looking callphone mast about 3km away.

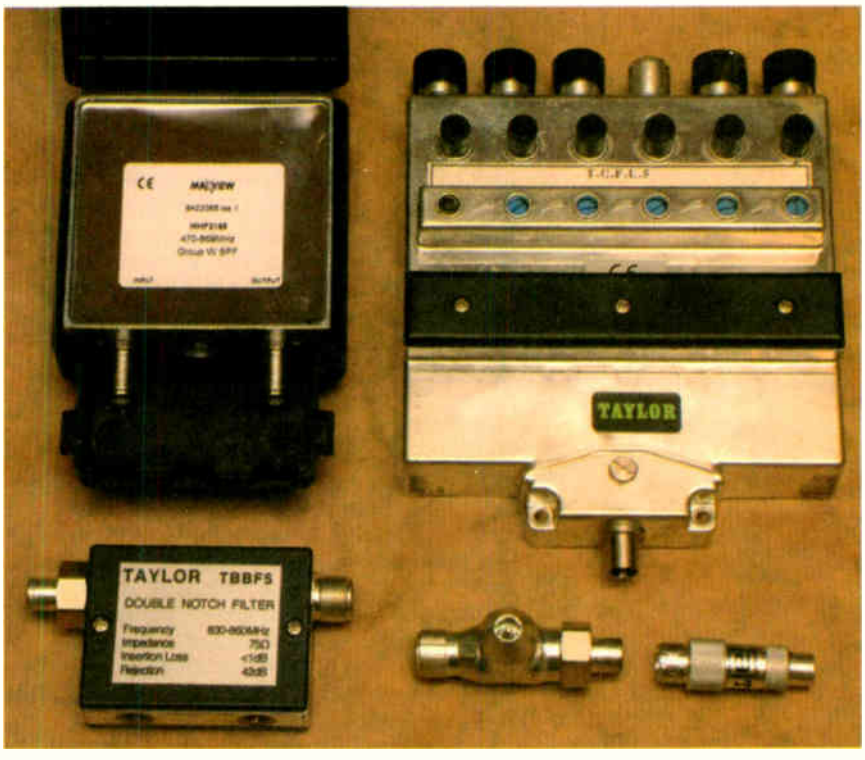


Photo 2: Various types of filter. Clockwise from the top left bandpass, channel-pass/leveller, high-pass, single-notch and double-notch.

A two-stage masthead amplifier is much more likely to be affected than a single-stage one. Two-stage amplifiers have a gain of about 25dB, single-stage ones about 14dB. Quite often the extra gain provided by a two-stage amplifier is unnecessary, and the only thing you need to do to get rid of the interference is to fit a single-stage one instead. The rule-of-thumb I use for assessing whether a two-stage masthead amplifier is required is simple. Assuming that the downlead losses are less than 3dB, I would consider the use of a two-stage amplifier only when the weakest analogue channels are below –8dBmV (52dBμV) at the aerial terminals.

If TETRA or other signals below the UHF TV spectrum are causing problems, it's best to use a UHF-only masthead amplifier. These incorporate a high-pass filter that can provide a good degree of protection against interference at 400MHz.

It's also important to use a fully-screened masthead amplifier. Most if not all the major manufacturers now have fully-screened products available. Some of the more 'vintage' masthead amplifiers are poor performers by modern standards, and are very susceptible to strong out-of-band or in-band interference. Maximum output levels are often rather low, which means that the cross-modulation threshold is easily exceeded by unwanted transmissions.

Filters

Having sorted out the masthead amplifier, if there is one, the next thing you have to consider when faced with strong out-of-band interference is the use of filters. Fortunately lots of these are available. Four basic types are relevant: bandpass, channel-pass/leveller, notch (single or double) and high-pass – see Photo 2.

A bandpass filter passes only the specified frequency range. A high-pass filter rejects everything blow its cut-off frequency. A notch filter rejects a spot frequency. A channel-pass filter passes only the

channels specified. There are pros and cons with each type, but whichever type is used it must normally be inserted before the first amplifier in the system. All filters lose a little bit of the wanted signal as well, and with the filter in front of the masthead amplifier the carrier-to-noise ratio will inevitably be degraded, if only slightly. This is unavoidable, but in a marginal reception area it's a good reason for not fitting a filter if this can be avoided. In a difficult case where it's felt that the slight loss before amplification introduced by the filter is unacceptable, it might be possible to use a low-gain amplifier before the filter. Further amplification to overcome cable or distribution losses can follow the filter.

In many cases a bandpass filter will do the trick, with no further complications. They are also known as 'group-pass filters'. Since the filter will normally be before the masthead amplifier it will usually be outdoors, so it must be built into a weatherproof housing. Fringe and Maxview amongst others have such filters. The Maxview MHF range is fully-screened and has F connectors. It includes types for channels 21-37, 21-42, 21-68, 35-53, 35-68 and 48-68. To reject TETRA at 400MHz, use the filter designed for the highest possible group of channels. Through loss with the wanted channels is less than 1dB while the rejection at 400MHz is better than 25dB.

High-pass filters are most familiar to us as in-line CB filters. Examples are the Antiference TVI and TVI-U. These filters' cut-off frequency is generally not high enough to reject TETRA signals.

Notch filters come into their own when a distribution system carries VHF-FM and DAB radio as well as TV. A notch filter tuned to the exact TETRA frequency should be fitted in-line with each aerial feed prior to the amplifiers. Aerials for DAB can receive a lot of TETRA signal, but fortunately a double-notch filter can provide very high rejection – as much as 40dB is possible. Accurate tuning is difficult without a spectrum analyser.

Taylor Bros (Oldham) can supply notch filters for any frequency. Alternatively bandpass filters are available from Taylor Bros for VHF-FM (type TBP2) and DAB (type TBP3). These are indoor units which are intended to be fitted just in front of the distribution amplifier. In the unlikely event that a masthead amplifier is used for VHF-FM or DAB, the filter can be fitted into a standard ABS electrical junction box. A 120 x 180 x 50mm box with a rubber seal on the lid is ideal.

It is unlikely that you would need to resort to channel-pass filters with a simple domestic installation. On the other hand the majority of distribution systems would benefit from having such a filter at the aerial input, even when out-of-band interference isn't a problem. But if the aerial receives TETRA or any other unwanted signal at significant strength a channel-pass filter/leveller is a must. By 'significant strength' I mean about 6dB lower than the digital TV multiplexes. Since TETRA often appears at the aerial terminals at higher strength than even the analogue TV channels, it is very likely in areas with TETRA coverage that a distribution system will need a channel-pass filter/leveller. We now take this for granted, the only exceptions being small systems with twenty or fewer outlets in places where the TV signals are very strong, at about 20dBmV or more. Filters for five analogue channels and six digital multiplexes can cost as much as £150. Believe me, we wouldn't use them if there was a cheaper alternative that works as well.

Aerial work

Don't start adding filters and changing masthead amplifiers without giving the aerial a cursory glance at the very least. A bit of aerial work can pay dividends both technically and financially, the latter because customers seem to see more value in shiny things on the chimney than in boxes in the loft or your time.

The fundamental requirement is to improve the ratio between the wanted and unwanted transmissions as much as possible. First I'll state the obvious: the aerial should be pointed at the TV transmitter accurately, and should be sited as advantageously as possible. If raising the aerial or moving it to another chimney gives better line-of-site to the transmitter without improving the view towards the TETRA mast, it's worth doing the work. Apart from alleviating the TETRA problem, there will be a general improvement in reception. Don't waste your time putting the aerial off-beam from the transmitter in the hope of 'nulling out' the interference: it doesn't work.

TV aerials designed to work right down to the bottom of the UHF TV spectrum (470MHz) seem to function surprising well at 400MHz, even exhibiting directional properties and gain! If possible, avoid the use of wideband aerials. These are often installed unnecessarily nowadays, thanks largely to a widespread misconception that they are always needed for DTT reception. If all the analogue and digital TV signals required are in group B or C/D, the low-frequency response of a wideband aerial merely contributes to troublesome interference such as that from TETRA. The inferior performance of a wideband in comparison with a grouped aerial can also make a difference.

As a desperate last resort, it might be possible improve the signal-to-interference ratio by relocating the TV aerial to a spot that's screened from the TETRA mast. Unfortunately 400MHz signals aren't attenuated by buildings and trees as much as UHF TV ones, so this might not be all that effective.

Most VHF-FM aerials have to be installed horizontally, which helps avoid TETRA interference. Unfortunately DAB aerials have to be installed vertically.

In conclusion

The electromagnetic spectrum has become ever more crowded over the years. During my time as an aerial installer I have seen all sorts of innovations that have caused UHF TV reception problems. In the late Seventies and early Eighties there was the CB craze. Then we had the illegal high-powered cordless phones. Meanwhile many of the CB fanatics migrated to amateur radio and started to transmit lots of watts at 144MHz and 432MHz, usually in the middle of crowded housing estates. Next illegal video senders became popular – I could write a book about the trouble they caused. Low-powered RSL radio stations have sprung up all over in recent years, cellphone masts adorn every bit of high ground, and we now have five analogue channels and six digital multiplexes competing for space in the UHF TV spectrum, with the old channel-spacing rules thrown to the winds. No wonder we have interference problems!

We must remember though that the majority of these problems are not caused by the interfering transmitter but are the result of poor EMC (electromagnetic compatibility) at the receiving end. Poor amplifier design, the wrong type of amplifier, cheap coaxial cable, poor TV set design and an inadequate aerial installation can all open the door to interference.

Ensuring good EMC performance has become an important part of installers' work over the years. TETRA is just the latest challenge. I'm sure it won't be the last!

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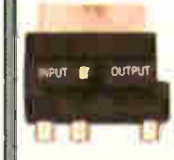

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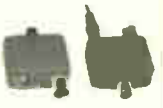

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distributor of electronic components

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
AV29SX*PF	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
MAKE & MODEL	**KIT TYPE**	**CODE**
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	£ 15.00

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

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Matsui

1496R/T and 2096R/T Repair Kit for Power Supply using a BUZ90

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Price £ 7.00 + vat

Matsui

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Order Code MODKIT44

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Sharp

56FW53H,66FW53H, 66FW54H,76FW53H, 76FW54H PSU & Dolby Upgrade

Order Code MODKIT45

Price £ 4.00 + vat

Sony VCR

SLV715HB SLV777UB Repair Kit for Power Supply

Order Code MODKIT40

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Thomson

ICC17 Power Supply Repair Kit

Order Code MODKIT41

Price £ 6.00 + vat

Grandata Ltd

distributor of electronic components

Konig Remote Controls

KÖNIG ELECTRONIC

AKAI

Part No.	Code
CT2582E	IR9700
CT2585	IR9700
CT2885	IR9700
CT2885E	IR9700
IR16	IR9700
RC556	IR9397
RC85	IR9700

AMSTRAD

Part No.	Code
SRD550	IR9386
SRX510	IR9386
AE6001	IR9352

B & O

Part No.	Code
Beolink 100	IR9843

BEKO

Part No.	Code
RC51321	IR9398
RC51331	IR9398
RC61331	IR9398

BLAUPUNKT

Part No.	Code
8669493	IR9188
1532	IR9503
1570-46	IR9516
8627 105 463	IR9188
8668813000	IR9516
1555-46	IR9516
1563-46	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

Part No.	Code
RC51331	IR9398
RC61331	IR9398
2190T	IR9397

DAEWOO

Part No.	Code
DMQ1414	IR9397
DMQ14A 1	IR9840
DMQ20A 1	IR9840
DMQ2195	IR9840
DMQ2595	IR9840
DMQ2895	IR9840

FERGUSON

Part No.	Code
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	IR9594
51K3	IR9594
59B0	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

FERGUSON ..continued

Part No.	Code
68LS2	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

Part No.	Code
105-068	IR9403
105209B	IR9862
105210A	IR9862
105-219J	IR9854
105-224V	IR9854
105-229H	IR9854
105230A	IR9854
105-230C	IR9854
38T1	IR9854
CB20E40X	IR9854
CBT2190E	IR9403
CBT4902	IR9403
CBT4902E	IR9403
CBT9905	IR9403
VS068K	IR9862

GRUNDIG

Part No.	Code
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

Part No.	Code
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

HITACHI ..continued

Part No.	Code
C24WS511T	IR9983
C2514	IR9476
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
CST1430	IR9576
CST1435	IR9576
CST1560	IR9576
CT2116	IR9476
CTRM200M	IR9542

JVC

Part No.	Code
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

Part No.	Code
FB300	IR9616
FB50	IR9514
FB52	IR9514
FB70	IR9514
FB72	IR9514
FB90	IR9514
FB91	IR9514

MATSUI

Part No.	Code
076G047240	IR9490
076L067240	IR9490
2076R	IR9490
2092T	IR9490

NOKIA

Part No.	Code
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
FS4/1	IR9573
FS4/2	IR9573
FS5	IR9506
FS5/1	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

Part No.	Code
02280227	IR9835
91005926	IR9835
EUR50100	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

Part No.	Code
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

PHILIPS ..continued

Part No.	Code
RC9020	IR9434
RC9030	IR9434
RC9050	IR9556
RC9057	IR9710
RC9060	IR9556
RC9070	IR9434
RC9133	IR9710

SAMSUNG

Part No.	Code
CX5312W	IR9432
CX5325W	IR9432
CX532WT	IR9432
CX534WT	IR9432
RM104	IR9432
RM109	IR9546

SANYO

Part No.	Code
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
RC317	IR9457
RC318	IR9457
RC321	IR9457
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

Part No.	Code
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
DV1706SN	IR9487
DV2108IS	IR9711
DV2130EX	IR9487
DV25071S	IR9711
DV25073S	IR9711
DV25081S	IR9711
DV25083S	IR9711
DV28037S	IR9711
DV28071S	IR9711
DV28081S	IR9711
DV28083S	IR9711
DV3750S	IR9788
DV3760S	IR9788
DV5160S	IR9788
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DV5432S	IR9711
DV5465S	IR9711
DV5470S	IR9711
DV5935H	IR9711
DV6301S	IR9711
DV6303S	IR9711
DV6311S	IR9711
DV6313S	IR9711
DV6332S	IR9711
DV6336S	IR9711
DV7001S	IR9711
DV7002S	IR9711
DV7003S	IR9711
DV7011S	IR9711
DV7024S	IR9711
DV7032S	IR9711
DV7036S	IR9711
RRMCG0351CESA	IR9487
RRMCG0351CESB	IR9487
RRMCG0351CESD	IR9487
RRMCG0370CESA	IR9487
RRMCG0483PESA	IR9487
RRMCG0489CESB	IR9487
RRMCG0568PESA	IR9487
RRMCG0617PESA	IR9487
RRMCG0618PESA	IR9487

SHARP ..continued

Part No.	Code
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

Part No.	Code
RM604	IR9974
RM607	IR9974
RM609	IR9974
RM615	IR9511
RM620	IR9511
RM625	IR9511
RM630	IR9511
RM631	IR9511
RM632	IR9511
RM633	IR9511
RM634	IR9511
RM635	IR9511
RM640	IR9321
RM641	IR9321
RM641A	IR9321
RM650	IR9336
RM651	IR9336
RM652	IR9336
RM654	IR9336
RM656	IR9448
RM657	IR9336
RM658	IR9321
RM661A	IR9321
RM670	IR9123
RM671	IR9123
RM672	IR9123
RM673	IR9123
RM677	IR9448
RM681	IR9442
RM682	IR9442
RM683	IR9442
RM684	IR9442
RM685	IR9442
RM686	IR9442
RM687B	IR9448
RM687C	IR9448
RM689	IR9441
RM694	IR9452
RM698	IR9442
RM717	IR9448
RM719	IR9448
RM816	IR9441
RM817	IR9441
RM820	IR9452
RM826	IR9441
RM828	IR9452
RM830	IR9443
RM831	IR9443
RM832	IR9443
RM833	IR9451
RM834	IR9452
RM836	IR9871
RM837	IR9451
RM839	IR9871
RM841	IR9452
RM842	IR9443
RM883	IR9871
RM886	IR9871

THOMSON

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14GM53	IR9639
14GM56	IR9639
14M570	IR9639
21M576	IR9639
21MG51	IR9639
225TX1 049	IR9508
RCT2000	IR9259
RCT3000	IR9831
RCT5000	IR9259
RCT5020	IR9502
RCT5141S	IR9470

TOSHIBA

Part No.	Code
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

TOSHIBA ..continued

Part No.	Code
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	IR9852
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	IR9852
216R9B2	IR9852
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
2545DD	IR9852
2550TB	IR9953
2552DB	IR9953
2552DD	IR9953
2555	IR9953
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
2857DD	IR9953
2863DD	IR9953
2866DD	IR9953
2873DB	IR9953
2877DB	IR9953
2879DB	IR9953
3327DB	IR9953
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
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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

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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
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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
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TDA4861	£3.50
TDA4866	£2.75
TDA4880	£4.50
TDA4918A	£17.00
TDA4930	£5.00
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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
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TDA5702	£13.00
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TDA7266	£5.00
TDA7269	£5.00
TDA7269A	£2.75
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TDA7294V	£5.50
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TDA7297	£3.50
TDA7300	£5.50
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TDA7310	£8.00
TDA7312	£4.50
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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
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TDA8303	£2.50
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TDA8305	£5.00
TDA8305A	£5.00
TDA8310	£6.00
TDA8350Q	£2.75
TDA8351	£2.00
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TDA8362AN3	£7.50
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Servicing the Sharp DA100 (50Hz) and DA50W chassis

Part 3 of this series, by Alex Towers, deals with the dynamic focus, EW correction and field output stage circuitry and outlines line and field timebase fault-finding procedures

We ended last month with the operation of the basic line drive and output stage circuitry. Before we start on fault-finding in this area we should take a look at the focus-modulation circuits used in larger-screen models, since these are linked to the line-scan current path.

Dynamic focusing

Because of their larger screen size, 66cm and 76cm models employ a focus-modulation circuit. It's driven by the line-scan current waveform. The function of the focus modulator is to ensure that the picture is kept in focus at the edges of the display. When the beams are deflected to the edges of the screen they become distorted, as the distance they travel is greater than at the centre of the screen.

Fig. 24 shows the circuit used in GF models. The primary winding of transformer T1602 is connected in series with the line-scan current path, prior to the chassis return via the scan-correction capacitor C613. The signal generated in the secondary winding is fed to the slider of the focus control potentiometer, and is thus superimposed on the DC focus voltage.

This basic arrangement is used in both FW and GF models. Because of the different type of screen with FW models however a rather more complex focus-modulation circuit is used, see Fig. 25. With FW models the screen is not truly flat, the curvature affecting the time taken by the beams to reach the screen to a greater extent than with a flat screen. Focus correction in both the horizontal and vertical directions is therefore required. Horizontal correction is carried out as with GF models, but vertical correction is added, see Fig. 25. The EW drive signal is fed via R1610 and C1605 to pin 2 of IC1601, whose output at pin 1 drives Q1602 and Q1601. The latter adjusts the waveform produced by T1602's secondary winding.

Fig. 26 shows the focus-modulator PCB in FW models.

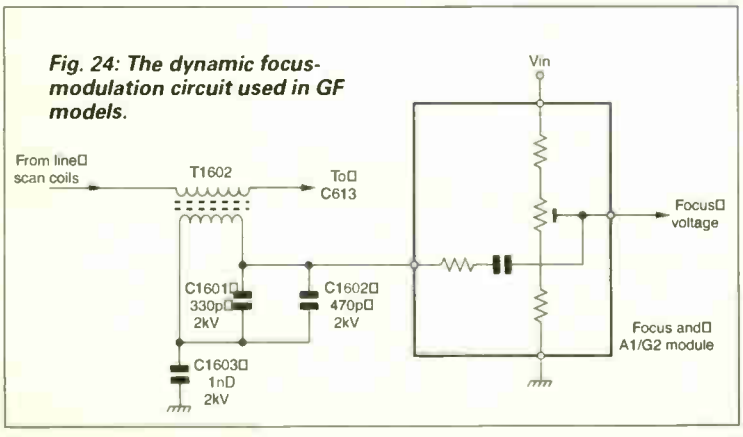


Fig. 24: The dynamic focus-modulation circuit used in GF models.

Line output stage faults

If the negative supply used to switch off the line output transistor Q601 is too low it won't turn off rapidly. A large voltage will be developed across its collector-emitter junctions during the switch-off period, while current is still being drawn. The power generated has to be dissipated by the transistor itself, which will get very hot and will eventually fail. The usual cause of this problem is C607, which can fall in value or become leaky. As a result, the negative switch-off supply falls. If this has not already been done, it's advisable to fit a 105°C capacitor in this position.

For intermittent failure of the line output transistor it's advisable to replace C607, D610 and D611. Dry-joints can also cause this problem. The areas most commonly affected are the line scan coils' chassis return circuit (C613, R613 and the associated components) and the scan coil connector itself. Sometimes C613 or R613 become open-circuit, the result being loss of line scanning with the possibility that the output transistor becomes short-circuit or leaky. C613 can fail under load, so it's best to check it by substitution. C528, C632 and C615 can also be responsible for intermittent failure of the line output transistor.

Note that the correct type of line output transistor must be used. An incorrect type will result in erratic operation or premature failure of the device. The Sharp part number for Q601 is RH-TX0144BMZZ.

You could find that the line drive is missing even though the main microcontroller chip IC1001 has gone through the boot-up sequence. The line drive signal comes from pin 50 of the video/deflection processor chip IC801. IC1001 produces a line mute output at pin 57 – this is rather misleadingly referred to as HOUT. The mute can be released to enable the line output stage to start up by short-circuiting the base-emitter junction of Q607 (2SC2412) or temporarily disconnecting link wire JL2, see Fig. 27.

If D1601 on the focus-modulator PCB (66 and 76cm models only) becomes leaky or short-circuit, the result will be an over-large picture as the EHT drops to about 20kV.

EW correction

In addition to the normal EW correction required with a 4:3 aspect ratio, 110° deflection tube a widescreen set requires a change of correction for different scanning modes. There are generally three basic modes with widescreen sets, 4:3, 14:9 and 16:9, but in addition the latter can have three variants, full, panorama and cinema. The full mode is used to stretch a 4:3 format picture which contains fast-moving action, for example motor racing: so it doesn't matter greatly if the horizontal linearity is not constant across the screen. The panorama mode is similar but for slow-action or even stationary displays, for example news programmes, where any variation in linearity would be noticeable. To overcome this problem the linearity

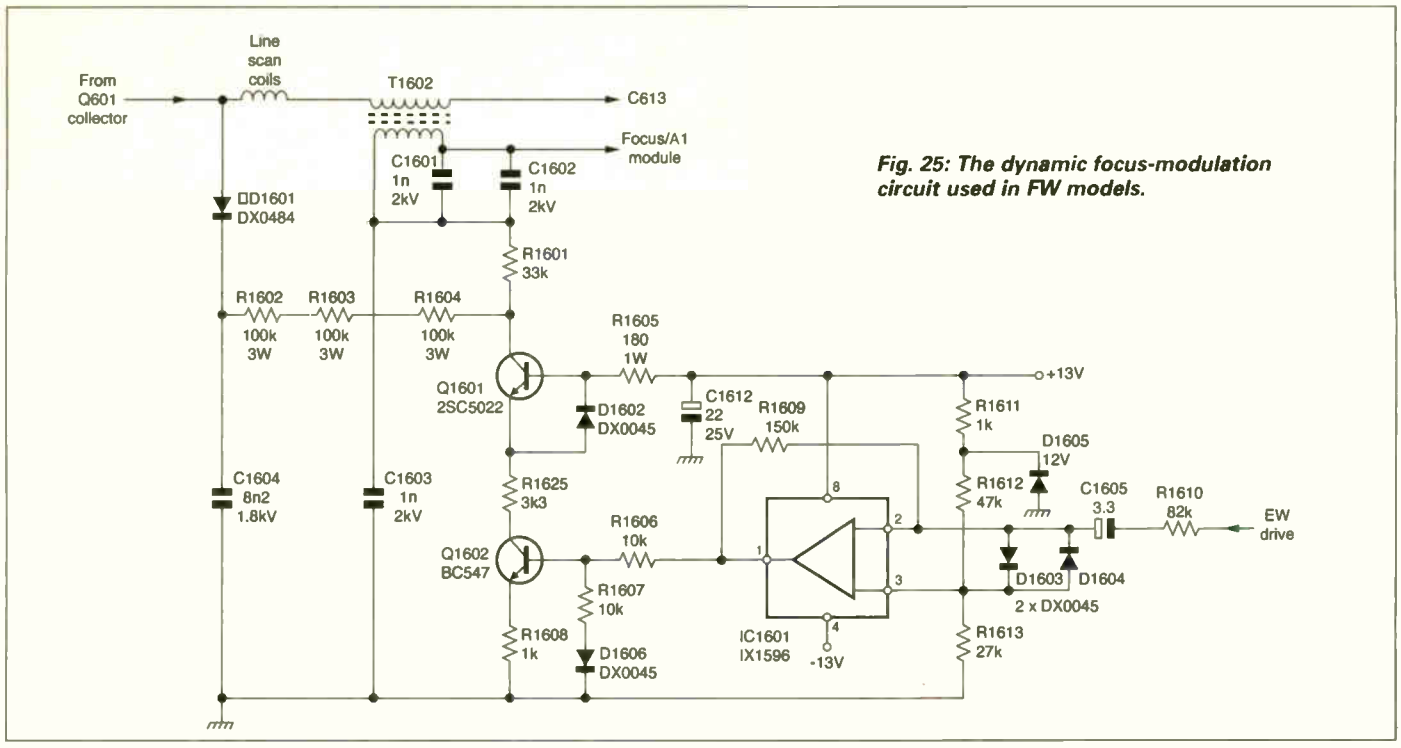


Fig. 25: The dynamic focus-modulation circuit used in FW models.

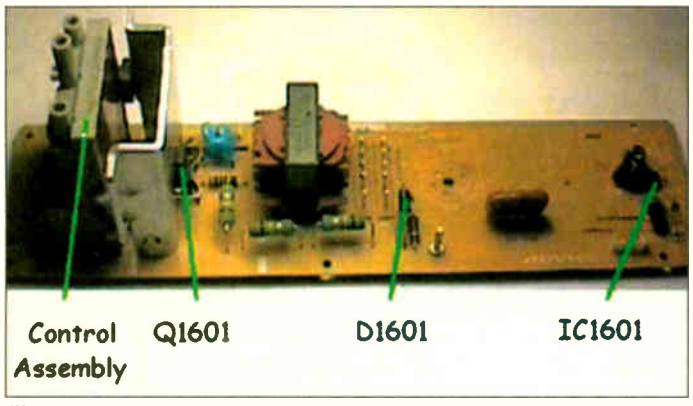


Fig. 26: Photo of the FW focus-modulator PCB.

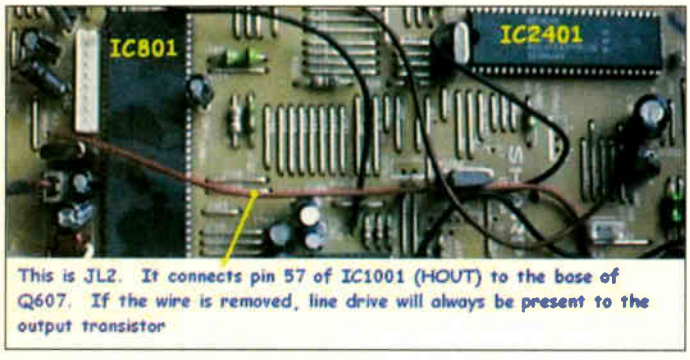


Fig. 27: Location of link wire JL2.

is kept constant at the centre of the screen, the sides of the picture being stretched to fill the screen. The cinema mode is for use with pictures that are in true 16:9 format. When setting the geometry, the set must be put in the 'full' mode.

Fig. 28 shows the basic EW correction and line scan circuitry used in these sets. It's centred on transistor Q506, which operates slightly differently from a conventional EW diode-modulator driver in that it is turned on to increase rather than reduce the width. This enables the circuit to work more efficiently, and as a result the transistor does not become overly hot in operation.

IC503 is a switching amplifier. Integrated line-frequency pulses from the line driver circuit are fed to the inverting input via Q501, while a parabolic EW signal from pin 32 of the video/deflection processor chip IC801 is fed to the non-inverting input. The result is a pulse-width modulated output at line frequency, with the width of the pulses determined by the parabolic EW signal. This output is fed to Q506, which is biased for class D operation, is then low-pass filtered and is finally used to drive the diode modulator (D603/604 and C601/610). The low-pass filter consists of L603 and C610. In addition the output from the filter is fed via C611 to coil L604. The centre tap of this coil is connected to the line linearity circuit, while the other end is connected to chassis. Thus the line linearity can be adjusted by the parabolic EW signal.

Fig. 29 shows the print side of the EW circuit and Fig. 30 the component side.

Fault-finding in the EW correction circuit

It is important to establish in which part of the circuit the fault lies. Check the control output at pin 32 of IC801. There should be a parabolic waveform here, at a base frequency of 50Hz. It will change shape depending on the amount of correction applied. So it is important to enter the service mode (see later) and ensure that none of the adjustments are at minimum or maximum.

If this waveform is present and changes as adjustments are made, the cause of the fault will be in the drive or output circuitry. Faults that can be experienced in this area include:

(1) R519 (usually 100kΩ), which is connected to the 150V supply, can go high in value or open-circuit. It's mounted on the component side of the PCB. The part number is VRD-RA2HD104J. Note that the value is sometimes 150kΩ. Check the value before fitting a replacement, as incorrect value will result in poor EW geometry performance.

(2) Q506 (2SD2391), which is a surface-mounted device, can be leaky, short-circuit, open-circuit or can overheat. The part number is RH-TX0151BMZZ. If it has to be replaced, the following should also be changed: L603/4, D502-4, D516 and C528.

The resistance of L603 and L604 can fall – L603 is normally 8Ω. The part numbers are L603 RCLIP0286BMZZ and L604 RCLIP0284BMZZ. Clamp diodes D502-4, part number RH-DX0551BMZZ, can be intermittently faulty. Clamp diode D516, part number RH-EX0837BMZZ, can also be intermittently faulty – it's not shown in the GF circuit diagram but is fitted to the chassis. The reservoir capacitor C528 (10μF, 63V) can become leaky. Its part number is VCEAGA1JW106M.

(3) The EW modulator diodes D603 and D604 can go open- or short-circuit. Part numbers are D603 RH-DX0299BMZZ and D604 RH-DX0302BMZZ.

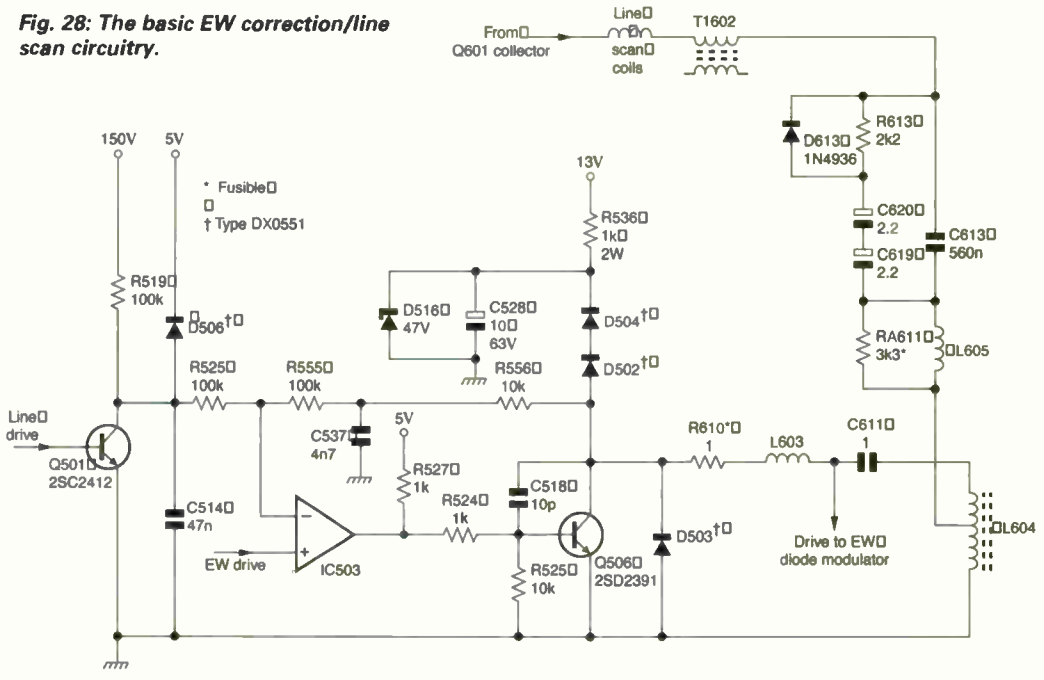
(4) A dry-joint can be present at C601 and/or C610.

If the waveform at pin 32 of IC801 is not present, is severely distorted or the adjustment range is poor, the cause of the fault could be the EEPROM chip IC1003 or the video/deflection processor chip IC801. In this case it is recommended that IC1003 is first blanked (see later). If this does not cure the problem, IC801 is probably defective.

Sometimes it may not be possible to set the geometry correctly in all modes after blanking the EEPROM. In this case ensure that the EPROM (IC1002) is the correct type – see Part 1. When the correct EPROM has been fitted, the EEPROM will have to be blanked to enable the correct data to be downloaded to it.

Replacement EPROMs have been produced to provide minimal geometry adjustments. If the picture geometry is still poor after carrying out this procedure, the fault will lie elsewhere in the EW circuitry.

Fig. 28: The basic EW correction/line scan circuitry.



The CRT PCB

Two types of CRT PCB are used, one for 66cm and 76cm sets and the other for the 56cm Model 56FW53H. The major difference is that there is no scan-velocity modulator or picture-rotation circuitry in the 56cm model, so the PCB is smaller. Note that the RGB output chip IC1801 can be one of three types, see Part 1. Fig. 31 shows the 66cm and 76cm PCB, Fig. 32 the 56FW53H PCB.

It's possible for the grey-scale to wander, the picture brightness ramping up or down. If the A1/G2 voltage is set correctly, check IC1801 by substitution.

Picture smearing will occur if the reference voltage at pin 2 of IC1801 (type TEA5101A or TDA6019JF) is about 10V instead of about 11·5V. This normally shows in the red display. If the voltage is below 9V the picture will blank. In both cases Q912 (TX0130) or its associated components can be the cause. This transistor can run hot (especially with GF modules, because the transistor draws more current). If you suspect that the transistor could fail because of this, a 68Ω, 0·5W resistor can be added between its collector and emitter. It is easiest to fit this resistor on the print side of the PCB.

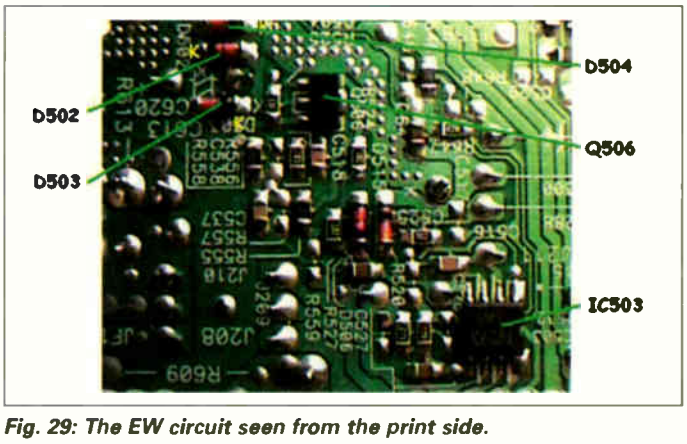


Fig. 29: The EW circuit seen from the print side.

Class D output stages

Sharp used discrete-component class D output stages for a number of years to minimise dissipation. Subsequently a specially-designed IC was introduced for the purpose. This device is ideal for TV audio and field output stages, where high efficiency (low energy use) is required. The TDA7480 IC is for use in audio and field output circuits, while the TDA7481 version is used to drive the sub-woofer in sets with Dolby Pro-Logic. Table 3 shows the pin details for the TDA7480, with voltages when used in the field output stage

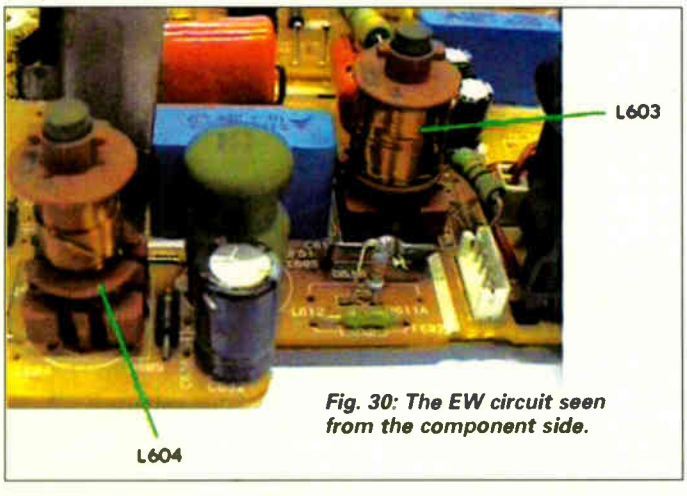


Fig. 30: The EW circuit seen from the component side.

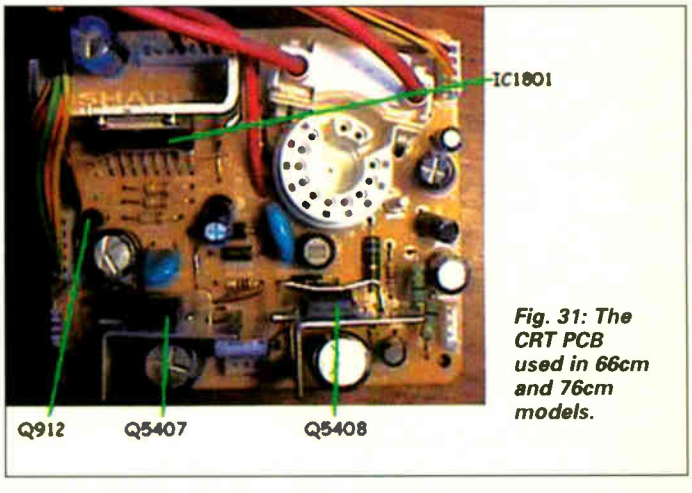


Fig. 31: The CRT PCB used in 66cm and 76cm models.

(IC501). The voltages differ slightly when the chip is used in the audio output stage.

Note that pins 1-3 and 17-20 are all connected together by a large area of print on the bottom of the PCB. This area is used as a heatsink for the device, so it's very important that all these pins are soldered when fitting a replacement, otherwise premature failure of the device may occur. Note that when the IC is correctly fitted it does not get hot during operation.

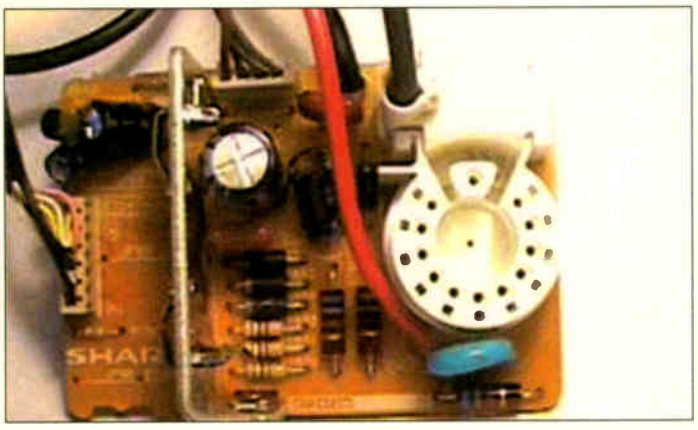


Fig. 32: The CRT PCB used in Model 56FW53H.

The external components fitted to pins 8 and 9 determine the base frequency of the PWM section of the IC. With an audio circuit the frequency will vary from the base frequency by at least the bandwidth of the audio signal (20kHz): this ensures that no beat signals that could interfere with the audio signal are produced.

The voltage at the standby/mute pin 12 determines the IC's operating state. At less that 0·8V the IC will switch to standby (no output). With a voltage between 1·8-2·5V the output will be attenuated by 60-80dB. For normal operation the voltage should be above 2·7V.

The field output stage

Fig. 33 shows the basic field output stage circuit. The TDA7480 chip IC501 is operated in a similar way to its use in the audio output stage, except that there's no mute circuit – though C511 prevents operation until the +13V supply is present.

The pulse-width modulated output at pin 4 is fed to a low-pass filter (L501, C504) that produces a ramp drive for the scan coils. The ramp is at +13V when the scan starts at the top of the screen, decreasing to –13V when the scan reaches the bottom of the screen. The scan coils are returned to chassis via Q503, which is switched on during the field scan period and off during the flyback. IC502 provides an error-signal output that's fed to pin 11 of IC501 for linearity and height correction.

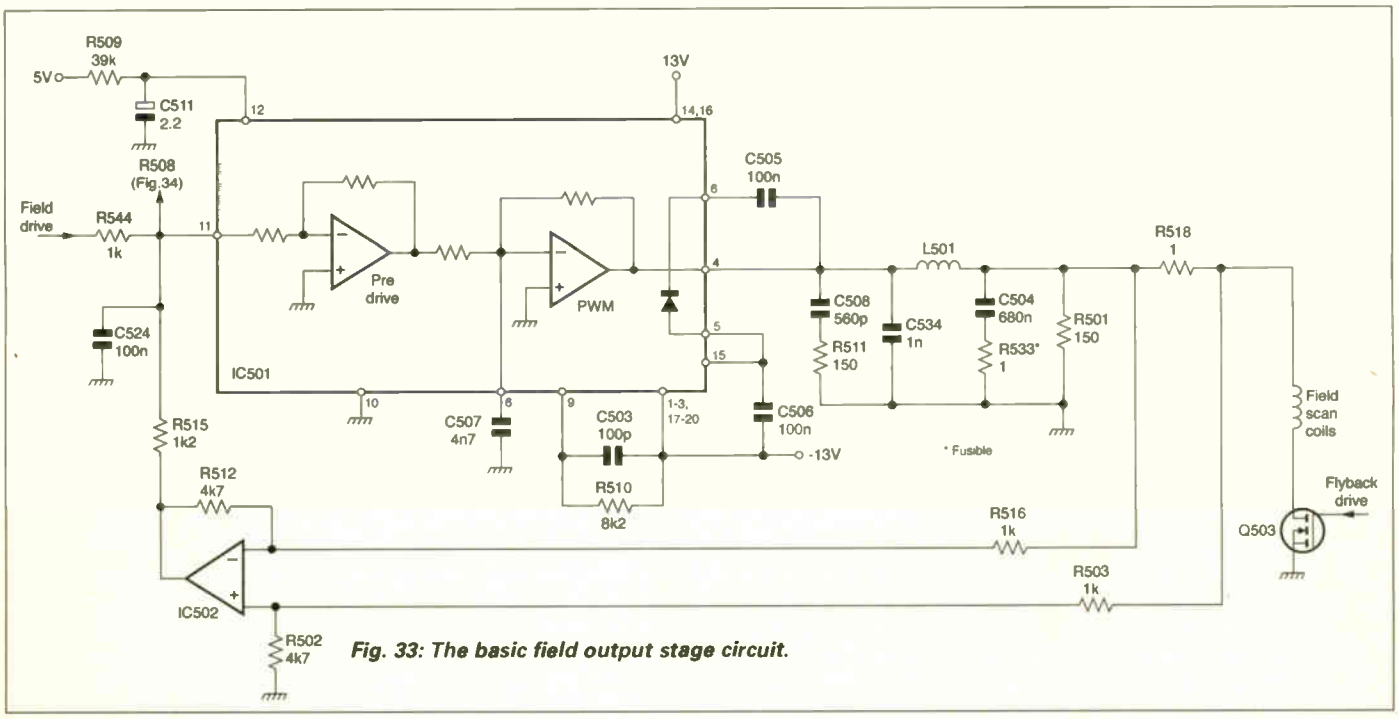


Fig. 33: The basic field output stage circuit.

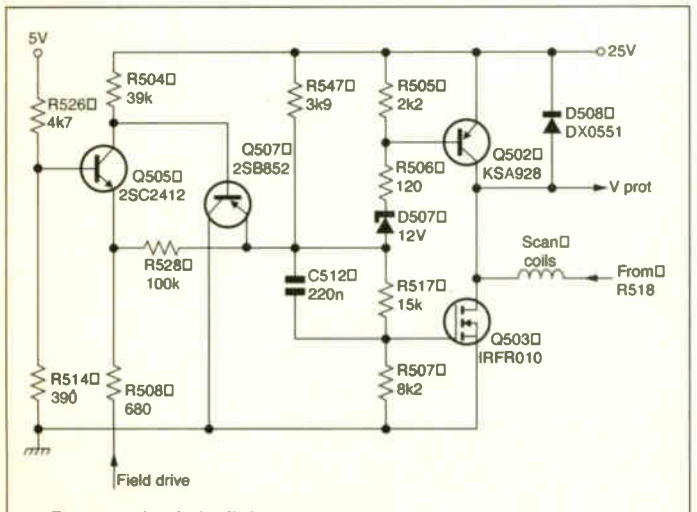


Fig. 34: The field flyback circuit.

Fig. 34 shows the circuit used to generate the field flyback. Q503 is switched off to start the flyback and Q502 is switched on, connecting the 'earthy' end of the scan coils to +25V. Since there is –13V at the other end of the scan coils at this time, there is effectively 38V across them. The beams are thus driven back the top of the screen.

The field drive signal from pin 31 of IC801 has a negative-going pulse in addition to the ramp waveform. This negative-going pulse initiates the flyback. It's fed via R508 to the emitter of Q505, whose base voltage is set by the potential-divider R526/R514 so that it switches on only when the negative-going pulse appears at its emitter. When Q505 switches on its collector voltage falls, switching Q507 on. Q507's emitter voltage then falls to chassis potential. This has two effects. First Q503 is switched off because its gate bias has been removed. Secondly D507 conducts, switching Q502 on.

The field flyback pulses generated at the collector of Q502 are fed to pin 11 of IC801 as the V prot signal, see Fig. 35. This provides an indication that the field output stage is working. If IC801 does not detect the negative edge of this pulse, it assumes that the field output

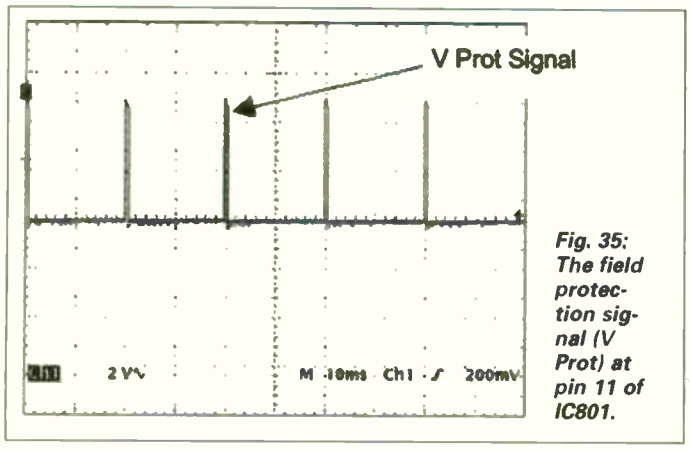


Fig. 35: The field protection signal (V Prot) at pin 11 of IC801.

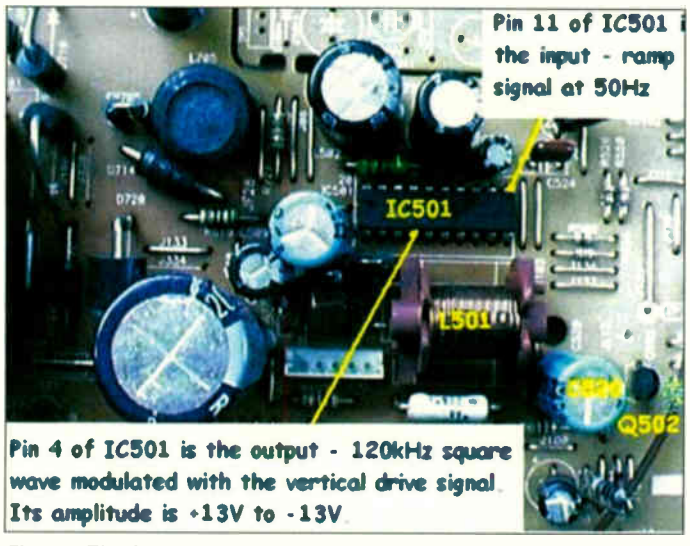


Fig. 36: The field output stage, component side of the PCB.

stage is not working and blanks its RGB outputs.

Fig. 36 shows the field output stage from the component side and Fig. 37 the layout on the print side of the PCB.

Field timebase faults

Most field-scan faults are caused by software corruption or output IC failure. If the EEPROM gets corrupted it can cause severe vertical distortion, no drive, or foldover at the top of the screen. An EEPROM problem can be solved by blanking it, using the blanking OTP (see later). As the audio and field output ICs are the same, a substitution check will prove whether the field output IC is faulty.

When a 56FW53H set is fitted with a Thomson tube, check that EEPROM location F7 on page 0C is 0D. This location controls the field blanking point and, if set incorrectly, can cause red, blue and green lines to flash intermittently at the top of the screen. The setting can be incremented to 0E, 0F or 10 if necessary. 10 is the maximum allowable value – any higher setting will result in an unstable blanking level. If the symptom persists with a setting of 10, there's a fault elsewhere in the chassis.

Field collapse produces the blank-screen symptom. To avoid a line being burnt on the screen in this event IC801 monitors, at pin 11, the field flyback pulses. It blanks the screen when these pulses are missing, by shutting down its RGB outputs. When the blank-screen symptom is present, check for 50Hz pulses at an amplitude of 5V at pin 11 of IC801. They may be missing or corrupted because of a fault in the flyback circuit. The

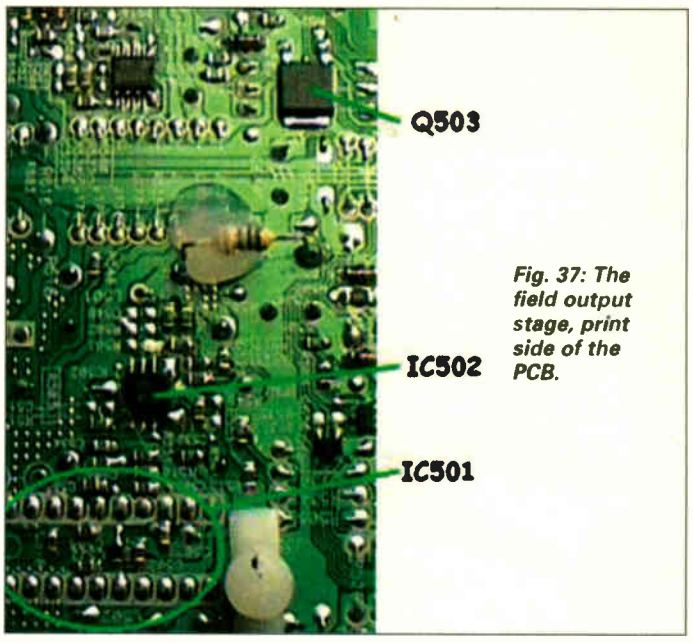


Fig. 37: The field output stage, print side of the PCB.

usual cause is that Q502 and/or Q503 is leaky or short-circuit. In this case the 25V supply will probably be low.

Red, green and blue lines may be seen at the top of the screen. This normally means that the automatic grey-scale correction lines generated during the field flyback period are not being blanked correctly. Adjustment of the A1/G2 setting on the line output transformer will normally cure this problem. It is possible for the fault to be caused by incorrect operation of the field flyback circuit however. First check that the +25V supply generated by D510/C520 is not low (below 18V) and that there is no excessive ripple here. If there is a problem in this area, the flyback circuit is unable to generate a high enough pulse to send the beams back to the top of the screen. It is not unusual to find that C520 or the feed resistor R530 (10Ω, shown as R617 in Fig. 22) is faulty.

If there is severe vertical distortion or a very small picture, pin 12 (mute) of IC501 may not be at 5V. At any voltage less than 2·7V the IC's output will be attenuated by 70dB. The cause could be failure of C511 or R509.

Foldover at the bottom of the screen when the set has been operating for about fifteen minutes can be caused by failure of the 100nF surface-mounted capacitor C505. Replace it with a capacitor from Sharp, part no. VCKYTV1HF104Z.

Next month

Next month we'll continue with the operation of the audio circuitry and fault finding in this section of the receiver.

Table 3: TDA7480 pin details

Pin(s)	*Nominal voltage*	*Function*
1-3	–13·1V	Negative supply
4	0V	PWM output
5	–2·5V	Anode of internal bootstrap diode
6	9·9V	Connection to external bootstrap capacitor
7	0V	No connection
8	0V	Connection to external feedback integrating capacitor
9	–11·8	Connection to external frequency-setting resistor
10	0V	Signal earth
11	0V	Input
12	5V	Standby/mute control
13	0V	No connection
14	14·1V	Positive signal supply
15	–2·5V	Reference voltage
16	14·1V	Positive power section supply
17-20	–13·1V	Negative supply

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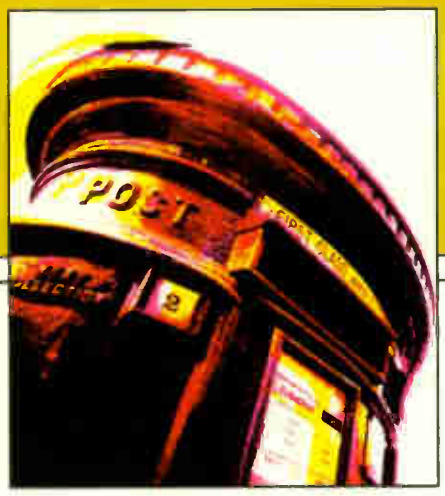


DTT redundant?

I had to laugh when I read the item headed 'Aerials for DTT' in Teletopics (September). After all the misleading publicity about how good DTT is, someone has finally admitted that "because the characteristics of DTT reception differ significantly from those of analogue TV reception, it's much more difficult to ensure that an aerial installation will be satisfactory". Those of us in the trade always knew this.

Where do Monkey and Johnny Vegas fit into this? According to them, when it was still ITV Digital, all you had to do for super digital pictures was to pick up a box from your local dealer and glue it to the end of your existing aerial. Over much of the country this simply didn't work. Since the reworking and renaming of the service, it has been improved technically and the signal is more robust. Yet the Digital TV Group still says that the aerial system is of paramount importance for the system to work – you can get problems because of co-channel interference, multipath reception, marginal signal strength and overloading. Perhaps my memory is becoming foggy, but weren't all these problems going to disappear as a result of DTT's marvellous error-correction systems and the extreme robustness of the digital signal?

We already have a perfectly good digital TV delivery system, via Astra. Once you've bought your DTT box then paid out anything up to £150 to get your aerials sorted out, you can receive a service that's of limited technical capability because of bandwidth limitations and can, for the same reason, never be expanded to include the premium channels. You might as well go for Astra.

Satellite broadcasting is superior: the signals can be received relatively easily and cheaply almost anywhere. We now have a sorry mess of a broadcasting system. All that was needed was a little co-operation between all parties. Once again the politicians got it wrong.

Geoff Darby,
Earls Barton, Northampton.

Fire hazard

When I took the back off a Bush Model WS6671 (Vestell 11AK19 chassis) recently I noticed, printed on the top right-hand side of the PCB, the words 'risk of fire'. Too true! The fault was a dry-joint at C613 (12nF) in the EW diode-modulator circuit, and the associated fusible resistor R629 (2·7Ω) had in turn been fried. This seems to be something of a design muck up. Had the genius who was responsible thought about it, a fusible resistor that's designed to go open-circuit in the event of an overload in the circuit it protects is likely to get hot and should therefore be mounted on long leads in mid air, not close to the PCB. As a result R629 burnt a hole in the board the size of the Grand Canyon, and carbonised some of the board as well.

All was not lost as I persevered, cleaning up the PCB with a fibre pen, and mounted the replacement fusible resistor in mid air. Otherwise the set would have been consigned to the skip. So yet another big waste was avoided.

The EW coil was also damaged, and it took some time to obtain a replacement. I was told that there is quite a demand for it.

Ray Withey,
Edinburgh.

Reliability

During the Seventies and Eighties I was a regular contributor to this magazine. I've long since left the trade, but still buy the magazine regularly. Recent reports on the demise of the service industry as we knew it, because of the greater reliability of modern sets and the 'throw-away' approach that cheap new equipment has brought about, lead me to relate the following story.

Way back in 1979 a friend of mine bought two 'nearly new' Philips sets fitted with the G11 chassis. By nearly new I mean that they had been in use for about six months in a hotel. New owners and a change of regime meant that they were no longer required. So my friend snapped them up for his own use. I gave them the once-over at the time, and also carried out a little experiment that I'll come to shortly.

Twenty four years on the sets both remain in daily use and work perfectly. I had replaced the notorious HT reservoir electrolytic capacitor in both sets. In one set I'd had to replace the TDA2600 field timebase chip, the two EW modulator diodes, and attend to dry-joints all over the place. But both sets have their original CRTs and line output transformers, also the original line output transistors and power supply thyristor rectifiers. Even the troublesome beam-limiter transistors on the power panel are the same.

Why? Maybe because of the little experiment I mentioned earlier. At the time I decided to see how low the nominally 152V HT voltage could be set without materially affecting the performance of the sets. I found that it could be reduced to 142V with no noticeable effect on picture quality. There was a slight reduction in both the width and the height. This was only to be expected, and was easily corrected by slight adjustment of the appropriate timebase presets.

Although it has always been said that under-running a receiver is as detrimental as over-running it, I can only assume that the de-stressing effect of my adjustments was the reason for this remarkable longevity. Either that or an amazing coincidence – remember that we're talking about G11s!

I would be interested in any opinions readers may have about this.

Steven Knowles,
Enfield, Middx.

Polarity protection

With reference to Jim Littler's letter (October) concerning protection against reverse-polarity battery connection, a simpler solution is to add a bridge rectifier to the battery input of any device that's to be used with a car or truck battery. I have done this many times – and have watched

with amusement the expressions on people's faces when I have swapped the battery connections over and the piece of equipment still works!

Fig. 1 illustrates this.

David Mawtus,
Scarborough, North Yorkshire.

Vintage radio repairs

I was very interested to read Pete Roberts' article on the Bush Model VTR103 transistor radio in the October issue. More on vintage radio please!

You can always recognise the VTR103 with its red pip at the end of the telescopic FM aerial. I have one in my collection (cream coloured front and back with brown rexine sides). It works on all three bands but the VHF quality is not so good. I might replace the AF115 transistor in the VHF mixer/oscillator stage with an AF125, as Pete suggests, to see if this provides any improvement. I don't think anyone has interfered with the VHF alignment!

The large, circular Perspex tuning knob on the front of the VTR103, TR82 and the original MB60 valve mains/battery model was always difficult to remove. I usually try to place an old cloth under and around the knob and try to get an even 'pull' on it. Don't bend the pointer in the process! If any damage to the knob does occur, a replacement can be found from a scrap DAC70 or VHF90C valve radio. It's a good idea to put some vaseline on the control shaft and on the inside of the control knob, where the shaft goes in, so that the knob can more easily be removed should the need arise. Like Pete, I've never had to replace those Hunts Mouldseal capacitors in these transistor radios. The only time that I replace them is in valve radios.

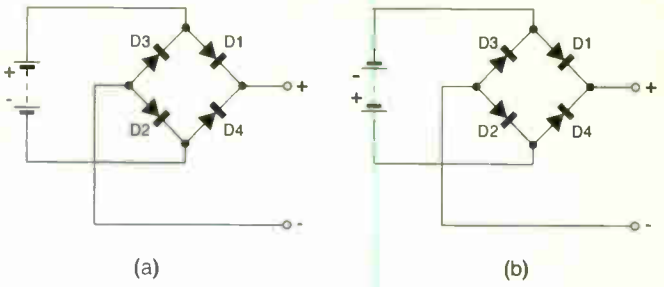


Fig. 1: Addition of a bridge rectifier between a battery and the equipment it powers. It doesn't matter which way round the battery is connected. In (a) diodes D1 and D2 provide the connection, in (b) diodes D3 and D4 do the job.

The backs of these transistor sets often suffer from damage. They are usually held by a coin-screw that gives access to the battery, but people try to lever the back off with a screwdriver. Hence pieces of missing plastic around the sides of the back. In addition some previous owners drill out holes in order to install various sockets, which never get used, in the back of these sets. The back looks very tatty in this condition. So I fill the spaces with epoxy resin and try to match the original colour.

Mike Horne,
www.mikesradio.freeservers.com

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 or email to t.winford@highburybiz.com

Wanted: Remote-control unit for the Manhattan 9000 stereo satellite receiver, also operating instructions. Willing to pay for these or does anyone know where I might purchase them? Phone Mike Commelford on 0771 525 8580 (Chesterfield).

Wanted: Line output transformers (oil-filled) for the Murphy Models V290C and V320A, which date from around 1956-58. I am also looking for a Murphy Model V410 or V430. Full costs paid. Phone Trevor Goodenough on 01563 540 444 or email trevor@goodenough.freeserve.co.uk

For disposal: A Commodore Vic 20 computer with cassette deck, manuals, tapes and power supply. Believed to be working but needs good clean and some TLC. Free for collection (Bishops Stortford). If interested, please email David Martin at dandjmartin@ntlworld.com

Wanted: Service manual for the Technics SA-DV170 stack audio system incorporating a carousel DVD player. I have sorted out the power connection problem but one channel of the base unit, which also contains the power supply, is dead. Can anyone help? D. Housley, 30 Arncliffe Drive, Heelands, Milton Keynes, Bucks, MK13 7LH.

Wanted: Old half-inch diameter ferrite rods. Must be six inches or more long. Willing to pay very good money for them. Peter Tankard, 16A Birkendale Road, Sheffield, S6 3NL. Phone 07931 463 823 (mobile) 9 a.m. to 10.30 p.m.

Wanted: A TMP47C834N R165 microcontroller IC for the Philips TV Model 14PT156A/05. G.T. Singleton. 59 Garstang Road, Catterall, Preston, Lancs, PR3 0HD. Phone 01995 606 864.

Wanted: Circuit diagram (photocopy OK) for the Schneider Model STV2801, or any information on the power supply and line output circuitry. The set is lifeless and I suspect a power fault. IC102 could be faulty but the number cannot be seen. Donald Bills, 46 Blewitt Street, Pensnett, Brierley Hill, Dudley, DY5 4AN.

Wanted: For spares. Quad 303 and 405 power amplifiers, 33 and 44 preamplifiers and FM2 and FM3 tuners. Working or non-working. Phone Mike on 01758 613 790.

Wanted: Can someone out there help or at least point me in the right direction? I have a DVD player that provides S-video and composite video outputs, but the TV input I wish to use expects to see YUV or Y/Cr/Cb. The only converter I can find listed is a semi-professional multiple switched input device that also gives an RGB output but is far too expensive at almost £300. It will obviously do what I want, but has too many extra bits I would never use – I need simple S-video in to YUV out. I'm sure I can't be unique in requiring such a device! Phone Mike Harris on 0161 485 1621 (Cheshire) or (mobile) 07966 377 684, or email mike.harris@ukonline.co.uk

Wanted: Tigan loudspeaker cloth, large size. Phone Steve Beeching on 01636 626 895 or email steve@grovefarm.force9.co.uk

Wanted: Manual (photocopy OK) for the Telequipment S54A oscilloscope. Your price paid! Phone Steve (M.D. Stevenson) on 01702 522 929.

Wanted: Working teletext PCB for the ITT Compact 80-R-DST chassis, a remote-control unit for the Sony Betamax VCR Model SL-C30UB, and a tuning tool for the Ferguson TX90 chassis (it operates the AFC). Phone Mark on 01268 414 654.

Wanted: Remote-control IC type μPD550-25 for the Hitachi music centre Model SDT900. I know it's an oldie, but someone out there must have one. Please have a good look! Phone Stan (Stanley Swales) on 01924 829 653 (Wakefield, West Yorkshire).

Wanted: Spare parts for the Bush MB60 valve mains/battery radio, and control knobs for the Pye Fenman II valve radio (they suffer from brittleness and don't come away from the set easily!). Please email Mike Horne at mike@jhorne62.freeserve.co.uk

DX and Satellite Reception

Terrestrial DX and satellite TV reception reports. Broadcasting news. LNB-dish matching. Interference from PLT. Roger Bunney reports

People blocked the main routes out of New York during the power outage in NE America in early August. This shot, from WCBS, was received via NSS-7 (21·5°W).

During August there was a remarkable spell of hot weather, broken by colder weather from the north with rain from the 28th. The very settled high-pressure system from the 4th produced the best tropospheric propagation for some years. A noteworthy feature was the first Band III DAB-DX!

Tropospheric conditions improved from about the 3rd, giving sustained reception from Scandinavia, Denmark, Germany, France and the Benelux countries in all TV bands. On several days Band III and the UHF bands were jammed with signals. Highlights were reception of SVT-1 Vannas (Sweden) ch. E2 and YLE Tervola (Finland) ch. E3 while, of particular interest, Cyril Willis (King's Lynn) achieved the first recorded Band III DAB-DX, with reception from many stations in the Benelux countries and UK regionals at up to about 200 miles. So we now know that terrestrial digital DX is possible. After two weeks of excellent reception, the opening began to falter on the 16th.

Sporadic E conditions were also very active. Here's the SpE log:

3/8/03 TVE (Spain) ch. E3; RTP (Portugal) chs. E2-4.
4/8/03 TVE E3.
5/8/03 TVE E2. 3; RTP E3; RAI (Italy) IA.
6/8/03 NRK (Norway) E2, 3; SVT (Sweden) E2-4.
7/8/03 RAI IA; Tele A (Italy) E2–; C+ (Canal Plus, France) L2.
8/803 MTV (Hungary) R1; RTP E3.
9/8/03 NRK E3; RAI IA; TVE E2.
10/8/03 RAI IA, B; HRT (Croatia) E4.
14/8/03 RAI IA, B; BT (Belarus) R1; RTP E3; RTL (RTL Klub, Hungary) R2.
15/8/03 UT (Ukraine) R2; MTV R1; RTP E2, 3; TVE E2-4.
16/8/03 MTV R1.
17/8/03 NRK E4; RTL KL R2; MTV R1; RAI IA, B; TVE E2; TVE-IZ (Izana, Canary Is) E3; HRT E4; Dubai E2.
18/8/03 NRK E2-4; YLE (Finland) E4.
19/8/03 BT R1; C+ L2.
20/8/03 RTL KL R2; UT R2; RTP E2; TVE E2, 3.

During several late-evening spells of SpE reception from Spain the signals fell to a low but viewable level for some hours. On the 20th TVE ch. E2 produced late-evening signals that rose to very high levels with severe hum, almost like Auroral propagation. Odd.

All in all an excellent month.

Satellite sightings

During the late afternoon on August 4 there was the largest power outage in NE America for years, affecting an area from Ohio to New York and the Great Lakes to Pennsylvania. When I checked NSS-7 (21·5°W) for breaking news I found very fragmented reports via CNN Newsource at 11·563GHz H (SR 6.109, FEC 3/4). There were live helicopter-camera shots that showed a mass of home-going New Yorkers blocking the freeways, roads etc., and pictures from the WCBS and WNYW TV stations. These were interrupted several times for studio inserts to provide updating reports, I assume from the CNN NY bureau as there was an NY1 corner ident logo. Between these news inserts studio technicians and on-screen presenters attempted to gauge the power-loss area, with phoned-in reports from affiliated stations. When I rotated the dish to 12·5°W (Atlantic Bird-1) there was a total absence of signals – the outage had closed down the teleport. But later in the evening the GlobeCast downlinks returned. The CNN uplink teleport is at Atlanta, Georgia, which was outside the blackout region.

Less than an hour before the East Coast blackout President Bush was seen at the US Marine Corps Miramar Airbase, California, where he made a patriotic speech to marines recently returned from Iraq. The speech was carried by CNN Newsource.

The major bombing at the UN's Baghdad HQ on the 19th brought several satellite uplinks there into operation. APTN was running at both 10·961 and 10·964GHz V (4,167. 5/6) via Eutelsat W1 (10°E). Content concentrated on rescue work, with numerous

live reports back to networks in Europe and the US. ITN's Martin Giessler for example used the 10·964GHz channel. A couple of days earlier an American news package via Eutelsat W2 (16°E) at 12·533GHz H (5,632, 3/4) featured a large water main that had been damaged by an explosion, flooding the surrounding area. The same day an oil pipeline was blown up.

Eutelsat W1 is a major carrier of news and sports. Interesting that a rare N. Korean feed was seen on the 3rd. At the time the Israeli Satlink facility was present at 12·741GHz V (5,632, 3/4) with a threshold-level signal (1,425). At the end of a programme with Chinese-script captions a fluttering N. Korean flag (star in the middle) was seen, followed by colour bars then a blank screen. It seems to have been a relay of the main Pyongyang TV channel and, I suspect, was carried for the final Satlink network news broadcast. Satlink continued with a carrier, and later fed APTN footage from Jerusalem and Ramallah.

On the 9th it was the Mey Highland Games with Prince Charles and Camilla in attendance. Their appearance was the main reason for a sat truck to be present, since the sporting events were very parochial – tug of war, tossing the caber, and an odd game that required each contestant to hurl a large weight above his head while standing under a jumping-frame cross bar, then avoiding the weight crashing down on his head a few seconds later! There was a pleasant and happy crowd in that distant Caithness field. Seen via Eutelsat W1, the APTN UP4 feed, at 10·970GHz V (4,167, 5/6).

One evening in middle of the month I checked the Atlantic Bird-1 GlobeCast transponder at 11·014GHz H (20,145, 3/4) and found that the Channel 1 circuit carried a 'GlobeCast Miami Fl' ident. A check on the signal level with the RSD information menu showed a normal 70 per cent level, but the inlaid serial ident on the level bar alternated between the usual 'standard hop', 'hop 3', 'hop 4' and 'hop 8'. Very odd. Another oddity has been the transmission identified as 'Service 1' from Europe*Star-1 (45°E) at 12·678GHz V (6,109, 3/4). It carries the serial ident 'NDS Network', so it's obviously a TV feed. Although I've monitored the carrier on most days I've never seen video content.

HellasSat (39°E), which was launched to provide coverage of the 2004 Olympic Games in Greece, provides regular transmissions at 10·976GHz V (5,632, 3/4). Alan Richards (Nottingham) came across a Euro-political discussion here, with interpreters and four audio subcarriers for different languages. The transmission ended with a Greek-language documentary on the Olympics and a news update on construction progress at the venues for the various events. The service ident was unusual – 'Mountain 1'. Alan also found French-language content from Ethiopia, Mozambique, Cameroon and the Congo via the Atlantic Bird-2 (8°W) GlobeCast transponder at 11·501GHz H (6,111, 3/4) during each weekday evening in mid-July. All rare sightings.

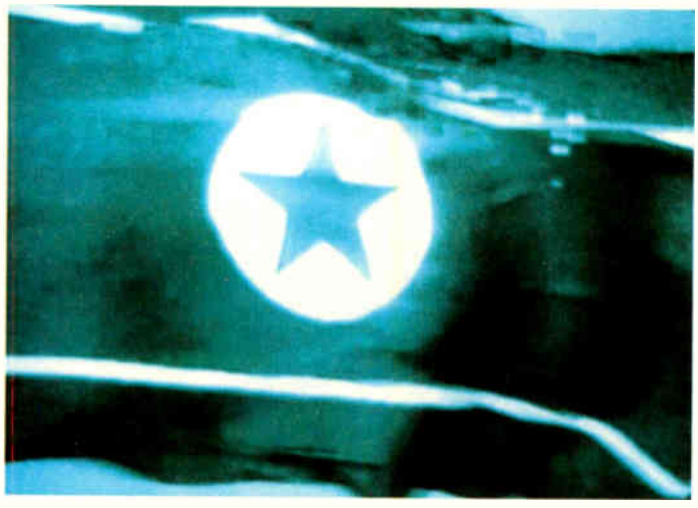
The Montenegro downlink via Atlantic Bird-3 (5°W) has been affected by jamming. Check at 12·642GHz H (3,885, 7/8).

Edmund Spicer (Littlehampton) viewed a major NASA press conference via the Atlantic Bird-1 GlobeCast channel 1 feeder following publication of the damning official report on the Columbia shuttle disaster. The NASA chief answered questions from its staff and interested parties. Clearly things will change.

News

The 2003 NAB convention revealed considerable broadcaster interest in the use of MPEG-4 video compression, which can be almost twice as efficient as MPEG-2. Recently developed bridging technology enables the two to be used together as deemed best, probably MPEG-2 for in-house purposes and MPEG-4 for transmission and broadband video applications.

Microsoft is increasing its presence in the broadcasting field with the Windows Media 9 system that was introduced last year, including the H264 and WM9 software packages. WM9 is already being used by Associated Press for rapid compilation and transmission of despatches to the newsroom from battle zones etc. via satellite phone. Panasonic is using WM9 for digital content management in sports and archiving. Tandberg TV is exploiting it for encoding video and audio, achieving remarkable quality with bit rates less than half that required for the equivalent quality with MPEG-2.



Closedown of Pyongyang TV (N. Korea), seen via Eutelsat W1 (10°E).

There's clearly a move to the use of increased signal compression in the broadcasting world.

Peter Merrett of Sciteq Pty Ltd., Australia, reports in the NZ trade magazine *SatFACTS* on a digital satellite receiver fitted with a new low-threshold tuner developed by Sharp. It achieved a signal level of 50 per cent compared with 20 per cent, going into pixellation, with a standard tuner. Sharp produces an extremely wide range of satellite tuners for digital equipment.

Edmund Spicer took this photo of the BT TES-43 satellite truck at Littlehampton.

Radio Marti and TV Marti, the US government-backed broadcasters to Cuba via a balloon at some 10,000ft above Key West, Florida, are to start broadcasting via satellite in order to overcome jamming. Ku-band downlinking capacity has been leased aboard the Hispasat satellite at 30°W.

The Russian ORT TV channel is being made available to US cable operators by Ascent Media Network, via Intelsat. The channel is received in London, sent via transatlantic fibre-optic cable to the New York AMNS switching centre, then on to International Channel Networks, Colorado for distribution.

LNB-dish matching

Recently Roy Carmen mentioned that the performance, i.e. signal output level, of his 1m Triax dish seemed to be the same as that of his 1·2m Channel Master dish, though the claimed performance of the two LNBFs used is similar – an LNBF is an LNB with integrated feedhorn. I am wondering whether the cause could be poor LNB-dish matching with the larger dish. I use a 1·2m Channel Master dish myself and am happy with it – apart from the fact that it becomes rather grubby and requires an annual clean off. My main concern in dish selection was a smooth polar response with minimal secondary lobes. Trying for example to receive low-level signals from Eutelsat 2F1 (21·5°E) with its inclined orbit (2·3° drift) is a challenge, being next to the Astra 1 powerhouse at 19·2°E. The polar response of the Channel Master dish seems to be excellent.

I've seen many glowing references to Triax equipment. Certainly the company's terrestrial aerials are first class, and its dishes are also said to be excellent. Roy has always tended to try the latest, lowest-noise LNBs as they appear on the market, to optimise performance with a smallish dish. Inevitably these are LNBFs. Most dishes used for reception from Hot Bird are up to 70-80cm in diameter, perhaps slightly larger in the far north. It occurs to me that LNBFs might be optimised for use with smaller rather than larger dishes. For optimum performance the feedhorn must 'see' the surface of the dish with minimal overlap, as overlap introduces noise. Conversely low-cost LNBFs may not see the whole surface of a larger dish, thus failing to produce maximum possible output. My own Channel Master dish uses a dedicated Channel Master feedhorn and flange assembly – the LNB is bolted on to the rear C120 flange of the feedhorn. This is referred to as an LNB+F. It ensures – I hope! – that the feed and dish match.

While Roy and I were considering the dish v. LNB(F) situation, an article on testing and evaluating LNBFs for digital signal reception appeared in *SatFACTS* (May 2003 issue). It included a small section on "lowering the noise wall". I quote from it: "In marginal reception situations you have only two choices – to get more signal or reduce the noise wall." This means use a higher-gain (larger) dish or improve the noise performance with a lower-noise LNB. The article points out that many people, when using an offset dish, neglect to use an LNBF whose 'feed pattern' is designed to see the physical shape of the dish correctly. A shaped dish requires a 'shaped feed pattern'. In theory a dish and LNBF should be sold as a matched pair. Otherwise the LNBF used may have been designed for a dish with a different shape, thus reducing the performance and polar response. In the UK dishes and LNBFs tend to be sold separately, which could explain why the expected performance is not achieved.

Bill Wright (www.wrightsaerials.tv) has carried out a few tests with a cheap 0·6dB noise LNB and signal analyser and found that ground noise was on average 7dB higher than sky noise. The comparison was with the LNB pointing at the sky and then at the ground, buildings etc. Aiming it at a tree produced similar readings to ground noise. These measurements were made at night: solar radiation might increase the noise during the day.

An LNB that sees beyond the edge of a prime-focus dish will pick up ground noise. Ground noise is less with an offset dish, as the LNB is aimed upwards. But in either case a response with minimal side lobes is important. Offset feeds are usually flared to optimise pick-up efficiency. Bill also comments that commercial dishes have a non-reflective skirt around the rim, perhaps to minimise man-made and thermal noise.

Interference from PLT

The following is not relevant to DX-TV or satellite reception. But many readers are in the trade, while others DX on the MW and SW bands, and may thus experience the problem.

Perhaps 18-24 months ago I mentioned concern in amateur radio circles about a new form of communication, PLT (Power Line Telecommunications) – sending data to houses, offices etc. via power lines. The EMC column in the June 2003 issue of the RSGB journal *RadCom* discusses two types of PLT, Ascom and Mainnet. Ascom uses up to three carrier frequencies, 2·4, 4·8 and 8·4MHz, with a 1MHz bandwidth. Mainnet uses a single carrier with a wider bandwidth, 4·25-6MHz. With both systems the sidebands tail off slowly, so the bandwidth is far in excess of the nominal one.

Dave Lauder, who has written the EMC column in *RadCom* for many years, has warned that PLT would cause serious disruption to amateur radio and SW transmissions if adopted. The government seems to be encouraging it. PLT trials have been carried out at Crieff in Scotland, and have been threatened for the Winchester, Hants area. Ominously, there was a mention of PLT tests recently in the business section of my local paper. It's now the end of August and I suspect that the Winchester tests have begun.

White noise and a sharp buzzing, with a rapid pulsing noise (several pulses per second), have become audible on the MW band from about 750kHz, increasing in level with frequency. By 1,400kHz the noise can be heard on weaker MW signals. At 1,600kHz a communications receiver measures S7 on the S meter scale. At 1,820kHz the reading rises to S9, and remains at this level up to 2,600kHz when it drops to S7. Tuning higher, I find that the noise falls to S6 but increases to S8-9 from 4,400kHz through to 6,200kHz, with white noise plus buzzing. It falls to S7 at 7,000kHz, then tails off into general SW noise from 7,300kHz.

Being involved in MW-DX I am aware of general MW conditions and know that this is a new and wideband form of interference. It clearly affects MW broadcasts, which is disturbing. The RSGB website that covers the Crieff PLT tests has sound clips of the Ascom system. These show a close resemblance to what I am hearing at my location. I have reported the problem to the RSGB and am making representations to the local electricity supply company. But big business interests are involved! I'll report further as things develop.

The following RSGB site contains the Crieff information: http://www.qsl.net/rsgb_emc/crieff ■

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AUDIO FAULTS

Reports from Geoff Darby Charles Coultas and Chris Bowers

We welcome fault reports from readers – payment for each fault is made after publiation. See page 40 for details of where and how to send reports.

Yamaha CRXM5

If one of these comes in and you suspect the laser unit, be very careful how you quote for the job. I would suggest that you allow a good two hours for labour if the laser unit is type KSS580.

There are two reasons for this. First the laser unit is not very easy to get at. You will spend twenty minutes or so getting to the point where the changer is out and you can see the deck itself. Secondly and much more importantly, you have to change the laser unit to type KSS710A. Although this is physically similar to the KSS580 in general mechanical terms, its connections and electrical characteristics are entirely different. So it comes with a kit of parts and two large sheets of modification instructions and diagrams.

The modifications involve removal of links from the PCB, removal of a number of surface-mounted resistors, replacement of others with resistors of different value, print cuts, and the addition of standard carbon resistors and a lot of wires across the back of the board. All this is after you've actually removed the main board of course.

In all fairness the instructions are fairly comprehensive, though a little misleading in places. For success you must follow the numbered instructions completely blindly. Do not attempt to figure out what you are doing by referring to the modified circuit diagram, as this will mislead you. All the resistors you are told to remove in the first couple of steps are still in the circuit diagram, but are shown with new values, in red. This is not correct. They should just be removed, and left removed, as the instructions say.

When it comes to the print cuts and adding the wires and external resistors, refer to the print layout supplied for help with interpreting instructions like "short the No 10 pin of PN801 to the No 9 pin cut above (the +side of C823)". You'll need good eyes or a magnifier to see the modifications clearly on the print layout. But they are there, and are correct. The procedure is not helped by instructions like "remove chip resistor R830 (silkscreened as R832)". Yes, R830 and R832 are marked incorrectly on the board but are shown correctly in the circuit diagram! One of them has to be removed and the value of the other has to be changed, so make sure you get them the right way round. Also one of the carbon resistors that has to be fitted has a value of 100Ω. The resistor supplied has this value, but its packet is incorrectly marked 100kΩ.

Finally there is a problem with the flexiprint connection tail from the replacement laser unit. It's upside down in comparison with the original, so it has to be twisted over before it can be inserted into the connector that joins it to the long white flexiprint which goes up to the main board. Be careful to do this close to the connector. Otherwise, even though the tail comes round a piece of plastic that should isolate the moving part from the fixed part, the twist can migrate up to the transition point and make the laser run stiff on its tracks.

Once I'd carried out these modifications a further twenty minutes were required to reassemble everything. I was then rewarded with a fully working unit. I dread to think what I would have done had it not worked. You certainly wouldn't want to put the original laser unit back, and such a situation would probably leave you seriously concerned as to whether your original diagnosis had been incorrect or you had made an error in fitting the modification kit. **G.D.**

Sony STR-DB940

This gigantic AV amplifier arrived on the bench with a note to say that it "makes a buzz from the sub". I soon discovered that the output to the sub had quite a high level of treble on it intermittently instead of being pure sub (bass). This odd behaviour could be instigated by slight movement of the flexiprint between the main PCB and the 'vol' sub-PCB.

No amount of cleaning of the connectors or foil tails at the flexiprint's ends would correct the problem. I was loath to believe that the cable itself was faulty, as it was quite thick and had never been stressed with tight bends near its ends. Eventually however I decided to order a replacement. When this had been fitted the problem was no longer present. **G.D.**

Sony HCD-MD313

This CD/MD player/radio/amplifier was brought in because 'no disc' was displayed when a CD was inserted. Without thinking too much about it, I suspected the optical block and ordered a replacement. But when it was fitted the fault was still there. I then noticed, as I should have done before, that the CD wasn't rotating. So maybe the optics had been OK after all.

Investigation into why the motor was not rotating led nowhere. The motor worked all right when it was tested with a 1·5V battery, and the sled and focus seemed to be working normally. I replaced the motor/focus/sled drive IC, but this made no difference.

Much delving around with the scope didn't help, but I then found that focus search was missing. I sat back and thought about the problem. Perhaps the disc doesn't spin until some positive result is obtained from the focus search. When I scoped the output from the focus-coil drive IC it was cycling up and down but the lens wasn't. A little further investigation showed that the flexible, flat cable to the optical unit was damaged. I also realised that I had forgotten to remove the solder short that protects the laser when the optical unit is in transit! I probably damaged the flat cable with all the messing about I subjected the drive to.

A new flat cable and removal of the solder short put matters right. **C.C.**

Sony MZ-R90

There was no recording with this MiniDisc unit. A look inside revealed the cause: the overwrite head didn't come down because of a defect with the HC gear, reference 113. A new gear, part no. 4-222-215-01, restored normal operation. **C.B.**

Sony ICF-SW7500

This small LCD radio produced an IC-type cracking noise after five-six minutes with FM operation only. A look inside, on the B side of the main board, revealed that the small surface-mounted electrolytic capacitor C69 (220μF, 4V) had started to leak on to the board. A quick board clean up and replacement of the capacitor, part no. 1-126-246-11, restored normal FM sound. **C.B.**

Sony MZ-R900

This silver MiniDisc player had a broken LCD module. I've had this problem several times. You have to fit a replacement module, part no. 1-804-171-11. Units with serial numbers CED325801-326000 are prone to this fault. **C.B.** ■

MONITORS

Fault reports from Gerry Mumford and Ian Field

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

Reports can be sent by post to:

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

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

Taxan EV760TCO95

This dead monitor produced the usual clicking sound of the trip action. Checks in the line output stage revealed that D104 (BY329-1200) in the EW diode modulator circuit was leaky. When the monitor was tested after fitting a replacement it powered on very briefly, with a massive burst of EHT, then started to trip again. This time the line output transistor Q106 (2SC5048) had gone short-circuit. The massive burst of EHT before its demise gave the game away: the real cause of the fault was the line output stage tuning capacitor C105 (6·2nF, 2kV) which was open-circuit and, when removed, was seen to have a slightly bulged appearance. Once these two items had been replaced the EHT was down to its correct level and the monitor produced a good display. **G.M.**

Viewsonic M70 (Model VCDTS21503-1E)

This monitor powered up with light from the green LED but no display. There was no EHT and a quick visual inspection revealed that C556 (100μF, 200V) on the secondary side of the power supply was leaking electrolyte. Replacement of this capacitor cured the fault.

Since the first occasion we've had many more of these monitors with this fault but, deceptively, the capacitor has always looked OK – especially in the Taxan variant that uses an almost identical chassis. **G.M.**

Viglen AX1595

This monitor was dead with a blown up power supply. The items one usually has to replace in this event are the 2SK2545 chopper FET Q301, the UC3842 controller chip IC301 and the 15V, 500mW zener diode ZD301. In this case we also had to replace the mains bridge rectifier diodes D301-4 (unmarked, use type 1N4007) and the current-sensing resistor, which consists of five 1Ω, 0·5W resistors connected in parallel (R306-R310). Once the replacements had been fitted we had a working unit with a good display. **G.M.**

Elonex/AST TE1438A

The complaint with this monitor was no blue. It had received previous attention which, to say the least, didn't help. Whoever had last removed the screening plate from the CRT base PCB hadn't bothered to unsolder the lugs! A vague attempt had been made to reattach the plate, but it fell off as I eased the CRT base connector off. I then noticed that the pads for Q205 in the green emitter-follower pair circuit had been pushed off the PCB. As I unsoldered the transistor the tracks fell off completely.

Once the missing tracks had been replaced with stout wire, and the PCB had been cleaned for closer inspection, I found that the blue cathode pin on the CRT base receptacle had pushed its solder pad off the PCB. The heater pins' pads had also lifted, but not severed the tracks.

The damaged solder lands for the screening plate's lugs were repaired by binding tined-copper wire along the edge of each slot. The best way to describe this repair method is that it's like the 'blanket stitch' without the fancy loop! After cleaning off the green varnish, you anchor a length of tinned copper wire at one end of the slot and repeatedly thread the wire around the edge of and through the slot, pulling it tight, so that it runs along the edge like a 'layer-wound' coil. Solder the tail end down at the end. to secure the turns and restore the integrity of the earth track if this has been broken.

Depending on the thickness of the tinned-copper wire used, the legs of the screening plate might be a tight fit. They can usually be eased in if heat from a soldering iron is applied at the same time. **I.F.**

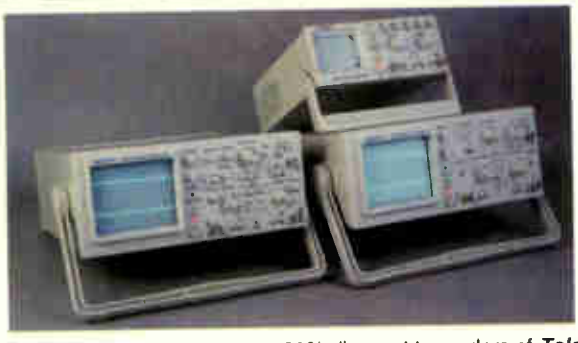
Apricot XJ52023

Sometimes a monitor comes in simply because a switch has been mis-set. This 17in. monitor spent some time making clicking noises before it started up and produced a distorted blank raster. So I decided to try the two slide-switches at the back: sync on/off and power saving on/off. When the sync on/off switch was moved from off to on the 'fault' completely disappeared.

The only difference the power-saving switch makes is that in the on position removal of either the H or V sync pulses shuts the monitor down, while in the off position removal of either the H or V sync pulses simply blanks the raster. The situation is no different whether the 15-pin sub-D or 5 x BNC input is used.

I am puzzled as to why a monitor would have a switch to cut off the sync input. As I don't have the manual I've no clue as to what purpose it might serve. To prevent a repeat performance I considered gluing the switch in the on position, but instead opted for a sort of compromise. I cut the sync switch lever flush with the screening plate and concealed it with tape. Thus it's not impossible to operate the switch should the need arise, but anyone intending to do so will first have to remove the tape.

I cut the power-management switch lever down to about half its length to reduce the chance of inadvertent operation. It's unlikely to stop the monitor working but could cause erratic operation while the PC is booting up and initialising the sync-ratio registers on its video output card. **I.F.** ■



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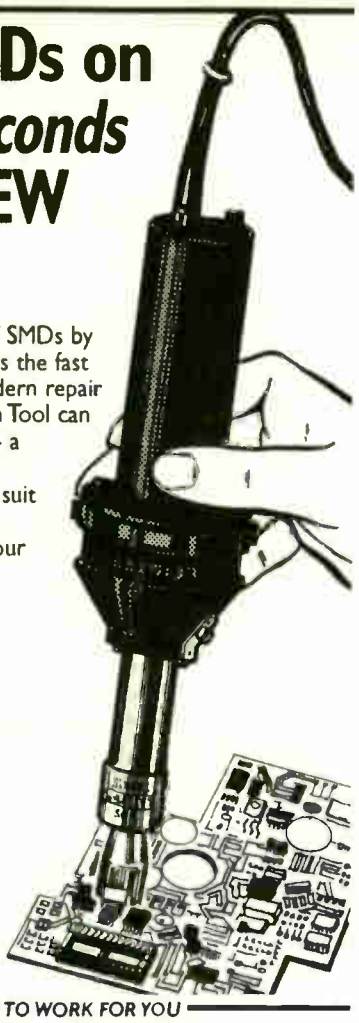

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VCR CLINIC

Reports from
Bob Flynn
Graham Richards
Andrew Duggan
Gary Laidler
John Coombes
J.S. Ogilvie
M.J. Abbott
and
Mark Tyerman

We welcome fault reports from readers – payment for each fault is made after publication. See page 40 for details of where and how to send reports.

Ferguson FV62 (R2000 mechanism)

There was no wind or rewind, though sometimes these functions would start then stop. All other functions were OK. The cause was traced to wear on the main brake lever (item K156) – it was worn underneath, where it contacts the clutch unit. Replacement cured the fault. The Ferguson part no. is 70420433. **B.F.**

Sony SLV-SE700 (S mechanism)

This VCR was dead with the input fuse blown. The cure was to replace the four 1N4005L bridge-rectifier diodes and the 2SK3047 chopper FET, which was very leaky. The TDA16846 chopper control IC was OK. **B.F.**

Hitachi VTM230E

The half-loading arm (item 256) was sticking on the cam gear underneath it. The reason for this was not obvious, but was found to be that the pinch roller was not secure on its shaft because the plastic sleeve had a split in it. **B.F.**

Toshiba V856B

The playback picture had spots in the background, the same as you get when the deck earthing is poor. Replacing CP051 (1μF, 50V) in the power supply cured this fault and also improved the display brightness. While I had the power supply out I also replaced CP041 (220μF, 10V) which causes dim displays, and CP007 (10μF, 50V) and CP008 (100μF, 25V) which cause no-power problems. **B.F.**

Saisho VR1200HQ/Matsui VX820

If the machine is dead with no clock display, though the standby LED lights briefly, go straight to the clock PCB and remove the five or six blobs of brownish glue, especially the one near the reset chip IC602. For no tuning check whether D2584 is open-circuit. **G.R.**

Sony SLV315

For full display illumination that's possibly intermittent, with maybe a whistling sound, remove the rewind/forward wind rotary-control assembly and dismantle it carefully. Clean the tracks and pins and reassemble. **G.R.**

GoldStar RC7031

This Nicam/VideoPlus VCR produced just a blue screen, with an occasional negative-looking picture appearing in the E-E mode. A check on the electrolytics C707 (4·7μF) and C727 (220μF) proved that they were faulty. The repair was completed by replacing the video coupling capacitor C710 (47μF) and the 12V supply decoupling capacitor C711 (47μF). **G.R.**

Sony SLV-SE70

There was no RF output/loop-through and no AV output. The cause was traced to Q607, which was dry-jointed. It's mounted on the print side of the PCB, near the power supply plug/socket CN600. **G.R.**

Ferguson FV81LV

The clock display could hardly be seen and dimmed even more when a function was selected. CP041 (220μF, 10V) in the display heater feed circuit was virtually open-circuit. While I had the power supply out I replaced the 10μF and 100μF electrolytics on the primary side as a precaution. **G.R.**

Akai VS66EK

The complaint was tape jammed with the loading motor running, also patterning in the E-E mode. After clearing the mechanism jam I scoped the 6V supply and found that there was lots of noise present. Replacement of the following electrolytic capacitors restored normal life to this machine: C1 (2,200μF, 35V), C6 (100μF, 25V), C15 (220μF, 35V), C24 and C25 (both 47μF, 25V). **G.R.**

Sanyo VHRH900E

This VCR was brought in with a tape partially loaded. When the tape had been removed the machine appeared to work normally. It was put on soak test, and after some time failed again. The tape was once more removed but this time, while the deck was finishing the loading cycle, it seemed to slow down. A new loading motor cured the problem. As a precaution, a new mode switch was also fitted. **A.D.**

Samsung SV209B

This machine chewed tapes and was very noisy in the FF/rewind modes. Removal of the gearing and idler assembly required some care. I then found that the centre gear was cracked.

This VCR uses the same deck as the **Toshiba V209UK** and other models. The centre gear is part no. BY730111. It's available from SEME. **A.D.**

Toshiba V703

This VCR's display was very dim. The customer wanted it fixed for sentimental reasons. Fortunately the state of C810/C813 gave the game away. They were leaking badly but hadn't damaged the print. **G.L.**

Hitachi VTM620

The complaint with this machine was that the E-E sound was missing at switch on.

The owner explained that it used to come on after a minute but now took ten minutes. So out with the hairdryer and freezer, which led me to the culprits – C407 and C411. **G.L.**

Philips Turbo deck

If tape playback is very jittery and the take-up spool is very jerky, fit service kit 1. It contains the changing gear, double gear and gear pulley. **J.C.**

Panasonic NVSD200 (K deck)

If one of these machines won't accept a tape, or intermittently won't do so, check the take-up sensor for dry-joints. **J.C.**

Samsung SV421

Tape chewing can be caused by a worn pinch roller of faulty mode switch. In this case however the idler assembly was tight. **J.C.**

Toshiba V631UK

A 'clicking noise' was the complaint with this machine. It seems to be quite a common problem with a number of Toshiba VCRs or, in some cases, the symptom may be a jammed mechanism that prevents loading. The cause of all this is a guide post that breaks off – the symptom depends on where the post lands. Its part no. is AC61-00122A. **J.C.**

Panasonic NVHD625 (K deck)

If there are loading problems or no FF/rewind etc. check the main lever unit, part no. VXL2307. It has a habit of cracking at one end. While you have the machine apart, check the loading-motor coupler (part no. VDP1434 or SEME VDC7540) for any signs of cracking. If in doubt, replace it. Also clean the mode switch. This will sort the machine out. **J.S.O.**

Sharp VCM27HM

This machine produced a blue screen in the playback mode, but the picture was OK in the FF/rewind search modes. On close inspection I could see that the top edge of the tape was being creased, as a result of which it rode up on the audio/control head. A replacement pinch roller put this machine back in working order. **J.S.O.**

Panasonic NVHD100

If there is no display check Q1701 (2SD973A-R) on the front display PCB. It tends to burn out. A BC337 can be used as a replacement. **J.S.O.**

Sharp VCA63HM

If the power supply is squealing replace C913 (47μF). **J.S.O.**

Philips VR6547/05

The complaint with this VCR, which is fitted with a JVC deck, was tape chewing. The cause was a faulty clutch assembly. This can be obtained from CPC under order code VSID469. The Konig 1493 will fit, but the pulleys have to be swapped. **M.J.A.**

Toshiba V720UK

This machine wouldn't play tapes because there was no take-up. The boss on the gear centre assembly was cracked. Part no. is BY730111. **M.J.A.**

Goodmans TVC146

The fault with this TV/VCR combi unit was no power. I found that the power switch SW08 was dry-jointed, ready in fact to fall off the board. **M.T.**

Ferguson FV44

This VCR had a very dim display. Replacement of C28 cured the fault. **M.T.**

Test Case 491

Test Case Rentals does not claim to have the richest clientele in the world. The situation is quite the opposite in fact, and prepayment meters, bread-and-butter TV sets and a diminishing number of VCRs are the stock-in-trade: exotica such as plasma screens figure hardly at all in the inventory. There are a few score Sony SLV-SE720Gs amongst the VCRs rented out, and the common problem that arises with them, data corruption in the EEPROM, is well known to the workshop crew.

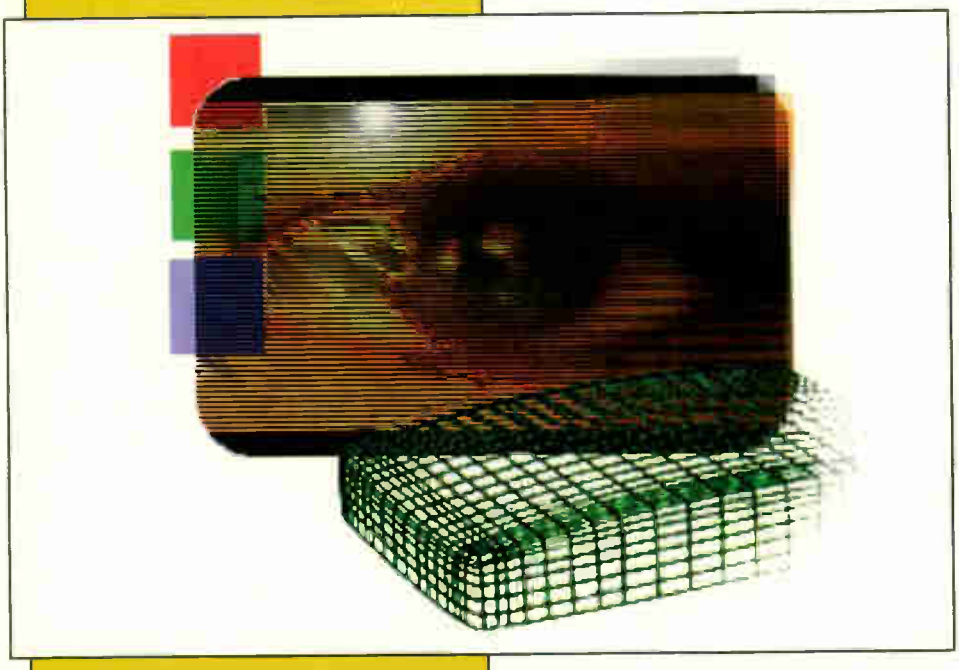
The effects of this fault, apparently brought on by incorrect marking and insertion of an electrolytic capacitor during production, are most often lack of any display on the front-panel indicator, incorrect functions when the on-board control keys are used, and various picture and sound problems during playback. The cure is to replace the now-faulty capacitor, C701, which is usually distressed and bulging as a result of its reverse-voltage ordeal, and to reduce the value of resistors R668 and R669 from 10kΩ to 4·7kΩ. In some cases it is also necessary to replace IC701 on the motherboard, though we haven't had to do this so far. Then, once the option bytes in the memory chip have been programmed correctly, all should be well. This has been our experience – until now!

Sage was not at all fazed then when a similar Model SLV-SE820G came in with the familiar symptoms described above. After replacing the capacitor and the two resistors he reassembled the machine, fired it up and pressed the record key, smartly followed by a five-second dwell on the zapper's menu key. The TV screen then produced the options display, in which the selected bytes appear highlighted. As is often the case, only two or three of them were shown in this way, and Sage set about programming the numbers. Having had to use them a number of times before, he had them listed in his little bench-side notebook: 3-14 inclusive, 19, 27, 33-35, 40, 41, 45, 47, 51, 60, 61, 63, 66, 69 and 72.

These were all banged in and then memorised with a stab on the zapper's menu key. The machine was next switched off and on again to reboot, after which the auto-setting of the head-switching point was invoked by keying 'test' (a concealed button behind the VCR's front panel) then SP/LP on the zapper – with an alignment tape playing. This setting is also stored in the EEPROM. All done then! Sage checked the picture and sound with his *Snow White* tape, made a quick test recording, then turned to the paperwork . . .

The machine went back to the customer next day, and no more was heard of it until after the weekend. Then Sage was summoned to the reception counter, to be confronted by the Sony machine's owner. He was brandishing the VCR in one hand and its instruction book in the other. Sage had mucked the VCR up, it was alleged. Since the machine had been returned, its dial-timer had not worked! Sage, muttering apologies, crept back to his bench with the machine, then consulted the instruction book to discover what the dial-timer was supposed to do. Set a timed recording, that's what. It did nothing at all when it was tried.

Sage was convinced that the cause was simply failure to reconnect the front-panel's ribbon cable during reassembly. Was this the case, or had the little jog-control mechanism been damaged perhaps? Sage delivered the machine in person later that day. What had ailed it? For the solution (think first!) turn to page 57.



TV FAULT FINDING

Reports from
Michael Dranfield
Philip Salkeld
Glyn Dickinson
Les Mainstone
Andrew T. Duggan
Martin Cole
Ian Turnbull
Jerry Fedorak
Dave Husband
Martyn S. Davis and
Steve Hague

We welcome fault reports from readers – payment for each fault is made after publiation. See page 40 for details of where and how to send reports.

Grundig 28EKB-T70-1020A (Professional 2500 chassis)

This newish set was dead. When it was switched on from standby the green LED lit up but nothing else happened. Not having seen one of these sets before I was quite pleased to find a large, blackened dry-joint at the line scan coils socket. But the set remained dead after resoldering this joint, and the power supply was up and running. Scope checks around the line driver FET (TL1) showed that gate drive was present but there was nothing at the transistor's drain. Nor was there any voltage at the drain connection to the driver transformer. At this point I was stuck, not knowing the set. Fortunately the local Grundig dealer lent me a manual, and I then found that a surface-mounted BAV203 diode (DL2) between pin 3 of the driver transformer and chassis was short-circuit. **M.D.**

Ferguson ICC5 chassis

As this old set used to provide such excellent pictures its owner gave the go-ahead for repair at up to £40. The picture was very ragged, as if there was a dried up electrolytic capacitor across the HT supply. But I found that tweaking the EW potentiometer cured the trouble. Unfortunately the picture then lacked width, so it was obviously not a power supply problem. Further investigation showed that CG01 (10μF, 50V), which is connected to pin 6 of the TDA4950 EW chip IG01, had dried out.

A replacement capacitor cured the raggedness, but the EW control now did nothing. At this point I noticed that with the new 10μF capacitor fitted the TDA4950 chip was getting very hot. A replacement IC restored normal operation. **M.D.**

JVC AV28WFR1EKS

The problem with this set was field collapse. But there was a wavy instead of a straight line across the screen. The last time I'd seen this symptom was with a set fitted with the Thorn 9000 chassis! The cause had been a dry-joint at the earthy end of the field scan plug/socket: the field collapse was being modulated by the line scan coils.

But no dry-joints could be found this time, and a resistance check showed that the field scan coils were open-circuit. It seemed that a new tube would be needed but, with nothing to lose, I decided to heat up the solder joints on the yoke and flow some fresh solder on. This provided a complete cure. Also a good tip from the customer – a 24-can case of Stella lager – who thought he was going to have to shell out for a new tube! **M.D.**

Thomson 32WX65US (ICC19 chassis)

There was no luminance though the OSD was OK. A scope check showed that the luminance signal was missing at pin 4 of IV001, so the cause of the problem was on the digital signal module, which is difficult to get at. The luminance signal passes through five ICs and a handful of surface-mounted transistors on this module. It's not easy to carry out scope checks on the module, but I eventually found that there was a luminance input at pin 26 of IV601 (TDA9143) but no output at pin 12. A replacement IC cured the fault. **M.D.**

Toshiba 28W93B (C8SS chassis)

This set was stuck in standby though 125V was present at the HT fuse F470 in the power supply. After finding nothing wrong in the line output stage I returned to the power supply to check the LT rails and found that there was no voltage at pin 21 of plug 813A. Tracing back from this I discovered that R430 (56Ω, 0·5W) was open-circuit and that there was a short-circuit at the emitter of Q430. The cause of the trouble was the 0·01μF disc ceramic capacitor from this point to chassis, C431. It was short-circuit. A new capacitor and resistor restored normal operation. **P.S.**

Goodmans 285NS

These sets always seem to come in dead because the line output transformer has

been arcing, as a result of which the output transistor blows. SEME can supply the transformer, under code no. HR7927. On this occasion however the set was still dead once these items had been replaced. There was HT at C805, the mains bridge rectifier's reservoir capacitor, and at pin 1 of the STR5707 chopper chip I801, but there were no other supplies. I decided to carry out a resistance check between pins 2 and 4 of I801, and discovered that they were short-circuit. A replacement restored normal working order. **P.S.**

Tatung T28NE51 (E chassis)

I was called out to this set, the complaint being no sound. When I tried the remote-control unit I found that the green cursor which shows the volume level remained at zero. The brightness, contrast etc. all varied. So the sound was locked. To release it you press vol+ on the set and at the same time press the mute button on the remote-control unit. After doing this the sound returned and could be adjusted normally. **P.S.**

Beko 16328NX

This oldish set had a vertical shift problem, i.e. a black line that was well up from the bottom of the screen. Use of freezer revealed the culprit, which was R725 (150kΩ, 0·5W). A long soak test after fitting a replacement confirmed that this resistor had been the cause of the fault. **P.S.**

Samsung CI6844N

In most cases replacement of the TDA8350Q field and EW output IC will cure field faults in these sets. However you will sometimes find a side effect, flyback lines at the top of the picture. To clear this fault replace R307 (10Ω, 1W). **P.S.**

Beko NR28426NDS

If you come across a dead set and the cause is not the sand-filled fuse, go straight to the BU508D line output transistor T504. You will find that it's short-circuit. Don't replace it until you have fitted a new line output transformer (TR502), because this will have been arcing. As this set was in warranty the replacements had to be ordered direct from Beko. **P.S.**

Grundig ST82-774 (CUC7890 chassis)

This monster seemed to be dead apart from the fact that the front display was illuminated. Investigation showed that the HT and LT supplies were present. When I moved to the line output stage I found that there was no drive. These sets use a TDA8140 line driver chip, IC526. Checks here showed that there was an input from the line generator at pin 7 (what a relief!) but no drive output at pin 1. A replacement IC restored normal operation. The next problem was to get the set off the bench. What a weight! **P.S.**

Philips Anubis AA-5 chassis

The report with this 21in. set said "crackling then dead". Seeing a dreaded triangle on the line output transformer's label I replaced it. The result was a tripping set, though all the supply voltages were correct. Line drive was present, but at very low amplitude – the TDA8361E jungle chip had been dealt a mortal blow. A replacement restored the EHT, and revealed field collapse! A new TDA3654 IC brought the picture back. I wonder how loud that "crackling" had been?

Note that this chassis differs from the Anubis A, which has a different jungle chip. **G.D.**

Grundig ST70-755/9 (CUC6460 chassis)

This set was dead though there was 330V at the mains bridge rectifier's reservoir capacitor C626 (220μF). This item is followed by a DC Wickman fuse, Si624 (1·6A), which was open-circuit. I also noticed that there was a bad dry-joint at C648 (470pF, 1·6kV), which is in parallel with the chopper transistor T644. I replaced the latter (IRFBC40) and IC631 (TDA4605/03), also C648 and, as a precaution, C633 (100μF, 25V) and C661 (1μF, 63V). A new fuse completed the repair and, at switch on, the set sprang to life. **L.M.**

Philips 29PT727B (GR2.4 AA chassis)

This set had a faulty line output transistor (BU2520AF) and transformer. I gave the customer an estimate, which was accepted. Fortunately it allowed some leeway for unforeseen eventualities. When the transistor and transformer arrived they were fitted and the EW modulator diodes D6546 (BY228) and D6547 (BYW95C) were replaced. After a quick check around the line output stage for anything else amiss I switched the set on. Result, a flashing front LED.

After the customary expletive, I isolated the line output stage and provided the power supply with a dummy load. It declared itself very happy. So attention was redirected to the line output stage, where I found that F1534 (315mA) was open-circuit. This led me back to the EW drive circuit, which is on the CRT base panel, and opened a can of worms.

Tr7533 (BD440) was short-circuit, so this and the two surface-mounted transistors Tr7530 and Tr7537 (both type BC848B) were replaced. I also replaced two diodes, D6560 (LL4148) and D6561 (BZX79-C68), which provide a feed to the protection circuit. The BZX79-C68 diode had tested OK with my equipment. After that the set was fired up, voltage checks were carried out and the set was boxed up. After five hours on the soak test bench it died again, with a thin squealing sound. At this stage I contemplated a plumbing course.

Off came the back and out came the chassis. This time I found that the bulky scan-correction capacitor C2550 (680nF, 250V) was the culprit, with a short-circuit reading. I assume that it had failed as a result of stress from the previous problems. **L.M.**

Samsung CI5337AN (US60A chassis)

This set, with its excellent, usually trouble-free chassis, arrived with a note to say that it did odd things at odd times, sometimes flashing and the text not working. Two of the diodes in the mains bridge rectifier circuit, D801 and D802 (type 1N4003), showed signs of overheating, so replacements were fitted. They are on the larger of the two PCBs. When the set was switched on it produced a blank raster, with no signs of any audio or video. I was suspicious of the two 12V regulators IC801 and IC802, but replacements made no difference. The culprit turned out to be the 5V regulator IC804 (MC7805). Once this had been replaced the set worked and, after retuning, behaved itself with normal text. **L.M.**

Grundig CUC2030 chassis

"Turns itself off when my back's turned" claimed the elderly lady customer. When I took the back off and removed the chassis I noticed a number of dry-joints on the secondary side of the power supply. These were repaired and the set was switched on. All the supply-line voltages were checked and found to be correct, so the chassis went back into the cabinet. When the set was switched on it was dead! Out came the chassis again and, after much twisting and tapping, a dry-joint was found at C53009. Dealing with this cured the erratic shut down. **L.M.**

Philips 25PT4494/05 (L6.3 AA chassis)

At switch on this set produced a raster but no sound. The front and remote controls produced no response, and there were no

signs of any graphics. A check on the outputs at the secondary side of the power supply showed that the 5V rail was at only 0·2V. This led to a check on transistor Tr7505 (BC337-40) which was open-circuit. A replacement cured the fault. **L.M.**

Daewoo DVT1482P

This combi unit was dead with no illumination from the standby LED. After some attempts the LED did light, but when Power was pressed the unit just tripped and died. While making a few checks in the power supply I noticed that C811 (100μF, 16V) was almost touching the heatsink for the chopper transistor Q801. As a result it had dried up. A replacement solved the problem. **A.T.D.**

Bush 1433 (11AK20M chassis)

This set was dead with a short-circuit chopper transistor – Q801, type 2SK2750. Checks revealed that in addition the following were either blown or short-circuit: R851 (0·33Ω), R801 (2·2Ω, 5W), R819 (0·47Ω), R812 (1kΩ, surface-mounted) and D808 (BA159). Just in case, I decided to replace the MC44603AP chopper control chip IC801 as well. After that the set ran perfectly. **A.T.D.**

Philips L01.1E chassis

If you get a loud mechanical noise as soon as the set is switched on from the mains, the degaussing coil is vibrating/rattling on the CRT's rimband. To cure the fault all that's required is a spot of hot-melt glue to keep the coil away. **M.C.**

Hitachi C32WF523-311

This flat-screen set would switch to standby after a few seconds. Checks revealed the cause to be loss of the first anode supply, because of a fault within the CRT. The tube fitted was an LG type W76QDD259X. **I.T.**

Philips 25PT4521 (MD1.1 chassis)

There was no picture because of field scan failure. I found that the –15V supply, which is derived from the line output transformer, was missing with circuit protector CP1463 (800mA) open-circuit. The cause of this was transistor Tr7440 (BC327), which was short-circuit, and diode D6440 (1N4148), which was leaky. These two components are mounted on a small sub-panel. **I.T.**

LG KE14U73

Very intermittently this combi unit's picture would disappear with motorboating on sound. In the fault condition all the main supply voltages dropped significantly. The cause was a dry-joint at R811 in the current-sensing part of the power supply. **I.T.**

Hitachi C2142N

The complaint with this set was loss of red, because of failure of the TDA6108 RGB output chip. A modified CRT base PCB is available from Hitachi to prevent repeated failure. The part no. is VS20089197. **I.T.**

Panasonic TX21GV1

The sound would sometimes disappear when a cassette was inserted in this combi unit. The cause was traced to dry-joints at C613 in the audio circuit on the VCR PCB. **I.T.**

Proline 28N1

This set was stuck in standby. When the remote-control unit was used to bring it out of standby the power supply would whistle then go back to standby. Cold checks in the power supply revealed that C25 was dry-jointed. Once it had been resoldered the set came back to life with good results. **J.F.**

Minato ST1411

This 14in. colour portable was dead. Checks in the power supply revealed that R502 (100kΩ), one of the start-up resistors, was open-circuit. In addition there was a dry-joint at C506. Once these points had been attended to everything was OK. **J.F.**

Grundig W70-2030

This one-year old widescreen set was brought in because it was dead. The standby LED at the front would sometimes light up. Visual checks in the power supply area revealed the cause of the trouble, dry-joints with arcing at plug R629 to the transformer (mounted at the corner of the cabinet). Normal operation was restored by resoldering the plug. **J.F.**

Wharfedale 550S (PT92 chassis)

Two of these sets required attention on the same day. The first one produced a rustle of EHT at switch on then shut down. Checks in the line output stage revealed a diode that looked as if it had nipped outside and spent too long in the sunshine. Sure enough it read 22Ω. That was the easy one.

Set two seemed to have a blanking fault – the picture was cutting out about once a second, though the sound and teletext were OK. So I dusted off the scope and ordered a service manual. After much wasted time checking waveforms and voltages I decided to enter the service mode (press sub-page on the remote-control unit and volume down on the set) to find out what was inside the micro. I discovered an item marked CL (cathode drive level), for which the manual suggested a setting of 4. It was actually at 8. To be on the safe side I set the level to 3. After that all was well.

Note that this chassis is used in the **Bush Model 2876T** amongst others. **D.H.**

Philips 25PT4523 (MD1.2E chassis)

This set was dead with its input fuses blown. It didn't take long to spot the cause. A small, blue high-voltage capacitor, C2540, had blown itself in half. This 220pF capacitor is connected in parallel with the chopper transistor. Its failure had taken out the big cement resistor and two of the mains bridge rectifier diodes.

For good measure I replaced the chopper FET, all four mains bridge rectifier diodes, all three HV capacitors and the large 1Ω anti-surge resistor. I was then rewarded with the satisfying sound of EHT rustling up and a working set. **M.S.D.**

Philips 32PW9544 (MD2.25E chassis)

There was a degree of urgency associated with the repair of this large, expensive dead set. When the customer arrived to report the fault she apparently became hysterical then abusive – to the extent that the police had to be called in. She then phoned our various managers to offer them her views, and followed this with a four-page letter to our MD. So it was a chance for me, the lowly engineer, to shine and retrieve the situation.

On investigation I found that the chopper FET was short-circuit and the control IC had a short-circuit diode and open-circuit resistor connected to pin 3, which drives the FET. The following items were replaced: Tr7541 (STW9NA60), IC7520 (MC44604), D6524 (BYV10-20), R3524 (10Ω), R3546 and R3547 (both 0·39Ω). Once this had been done there was the sound of EHT to confirm that the repair was successful. Phew! **M.S.D.**

Hitachi C2142 (11AK19 chassis)

I have not come across this model before – it didn't look like a Hitachi set. The reported fault was no sound. When I took the back off I was a little surprised to find a Vestel 11AK19 chassis. Not that I mind: it's relatively predictable, and easy to work on. A few quick checks revealed that pin 2 of the TDA2614 audio output chip was being held low. This is the mute pin, which is controlled by transistor Q100 (BC548B). When it was tested this transistor proved to be leaky. A replacement restored the sound. **S.H.** ■

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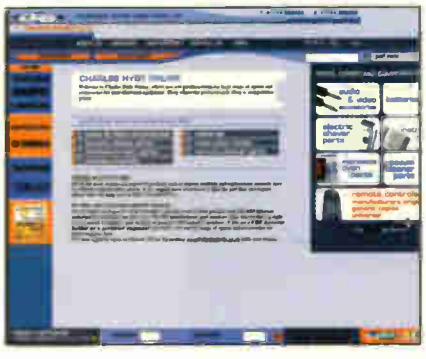

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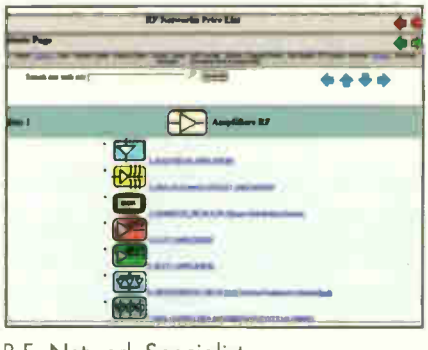

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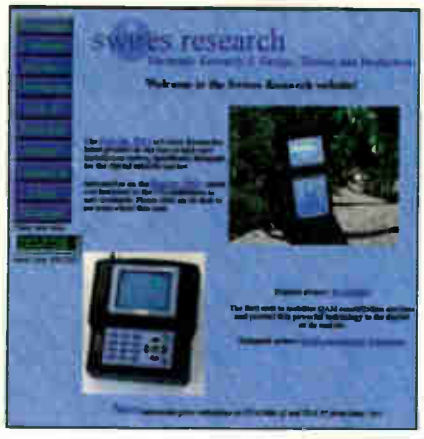

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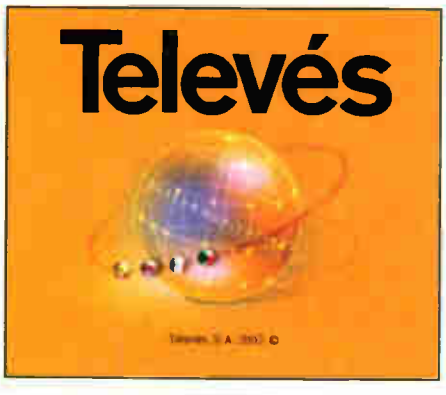

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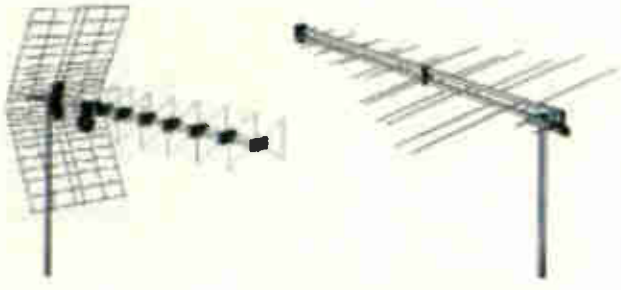

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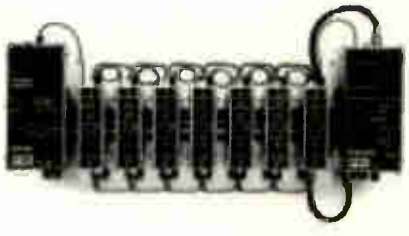

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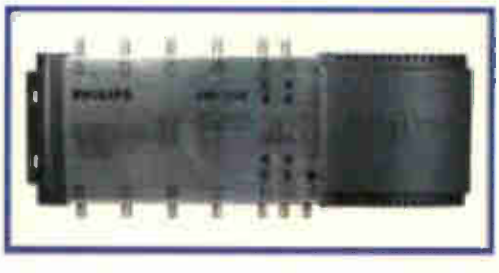

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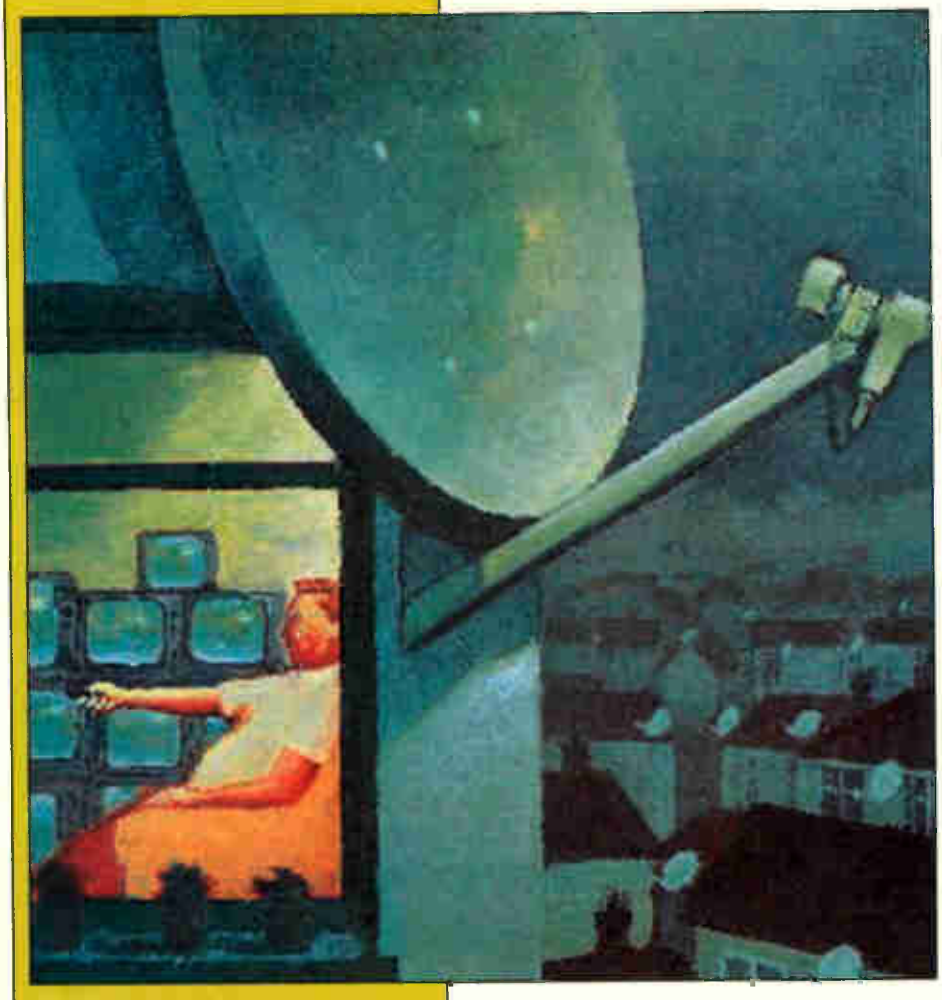

SATELLITE NOTEBOOK

Reports from Hugh Cocks Christopher Holland and Michael Dranfield

High-definition TV tests

The European 1,080-line high-definition TV system is due to start a regular transmission schedule at the beginning of next year. More information can be found on the internet at www.euro1080.tv

There are 25 frames per second, with a horizontal definition of about 1,900 lines. Tests are currently being carried out via the Astra 1 slot (19·2°E), at 12,168GHz V (symbol rate 27,500, FEC 3/4). Conventional MPEG-2 satellite receivers will tune in the signal but because of the large amount of data transmitted to achieve this definition, about 24,000Mbits/sec, they either crash under the data onslaught or show intermittent pixellated blocks on the screen. The best results I have obtained so far with a conventional receiver have been with an old Nokia 9600 box, which showed a zoomed-in top-left portion of the picture in 625-line format, though with intermittent picture and sound dropout.

PC-based satellite-receiver systems work much better. Using the TechiSat PC card system described in the September issue and a fast computer I was able to view and make recordings of the transmissions (see Photos 1-3). Recordings of the signal on a hard disk gobble a massive 180MB a minute, which didn't give much viewing time when transferred to a standard 680MB CD! I found that playback of the CD was possible only with a fairly recent PC, using the Windows Mediaplayer or the Elecard software mentioned in the September issue article. Attempts at playing the disc with a PC that had less than a 2GHz processor resulted in picture and sound dropout. Definition with a computer monitor is very good, especially if the monitor is large and can

Photo 1: Euro 1080 HDTV test transmission.

Photo 2: Euro 1080 HDTV test transmission.

Photo 3: Euro 1080 HDTV test transmission.

Photo 4: White line dashes at the top left-hand corner of the screen with BBC1 regional transmissions, seen when these are displayed in the letterbox mode.

Photo 5: Nigerian NTA 2 caption received via Intelsat 903.

Photo 6: Nigerian NTA 2 news reader received via Intelsat 903.

be set to the highest-definition possible.

Some experimentation with the receiving software was necessary. The Prog DVB program mentioned in the previous article would record perfectly well but displayed some blocks with live pictures. DVB Viewer however gave the best-quality live pictures but wouldn't record properly! The programs sometimes had to be opened and closed once or twice for live pictures to be displayed, because an 'error' message appeared on the screen instead. The software was obviously not entirely happy about handling this amount of data.

At the time of writing this report the transmissions consist of an approximately one-hour long demonstration tape that shows clips of various live orchestral and operatic performances, with the Astra and Euro 1080 logos in the top right-hand corner. No doubt dedicated HDTV receivers will soon be available, if not already at a cost, and possibly fantastic picture quality will be achieved if the output is fed to say a large-screen plasma TV display. **H.C.**

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

Channel and EPG no.	*Sat*	*TP*	*Frequency/pol*
Arrow Radio (911)	2B	32	12·324GHz V
BBC1 Channel Is (958*)	2D	50	10·847GHz V
Factory Outlet (670)	2B	33	12·344GHz H
Paramount 2 (128)	2A	11	11·914GHz H
Pop Plus (620)	EB	C6	11·426GHz V
Vectone Urdu** (828)	EB	C10	11·644GHz H

TP = transponder. EB = Eurobird. 2A/B/D = Astra 2A/B/D.

*BBC1 Channel Is will be on EPG 101 with viewing cards registered with in the region.
** Plus three Vectone test channels.

Digital channel update

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

ATN TV (EPG no. 827) via Eurobird transponder D12S has returned to the EPG after being off-air for several months.

RTE Radio 1 has been given EPG no. 910. This is the stereo version, which has been available for over a year via Astra 2D transponder 43 (10·744GHz H) using the digibox add-channels facility. The mono version of RTE Radio 1 (EPG no. 892) via Astra 2B transponder 32 (12·344GHz H) has been renamed RTE Europe, probably because of the much wider footprint of Astra 2B compared to Astra 2D. RTE Radio 1 has also recently started up via the good old-fashioned LW band, with a high-powered transmitter at 252kHz.

Ekushey TV (EPG no. 814) and Total Rock Radio (EPG no. 885) have ceased transmissions. **C.H.**

BBC1 regional oddities

I've noticed that the BBC1 English regional variations all have a small time delay compared with BBC1 London when transmitting national programmes. This is no doubt because the London output is sent to the regional studio and then returned.

When the digibox video output is set to 'letterbox' the regions all have a series of white line dashes at the top left-hand corner of the screen (see Photo 4). These seem to be the same whichever region is selected. The dashes are not present with BBC1 London, Scotland, Wales and Northern Ireland. I've also noticed that when a non-digibox receiver is used in the letterbox mode the dashes appear briefly after channel selection and are then suppressed. **C.H.**

Update at 34·5°W

The C-band channels available via Intelsat

Photo 7: Nigerian Minaj transmission via Intelsat 903.

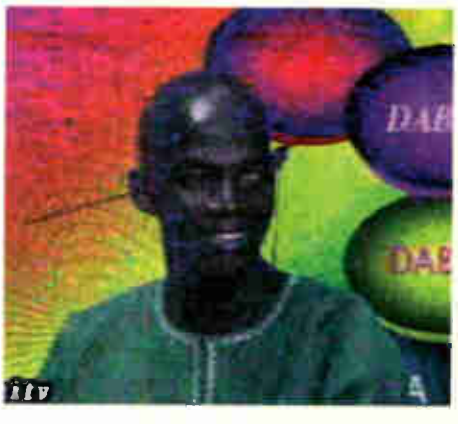

Photo 8: Nigerian MITV transmission via Intelsat 903.

Photo 9: Snell & Willcox widescreen test pattern with GTV 9 Melbourne identification received via Eutelsat W3.

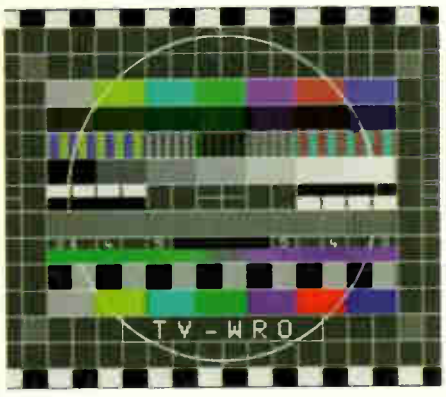

Photo 10: TVP (Poland) test pattern with Wroclaw identification received via Eutelsat W3.

Photo 11: British Telecom/NewSkies Satellites caption received via Eutelsat W3.

903 at 34·5°W were listed here about a year ago. Since then a Nigerian multiplex has become available at quite a reasonable signal strength. The frequency is 3·890GHz, with left-hand circular polarisation, a symbol rate of 16,300 and 3/4 FEC. TV channels are NTA 2 (see photos 5-6), MITV (see Photo 8) and Minaj (see Photo 7). Radio stations in the package are Cool FM, Ray FM, Rhythm FM and Star FM.

The MITV photo is of appalling quality. The signal appears to be picked up off-air at low strength complete with ghosts, the result being intermittent dropouts with the digital signal transmitted. It has been like this since I first started to take a look some weeks ago, with no attempt to improve the signal at the uplink site! **H.C.**

Unusual test cards

Continuing our series of unusual test cards and captions, Photo 9 is a very rare shot of a Snell & Willcox widescreen test pattern from the Australian TV station GTV 9 in Melbourne. It was transmitted prior to a Eurovision newsfeed via Eutelsat W3 (7°E).

Photo 10 is from state broadcaster TVP (Poland), again transmitted prior to a Eurovision newsfeed via W3, this time from the regional city of Wroclaw. I recall this Polish test card being transmitted via the terrestrial TVP network many years ago.

Photo 11 shows a British Telecom/NewSkies Satellites caption, again via W3.

The transmissions were at 11·043GHz, with vertical polarisation, a symbol rate of 6,665 and 7/8 FEC. **H.C.**

Pace 2200

This was a later version of the 2200 fitted with the ZIF tuner. It produced the 'no satellite signal received message'. The dealer who sent it to me said he had fitted a new tuner, but it looked more like a used than a new one. My first step was to check the installation menu, to confirm that the settings were all correct. I then removed the tuner and plugged it into my test rig. This confirmed that it was OK, so I refitted it and checked the tuning, 3·3V and 5V supplies, the serial clock and data lines, and the LNB supply. Everything seemed to be in order, but the digibox still didn't work.

I then realised that the 22kHz tone was missing from the LNB supply, though it was set to 'on' in the menu. The tone is generated by a pulse-width modulator within the ST20 housekeeping microcontroller chip U600, the tone output being at pin 142. It was present here. I continued scope checks through to C102 (470pF) and found that it was missing at the output side of this capacitor. But a replacement capacitor made no difference.

The tone is switched on and off by toggling pin 1 of U600. Time was wasted here. The tone is on when this pin is high (1·53V) and off when it's low (0V). But the change is not instantaneous: it takes place three seconds after you press 'select' with the remote-control unit. Very naughty!

Anyway U600 was OK, so it was back to the output side of C102. This is connected to the collector of the LNB switch-off transistor Q138 and the LM358M 22kHz tone amplifier chip U103. Clearly one or other of these items was deleting the tone. Replacing Q138 made no difference: replacing U103 made D101 (BAS16) go up in smoke. I also found that D107 (15V zener diode) and the 2SK2414 FET Q103 were leaky. Replacing all these items (U103, D101, D107 and Q103) finally restored normal operation. **M.D.**

Panasonic TU-DSB30

The picture produced by this digibox was covered in red and green blocks, which indicates a failed SDRAM chip. There are two to chose from, IC302 and IC303. I decided to check their temperatures using a laser-sighted digital thermometer. This showed that IC302 was running 2°C hotter than the other chip. A replacement (KM416S1120DT-G8) SDRAM in the IC302 position cured the problem.

I first used this trick about ten years ago, to locate a faulty RAM chip in an Atari computer that had eight of them in parallel. **M.D.**

Amstrad DRX100

This digibox was stuck in standby with no LNB voltage present. Its owner said he had fitted a power-supply capacitor kit some eighteen months previously. Checks showed that the cause of the problem was with the 3·3V supply, where the voltage was low at 2·2V. The value of the 1,000μF, 16V reservoir capacitor C12 had fallen to 12μF, with an ESR of 12Ω. All the capacitors were green in colour and made by 'Nover'. The quality of the kit capacitors that had been fitted was in fact probably worse than that of the originals.

Replacement capacitor kits were originally produced by SatCure, but have been copied by other firms that have undercut prices by using poor-quality components. I recommend purchasing capacitor kits from SatCure, which supplies low-ESR capacitors rated for high ripple current. **M.D.**

Pace 2500S5

Unlike the 2500S3, this model has the ZIF front-end on the main board. The MAX2115 ZIF chip is unfortunately prone to failure. This particular digibox produced the 'no satellite signal received' message, and the cause was traced to the ZIF chip.

Replacement is far from easy. You have to use a soldering station to remove the screening can after removing the LNB socket. The replacement chip measures only 6mm square and has 48 solder pads underneath. Unlike BGA chips, which come with pre-attached solder balls, the MAX2115 has bare pads. An exact amount of solder has to be applied to the PCB, then the chip is sat on top and taken up to reflow. This requires great skill and care to get it right. It's not my favourite job. **M.D.**

Amstrad DRX100

This digibox had a familiar symptom – it produced the 'no satellite signal received' message – but this time the tuner's local oscillator was running and it was producing Q and I outputs. The OSD said a signal was being received, but with no quality.

The cure was to replace the BMC4200KEF QPSK channel decoder chip U100. **M.D.** ■

Solution to Test Case 491

– see page 45 –

Home electronic and also electrical equipment is increasingly processor-controlled and software-driven. Few problems arise when the codebook and command set are burnt into a rugged ROM chip of some sort. EEPROMs used for the purpose are not so reliable however – their grip on the contents seems to be less firm!

With the user, factory and installation settings stored in a memory chip and acted upon by a microcontroller chip, we have in effect a mini computer. It has software, an operating system and peripherals, e.g. a deck mechanism. PCs do the right thing only when they are programmed correctly, and this was the problem with the Sony SLV-SE820G VCR. Sage had entered the right codes, but for the wrong model – the less-sophisticated SLV-SE720G. Thus the machine in question was suffering from some sort of an identity crisis and, in its new role as an SLV-SE720G, wouldn't have anything to do with its jog-timer knob – you don't have one of these with the SE720G!

Sage got out the SE820G data and found that its code table is somewhat different. He soon had the correct bytes entered – 3-15 inclusive. 19, 23, 27, 29, 32-35, 40, 41, 45, 47-50, 60, 61, 63, 64, 66, 69 and 72. After that the machine's functions and features could all be used.

This sort of thing is becoming increasingly common with modern equipment, along with software updates, not all of which can be transmitted over the air. So be wary!

NEXT MONTH IN TELEVISION

Mobile phones and their repair

Mobile phones are part of everyday life for most people nowadays. Chris Archer outlines their history, how they operate, and then describes dismantling and repair procedures for some common models. The aim is to provide enough basic information to enable you to attempt repairs rather than consigning faulty phones to the bin.

Maintaining PA amplifiers

Here's a useful sideline, looking after the PA amplifiers used by local bands. Geoff Darby has been involved in this work for some time and explains the sort of problems you get and how to deal with them.

Tackling the Vestel 11AK33 chassis

This chassis is used in various recent Hitachi and Wharfedale models. Tripping is a common fault condition which must be dealt with the right way. Alan Dent tells you how to go about it and describes some other fault conditions you might encounter.

Putting the triac to work

The triac is a useful semiconductor device that's not as widely used as it deserves to be. J. LeJeune describes its origin, mode of operation and how to make use of it.

PLUS ALL THE REGULAR FEATURES

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WHAT A LIFE!

TV and VCR faults. Band III converters. Strange customers and warm sets. Donald Bullock's servicing commentary

We were due to return to Spain earlier in the month but, by way of getting their pound of flesh, Steven and Paul thought up a wheeze that would keep me in the workshop for a couple more days. They decided to go on an extended tench fishing exercise. It's my own fault I suppose. I became addicted to the sport at fourteen or so and I guess they are just taking after me. Of course they are nowhere near as good at it as I am!

Enter Shiner

I had scarcely taken my coat off when Shiner Albright danced in. He's a 'ten per center' – he will take this or fetch that for anybody, saying that he does it out of the goodness of his heart. So he might, and no one says a word against him. But he always insists on a ten per cent discount from the shop, and charges the customer ten per cent on the price he should have paid to the shopkeeper. A handy way of getting by. He's also a natural charmer, with a quiet and casual gift of the gab. People queue up to have him help them.

He brings us a lot of jobs. so we can't complain. This time he brought in a Sharp VCM29HM VCR and a Toshiba TV set, Model 2151TB.

"For two of my good friends, Donald" he said. Then he heard cups chinking, but didn't let on. It was Greeneyes making the tea. He's always full of compliments for the ladies, and Greeneyes falls for his charm. He dropped his voice and smiled at her. "There wouldn't be a cup of that nectar for poor old Shiner, would there?" he asked.

There was of course.

The Toshiba TV

When he'd danced off I put the Toshiba set on the bench and plugged it in. After five seconds it clicked off. So I tried it again, and once more it tripped. I removed the back and looked around the chassis for dry-joints. There was a beauty at the mains bridge rectifier's reservoir capacitor. I felt good as I speedily dealt with it and tried again.

I didn't feel so good when the set tripped off once more. I had to do a bit of thinking. Then I reached for the meter to check the HT output from the power supply. It should have been about 115V, but the reading was way out at 145V. No wonder.

I decided to check the electrolytics on the primary side of the power supply and soon found that C817 (22µF, 100V) had fallen to about 2µF. It's the reservoir for the STR58041 chopper chip's –42V supply. The set worked perfectly once a replacement had been fitted.

The VCR

Then I got round to the Sharp VCR. Apparently it kept chewing tapes and seizing up. When I opened it I found that there was a large amount of tape debris, all saturated with oil. After cleaning out the debris and mopping up the oil I carefully degreased the deck. In so doing I noticed that the left-hand spool was stiff, because the back-tension band was sticking to it. A new one put that right.

When Shiner breezed back I'd prepared the bills, taking care to add the ten per cent that he would want subtracted. He paid up happily after deducting his ten per cent, as he always does.

"Er, Shiner" I commented, "you didn't accidentally drop a teeny spot of oil in the recorder's works by any chance, did you?"

"Well, in a manner of speaking, just the tiniest drop" he replied, "but I want to thank you for doing these two so quickly. One is my granny's, the other belongs to my aunt Rosie. You've made them both happy, Donald. Now it just so happens that I have another couple of jobs for you."

More TVs

He ran out then returned with a giant Goodmans TV, Model GTV69W3BLU4. We know it, the chassis being the Vestel 11AK19PRO. From where I was the set seemed to run in on its own two legs.

"Dead as a dodo" he said as he put it down. "It belongs to my uncle Herbie." Then he danced out again and returned with a widescreen Sharp set, Model 66FW54H (DA100 chassis).

"Cracking and banging and all sorts" he announced. "Belongs to my late younger brother's wife." He winked at me, clicked his tongue then put on a devout face.

The Goodmans set had a short-circuit line output transistor, type BU2508AF. A replacement restored the picture, but the width was poor and there was severe EW distortion. It didn't take long to establish that the BUK444-200A EW driver FET was short-circuit. I fitted a PNQ20T in its place as this is more up to the job. But the bowing remained. After checking the various capacitors in the circuit, including the scan-corrector C630 that gives a lot of trouble, I turned my attention to the EW modulator diodes. The capacitors had both been OK, but D611 (BY299P) was open-circuit. A replacement completed the repair, and the picture was perfect.

Not bad I thought, now for the Sharp set. There was a lot wrong with this one, which was arcing badly. The HT reservoir capacitor C720 (100µF, 200V) had blown off its top, and the BUH515 line output transistor Q601 was short-circuit. R623 (1Ω, 2W safety type) in the HT feed to the line output stage had gone open-circuit, and I assume that there had been excessive HT.

The MOC8106 otpocoupler IC705 in the power supply is the prime suspect in this event, and turned out to be faulty. So were R765 and R766 (both 100Ω) in the feed to pin 1 of the optocoupler. They all live on the copper side of the board.

There were a number of faults on the CRT base PCB. The TEA5101A RGB output chip IC1801 had to be replaced, also Q5407 (2SA1837) and Q5408 (2SC4793) in the scan velocity-modulator output stage. R5425 (470Ω, 1W) in the supply to this stage was open-circuit.

It took some time to replace these various items. I then switched the set on, somewhat gingerly, and breathed a sigh of relief when it behaved perfectly. To prevent a recurrence of this sort of thing Sharp recommends adding a 170V avalanche diode in parallel with C720, with its cathode to the positive side. The part number is RH-EX0875BMZZ.

Band III converters

Last month I mentioned that Bill and Hilary Wright were looking for a picture of a Band III converter, the first type of set-top box, that used to sit on top of BBC-only sets in the Fifties, after the start of ITV transmissions. I was doubtful whether there would be much response – they soon became obsolete, as the setmakers devised their own Band I/III tuners for fitting inside their sets. And what a mixed bag of tuners they introduced! Some were quite good and tidy, others were good but clumsy, and some were an absolute headache. The worst, to my mind, were the Ultra 'trombone' ones. They remain etched in my memory!

To my surprise however there was a good response. It's clear that many readers have collections of vintage radio and TV sets and other brown goods items. I received photos from two readers, Bob Webb of Burton upon Trent and Dave Higgison of Doncaster. One was of a brand new, unused converter made by Champion! Dave mentions that it was potentially lethal, because it has a two-pin 5A mains connector into which the TV set could be plugged. Nothing wrong with that but, instead of fitting a shrouded socket, there's a two-pin unshrouded live plug! My thanks to Bob and Dave.

Emails

I am also grateful to those who have sent me emails on various points. Keep it up! You can reach me at donald@wheatleypress.com

Greeneyes is also very grateful to a reader we recently met and is about to settle in Spain. It wasn't long before *Television* was mentioned and, when this column came up, Greeneyes confirmed that I was the guilty scribbler. He stepped back, looked at me carefully, then said:

The first sort of set-top box, a Band III converter that dates from the mid Fifties.

"Coo, but that picture at the top of the column is an old one of you, isn't it?"

In fact of course I'm much younger and more handsome than the picture makes out. I think someone else walked in front of the camera as it was clicked . . .

Strange types

Dave Smith of Leigh, Lancashire tells me about some of the strange types who have wandered into his TV and electronics shop. One was an old lady who came in and studied a large card display of control knobs. She declined assistance and eventually turned away, showing some upset. Dave approached her again and it transpired that she thought she was in an ironmongers and wanted a brass doorknob.

Another time a tall, intelligent-looking chap slapped his money on the counter and asked for a packet of rubber goods. Dave explained that they didn't sell them, and that he should try the chemists opposite.

"But," the chap persisted, "I naturally assumed that you would be the best place to try, this being an electronics shop. After all each one is electrically tested, isn't it?"

Then there was the chap who bought a radio kit and brought it back, saying it didn't work. It looked neat and tidy but when Dave investigated he found that a fine-nozzled tube of grey Bostick had been used instead of solder!

Darren Henwood of Romford, Essex mentions the oddball who came into his TV shop and plonked a pair of well-worn shoes down. "I'd like these soled and heeled please" he said.

Warm sets

Peter Nutkins of Charmouth, Dorset called at our place in Spain last year. He commented on the fact that customers often complain that their sets, after being repaired, get too warm. He recalled an incident in his early days in the trade when a customer with a Bush TV22 complained that it got too warm. Peter reassured him that he was mistaken, then placed the palm of his hand on the side of the Bakelite cabinet. It was red hot!

When he looked inside he soon found the reason for the heat. In an effort to suppress some slight mains-borne interference someone had added an *RC* circuit that consisted of a large wire-wound resistor in series with an even larger paper capacitor. This had been fitted to the side of the cabinet, on a tag strip, and wired across the mains input. The capacitor had gone short-circuit and the resistor was indeed red hot.

Another case involved a Bush TV53. This model had a strip of gold-coloured metal trim along the bottom of the tube's implosion screen. The owner phoned repeatedly to complain that she got shocks from the trim while adjusting the controls. He explained that this wasn't possible, as there was no connection between the trim and anything live.

Eventually she threatened legal action and he called to discuss the matter. In fact she was right! While it was true that there was no physical connection of anything live to the metal trim, a fault condition made it fleetingly and painfully 'live'. The EY51 EHT rectifier was going short-circuit intermittently. As a result the EHT would momentarily collapse and induce a charge in the metal. Profuse apologies and a new EY51 restored good customer relations.

Peter did not mention it, but I wonder why the lady didn't notice the effects of spasmodic EHT collapse on her picture? Too busy getting shocks maybe. ■

Colour CCTV camera, 8mm lens, 12V d.c. 200mA 582x628 Resolution 380 lines Automatic aperture lens Mirror function PAL Back Light Compensation MLR, 100x40x40mm. Ref EE2 £69

Built-in Audio .15lux CCD camera 12V d.c. 200mA 480 lines s/n ratio >48db 1V P-P output 110mm x 60mm x 50mm. Ref EE1 £99

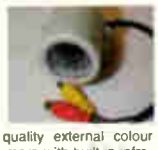
Metal CCTV camera housings for internal or external use. Made from aluminium and plastic they are suitable for mounting body cameras in. Available in two sizes 1 – 100 x 70 x 170mm and 2 – 100 x 70 x 280mm. Ref EE6 £22 EE7 £26 multi-position brackets. Ref EE8 £8

Excellent quality multi-purposeTV/TFT screen, works as just a LCD colour monitor with any of our CCTV cameras or as a conventional TV. Ideal for use in boats and caravans 49·7MHz-91·75MHz VHF channels 1-5,168·25MHz-222.75MHz VHF channels 6-12, 471.25MHz-869·75MHz, Cable channels 112·325MHz-166·75MHz Z1-Z7, Cable channels 224·25MHz-446·75MHz Z8-Z35 5" colour screen. Audio output 150mW. Connections, external aerial, earphone jack, audio/video input, 12V d.c. or mains, Accessories supplied Power supply, Remote control, Cigar lead power supply, Headphone Stand/bracket. 5" model £139 Ref EE9, 6" model £149. Ref EE10

Self-cocking pistol plcr002 crossbow with metal body. Self-cocking for precise string alignment Aluminium alloy construction High tec fibre glass limbs Automatic safety catch Supplied with three bolts Track style for greater accuracy. Adjustable rear sight 50lb drawweight 150ft sec velocity Break action 17" string 30m range £21.65 Ref PLCR002

Fully cased IR light source suitable for CCTV applications. The unit measures 10 x 10 x 150mm, is mains operated and contains 54 infra-red LEDs. Designed to mount on a standard CCTV camera bracket. The unit also contains a daylight sensor that will only activate the infra-red lamp when the light level drops below a preset level. The infra-red lamp is suitable for indoor or exterior use, typical useage would be to provide additional IR illumination for CCTV cameras. £49. Ref EE11

Mains operated and designed to be used with any CCTV camera causing it to scan. The clips can be moved to adjust the span angle, the motor reversing when it detects a clip. With the clips removed the scanner will rotate constantly at approx 2·3rpm. 75 x 75 x 80mm £23. Ref EE12



Colour CCTV Camera measures 60x45mm and has a built-in light level detector and 12 IR LEDs 0.2 lux 12 IR LEDs 12V d.c. Bracket Easy connect leads £69. Ref EE15

A high quality external colour CCTV camera with built-in infra-red LEDs measuring 60 x 60 x 60mm Easy connect leads colour Waterproof PAL 1/4in. CCD 542 x 588 pixels 420 lines 0·05 lux 3·6mm F2 78 deg lens 12V d.c. 400mA Built-in light level sensor. £99. Ref EE13

Colour pinhole CCTV camera module with audio. Compact, just 20x20x20mm, built-in audio and easy connect leads PAL CMOS sensor 6-9V d.c. Effective Pixels 628x582 Illumination 2 lux Definition >240 Signal/noise ratio >40db Power consumption 200mW £35. Ref EE21

A small colour CCTV camera measuring just 35 x 28 x 30mm. Supplied complete with bracket, microphone and easy connect leads. Built-in audio. Colour 380 line resolution PAL 0·2 lux +18db sensitivity. Effective pixels 628 x 582 Power source 6-12V d.c. Power consumption 200mW £36. Ref EE16

Complete wireless CCTV sytem with video. Kit comprises pinhole colour camera with simple battery connection and a receiver with video output. 380 lines colour 2·4GHz 3 lux 6-12V d.c. manual tuning Available in two versions, pinhole and standard. £79 (pinhole) Ref EE17, £79 (standard). Ref EE18

Small transmitter designed to transmit audio and video signals on 2·4GHz. Unit measures 45 x 35 x 10mm. Ideal for assembly into covert CCTV systems Easy connect leads Audio and video input 12V d.c. Complete with aerial Selectable channel switch £30. Ref EE19

2·4GHz wireless receiver Fully cased audio and video 2.4GHz wireless receiver 190x140x30mm, metal case, 4 channel, 12V d.c. Adjustable time delay, 4s, 8s, 12s, 16s. £45. Ref EE20

The smallest PMR446 radios currently available (54x87x37mm).These tiny handheld PMR radios not only look great, but they are user friendly & packed with features including VOX, Scan & Dual Watch. Priced at £59.99 PER PAIR they are excellent value for money. Our new favourite PMR radios! Standby: – 35 hours Includes: – 2 x Radios, 2 x Belt Clips & 2 x Carry Strap £59.95 Ref ALAN1 Or supplied with 2 sets of rechargeable batteries and two mains chargers £84.99. Ref Alan2

Beltronics BEL550 Euro radar and GATSO detector Claimed Detection Range: GATSO up to 400m. Radar & Laser guns up to 3 miles. Detects GATSO speed cameras at least 200 metres away, plenty of time to adjust your speed £319. Ref BEL550

TheTENS mini Microprocessors offer six types of automatic programme for shoulder pain, back/neck pain, aching joints, Rheumatic pain, migraines headaches, sports injuries, period pain. In fact all over body treatment. Will not interfere with existing medication. Not suitable for anyone with a heart pacemaker. Batteries supplied. £19.95 Ref TEN327 Spare pack of electrodes £5.99. Ref TEN327X

Dummy CCTV cameras These motorised cameras will work either on 2 AA batteries or with a standard DC adapter (not supplied) They have a built-in movement detector that will activate the camera if movement is detected causing the camera to 'pan' Good deterrent. Camera measures 20cm high, supplied with fixing screws. Camera also has a flashing red l.e.d. built in. £9.95. Ref CAMERAB

INFRA-RED FILM 6" square piece of flexible infra-red film that will only allow IR light through. Perfect for converting ordinary torches, lights, headlights etc to infra-red output only using standard light bulbs Easily cut to shape. 6" square £15. Ref IRF2 or a 12" sq for £29 IRF2A

GASTON SEALED LEAD-ACID BATTERIES

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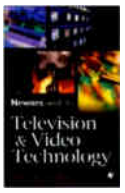

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CONTENTS: Basic television; The PAL system; Transmission and reception; Colour decoding; The TV receiver; Teletext; PAL-Plus, MAC and enhanced TV; Digital TV; Satellite TV; Cable TV; Development of video tape recording; Video tape; Signal processing; Signal processing; Servo systems and motor drive; System control for VCRs; The complete VCR; Tape formats compared; DVD players; Index

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CONTENTS: Foundations of television; Digital video and audio coding; Digital signal processing; Video data compression; Audio data compression; Digital audio production; Digital video production; The MPEG multiplex; Broadcasting digital video; Consumer digital technology; The future; Index

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Included is a list of references at the end of each chapter, along with a 50-page glossary at the end of book.

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CONTENTS: Magnetism and magnetic recording; Azimuth tilt technique; Frequency modulated recording and playback; Motor control and servomechanisms; Colour recording and playback; Systems control; Long play; Hi fi audio; Still pictures and slow motion; Camcorders; Digital camcorders; MPEG and D-VHS; Editing; PDC and IEEE1394; Soldering and desoldering; Index

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CONTENTS: General faultfinding; The workshop; Basic circuits; Power supplies; Aerials, feeders and propagation; Audio systems; Television and teletext receivers; Satellite television systems; Video recorders and cameras; Television distribution systems or Community Area Television (CATV); Index

April 1998 256pp 90 x 190mm 1 illustration Hardback ISBN 0750634480

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Enquiries about late publication dates should be addressed to:

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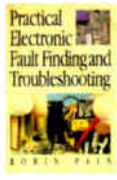

'Robin Pain has put down in words (almost entirely free of maths) the experience of many years practical work on audio, radio, TV and computer equipment.' Electronics Education

It isn't enough to be able to design. It isn't even enough to be able to debug. To be a real faultfinder, you must be able to get a feel for what is going on in the circuit you are examining. In this book Robin Pain explains the basic techniques needed to be faultfinder.

CONTENTS: Voltage, current and resistance; Capacitance, inductance and impedance; Diodes, transistors, op amps and negative feedback; Analogue fault finding techniques; Audio frequency; Radio frequency; Digital fault finding techniques; Discrete logic; Serial interfaces; Parallel interfaces; Microprocessor systems; Memory; Addressing; Microprocessor action; I/O control; CRT control; Dynamic RAM; Microprocessor systems: Fault finding techniques; Fault finding; Memory problems; Appendices; Index

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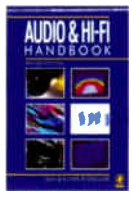

- **A handy reference tool for anyone involved in audio design, manufacture, installation and use**
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CONTENTS: Sound waves and acoustics; Studio acoustics; Microphones; Sound synthesis; Introduction to digital principles; Compact disc technology; Other digital systems (DAT, NICAM, DCC, MD); DVD audio standards; MP3 music on the internet; Nicam and satellite radio; Analogue tape recording; Noise reduction systems; The LP record; Disc reproduction; Tuners and radio receivers; Preamps and inputs voltage amplifiers/controls; Valve amplifiers; Loudspeakers; Loudspeaker enclosures; Headphones; Public address; In-car audio; Servicing; Interconnections; Index

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CONTENTS: Diagnostics and maintenance; Ink jet Printers in MFD machines; Laser and LED printers in MFD machines; Thermal printers; Scanners; Fax function; PC software for printer control; Standards and protocol; Consumables; Glossary; Abbreviations; References

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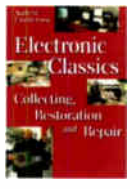

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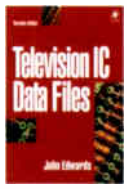

- **Over 30% new material**

The second edition covers over 70 ICs not included previously, making this book an essential update for the many service engineers who have discovered that John Edwards books are a vital workshop tool. However, the purpose of the book remains to cover the devices most frequently found faulty in television sets in production since the late 1980s, so all the key ICs will still be found here.

CONTENTS: A collection of television ICs files presented in alphabetical/numerical order

January 2000 256pp 156 x 234mm Paperback ISBN 0750645814

VCR IC DATA FILES

John Edwards

£20.99

Due to the increasing complexity of television and video equipment there is a growing need for service information that is current, accurate, affordable and readily available. The purpose of this book is to provide the workshop technician and the field engineer with a valuable and convenient method of fault finding without the need to consult workshop manuals which are often expensive or indeed out of stock.

CONTENTS: A collection of VCR ICs files presented in alphabetical/numerical order

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CONTENTS: Introduction; A-Z of manufacturers and models

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CONTENTS: Introduction; A-Z of manufacturers and models

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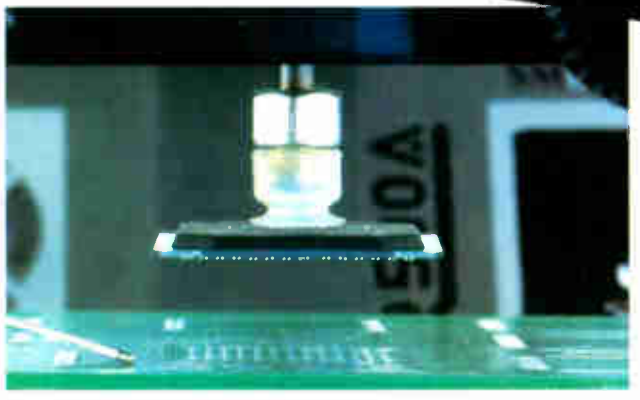

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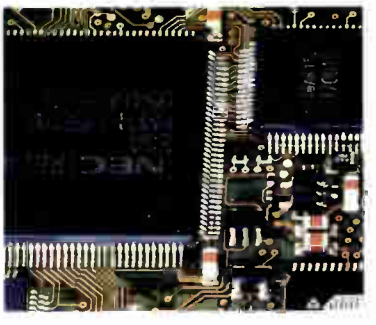

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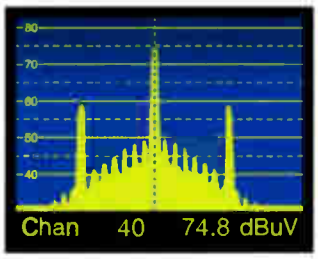

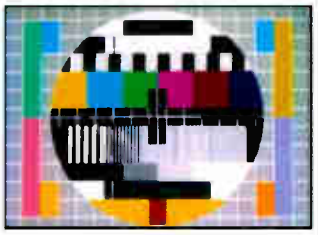

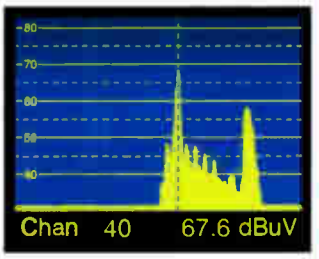

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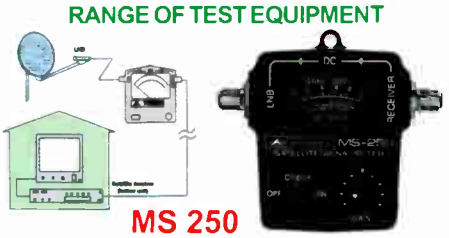

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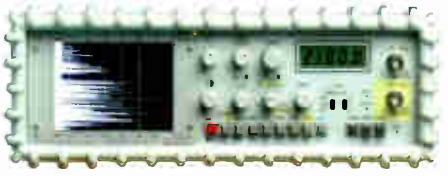

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