NEWS AND TECHNOLOGY ■ INSTALLATION ■ SERVICING ■ DEVELOPMENTS

TELEVISION

AND CONSUMER ELECTRONICS

DECEMBER 2004 £3.20

JAPAN CEATEC SHOW REPORT

A ribbon mic restoration

Measuring ESR

Bench notes: Hitachi TVs

9 770032 647139 12

FAULT FINDING FOR TV ■ AUDIO ■ SATELLITE ■ VIDEO ■ IT


Seasons Greetings
It's that time of year again! 2004 has been another year of growth for Classic. Our continuous product development programme has ensured that we remain the market leader with the best range of remote controls and other major service products in the industry. 2005 will see this range continue to expand to give you the products you need.
Look out for Classic's new product launches next year.
Seasons greetings to all of our Customers & Distributors.
For more information on the complete Classic range contact your usual Classic distributor, visit our web site, www.classic-serviceparts.com, call 01635 278678 or email us at uksales@classic-serviceparts.com
classic
Technical helpline 01635 278678

CONTENTS

December 2004 Vol. 55 No. 2

Editor
John A. Reddihough
TVeditor@highburybiz.com

Deputy Editor
Tessa Winford

Production Editor
Jane Massey

Production Executive
Dean Turner
01322 6110206

Group Advertisement Sales Executive
Steve Morley
01322 611 289
Fax 01322 616 376

Editorial Assistant
Caroline Fisher
01322 611 274

Managing Editor
Bill Evett

Publishing Director
Tony Greville

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

Next issue, dated January, on sale December 15

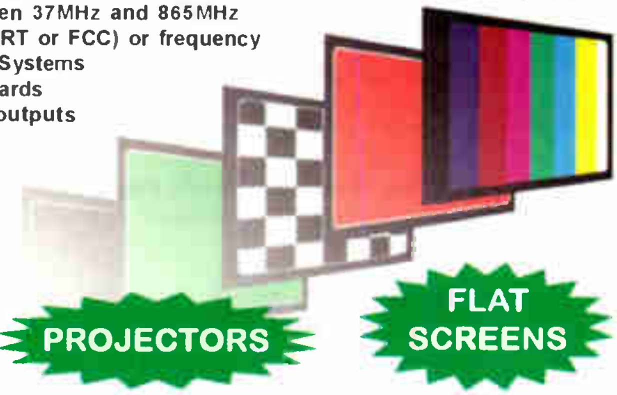
GV 198

PROMAX

TELEVISION TEST PATTERN GENERATOR

FEATURES INCLUDE :

- Suitable for Televisions, projectors and flat screens
- Covers 4:3 and 16:9 formats
- Tunable RF modulator between 37MHz and 865MHz
- Tunable by channel (CCIR, OIRT or FCC) or frequency
- PAL / SECAM / NTSC Colour Systems
- B / G / D / K / L / I / M / N Standards
- Composite Video and Sync outputs
- High Quality Construction
- 10 Front panel memories
- EUROCONNECTOR interface
- Electronic Attenuator
- Compact and Strong
- User friendly
- Attractive Price
- Clear LCD Display
- Available from Stock
- Full After Sales Service



AA 930

AUDIO ANALYSER

The AA-930 has been designed to facilitate the repair, tuning and analysis of audio frequency equipment in general. Hence, why the six indispensible measurement instruments from an audio service workshop have been combined into this one piece of test equipment. The AA-930 is equiped with RCA 600 Ω and DIN 47 kΩ connectors for the inputs and outputs. In addition, two BNC connectors on the front panel and two RCA connectors on the rear panel allow th user to view all of the signals measured by the instruments.

- Low Freqency Generator
- Wow and Flutter Measurement
- Distortion Meter
- Stereo Watt Meter
- Millivolt Meter
- Azimut

PROMAX

FOR ELECTRONIC TEST EQUIPMENT, THERE IS NO WIDER CHOICE THAN WITH PROMAX

GV 241

COMPUTER MONITOR PATTERN GENERATOR

In the world of computer monitors, unlike those for televisions, there is a multiplicity of different systems involved. To satisfy this incredible demand, PROMAX has designed the GV-241, a universal generator for the testing of computer monitors, which greatly facilitates their adjustment, control and repair.

- Test Patterns : Colour Bars; Red; Green; Blue; Scale of Greys; Cross hatch; Multiburst and White
- Outputs : R; B; G; CVS; HS; VS; CS; C1, C2, and C3

TA 903B

CRT REJUVENATOR

The TA-903B has been designed to analyse and rejuvenate the cathode ray tubes (CRT) of colour and black and white televisions and monitors. The user can detect and depending upon circumstances repair the leakage or short cicuits, simultaneously measure the current of the RGB cathodes in the cut off point, trace the voltage / current characteristics and rejuvenate each of the three cathodes independently.

Alban

ALBAN ELECTRONICS LIMITED

THE PROMAX SERVICE CENTRE

6 Caxton Centre, Porters Wood,
St. Albans, Hertfordshire, AL3 6XT.

TEL: 01727 832266
FAX: 01727 810546

WEB : www.albanelectronics.co.uk
EMAIL : info@albanelectronics.co.uk

SALES + SERVICE + CALIBRATION

CORRESPONDENCE
All correspondence regarding advertisements should be addressed to the Advertisement Manager, Television, Highbury Business, Media House, Azalea Drive, Swanley, Kent, BR8 8HU. Editorial correspondence should be addressed to Television, Editorial Department, Highbury Business, Media House, Azalea Drive, Swanley, Kent, BR8 8HU.

INDEXES AND BINDERS
Indexes for Vols. 38 to 53 are available at £3.50 each from SoftCopy Ltd., who can also supply an fifteen-year consolidated index on computer disc. For further details see page 123.
Binders that hold twelve issues of *Television* are available for £6.50 each from Modern Bookbinders, Pringle Street, Blackburn, BB1 1SA. Telephone: 01254 59 371
Make cheques payable to "Television Binders".

Newstrade Enquires
Seymour Distribution Ltd

ISSN **0032-647X**

SUBSCRIPTIONS
Highbury Fulfilment Services, Link House, 8 Bartholomew's Walk, Ely, Cambridge CB7 4ZD.
Telephone 01353 654 431
Fax 01353 654 400
Email hbc.subs@highbury-wyvern.co.uk
Please notify change of address.

Subscription rates:
UK 1 year £33.80
2 years £54.00
3 years £71.00
Republic of Ireland 1 year £38.95
2 years £62.00
3 years £81.85
Mainland Europe 1 year £49.00
2 years £78.40
3 years £102.90
Rest of World 1 year £63.50
2 years £101.00
3 years £133.00
Cheques should be made payable to Television.

BACK NUMBERS
If available issues are £4.00 each

HIGHBURY BUSINESS
A HIGHBURY HOUSE COMMUNICATIONS PLC COMPANY

The Ofcom review

The media regulator Ofcom published 'phase two' of its on-going report on public service broadcasting (PSB), i.e. non-commercial broadcasting, in early October. The main concern of this latest effort is what will happen to PSB in the coming all-digital era. It could, of course, be left to the BBC, with contributions from Channel 4 – it seems that ITV will be relieved of much of its PSB responsibility with the end of analogue TV licensing and the switchover to all-digital TV. But Ofcom feels that there should be some sort of alternative to BBC-provided PSB. To resolve the problem, it has come up with an innovative suggestion, to establish what it calls a Public Service Publisher (PSP).

The PSP would have a budget of "about £300m a year in today's money". This would be obtained by public or broadcaster taxes or an increase in the TV licence fee. The PSP would use it to "commission and distribute" TV content. It wouldn't be simply another TV channel. Indeed its output would amount to about three hours a day of new programming. This would be made available to viewers in various ways, e.g. via broadband-equipped PCs, mobile phones and video-on-demand-equipped TV sets. Some of this content would presumably be made available to the established broadcasters, the main aim being to ensure that such content is actually produced. The PSP would be run from outside London with a ten-year licence. Who exactly would run it remains open for further consideration.

There is likely to be a certain amount of public concern, to say the least, about its funding – and one can imagine the uproar if it turned out that the PSP produced expensive programmes that virtually no one watched. We don't, of course, know how TV will develop in terms of access: will substantial use be made of PCs and mobile equipment for TV viewing? That remains to be seen. One problem with all his is that access would require a certain amount of viewer effort. But as a means of ensuring that PSB material continues to be produced in what could be an increasingly commercialised TV era the PSP might well be worth a try. It will be interesting to see how Ofcom develops the idea, which still seems to be somewhat tentative.

Towards HDTV

HDTV would have been inconceivable in the analogue-only TV days, because of the huge bandwidth required. Digital TV, which brought with it data-compression technology, changed all that. But, naturally, an HDTV transmission still involves more data that a standard-definition one. HDTV standards for broadcasting have been established for some years. The parameters for DVB (digital video broadcasting), Europe's digital TV system, were initially agreed in 1993: they included an HDTV option. It took a little longer for the US to adopt a digital TV standard, with HDTV as an option. The various commercial interests there tend to take a long time to reach agreement, but the FCC finally set digital and HDTV standards in 1998.

HDTV raises many problems. How to display it is one, how to finance the huge cost of updating studio and broadcasting equipment another. The display problem has been eased with the introduction of LCD and plasma panels with high-resolution capability. The studio problem is being resolved as equipment is updated. There is the added factor that optical discs have made it easy to provide HD video.

Although the US adopted an HDTV standard later than Europe, HDTV is taking on more rapidly there than here. The US digital TV system, with SDTV/HDTV compatibility, has been providing HDTV for some time. There are currently estimated to be some 1·5m HDTV sets in US homes (a large number but a small percentage). The total is expected to reach 30m within the next three years. The need for US cable systems to upgrade – cable has long been a much larger provider of TV in the US than elsewhere – has held back HDTV in N. America. But it seems that the setmakers and broadcasters are now making a concerted effort to increase HDTV use. Sports in particular are seen as a major way of increasing HDTV's popularity. The Olympic games in China in 1998 will be the first to be available worldwide in HDTV form, so stand by for a big upsurge of interest then.

HDTV is coming, and can make a great difference to the TV experience. Some photographs on pages 119-120 give a hint of this. With digital technology, HD is not a wildly expensive option for domestic TV – the display is another matter, though people are already paying thousands of pounds for LCD and plasma panels. Movement towards HDTV in Europe is at present slow: there were estimated to be some 50,000 sets in use at the end of last year. But HDTV is on its way.

LCD surplus

With demand exceeding supply until recently, LCD TV sets and PC monitors have been selling at premium prices. It now seems that, as a result of high investment in new plant by LCD manufacturers and lower than expected demand, the position is about to change. Samsung, the world's largest LCD manufacturer, cut prices by 21 per cent in the third quarter compared to the previous three months. LG Philips LCD, the second largest producer, has reported a 20 per cent fall in prices and expects a further 10-15 per cent fall in the next few months. But despite a build-up of stock, LG Philips LCD says it has no plans to reduce output. According to research company Display Search, LCD manufacturers produced four million more panels than were needed in the third quarter, resulting in "extreme pricing pressure".

Some Taiwanese LCD manufacturers are reported to have delayed or stopped construction of new plants. Samsung plans to open its seventh-generation plant next year, the most advanced in the industry. This should reduce its production costs sharply, enabling the company to sell at lower prices while maintaining profit margins. The plant is a joint venture with Sony.

Archos has introduced a pocket video recorder, Model AV400, whose 20GB memory can store eighty hours of TV, 300 hours of music or up to 200,000 photos. A 3·5in. colour LCD provides viewing when you are out and about. Recordings can be made, as MPEG-4 video with CD-quality stereo sound, from a TV set, VCR or cable/satellite receiver using a specially-designed TV cradle. The device incorporates a 'recording scheduler' that controls the tuner in a VCR or set-top box to select the channel automatically, based on the time and duration set by the user. The 'video bookmarking' feature enables you to set a 'bookmark' manually at any point during a video recording and return to that point.

MP3, WMA and WAV music files can be recorded and played back, the Archos ARC library enabling you to select by artist, genre, title and year. Photos are stored as JPEGs. They can be transferred from memory cards using the CompactFlash reader. An optional adaptor is available for SD, MMC, SmartMedia, Memory Stick and Memory Stick Pro cards. Photo and data files can also be downloaded from a PC or Mac via the USB interface.

The AV400 pocket video recorder sells for about £400. For further details check at www.archos.com

Dolby update

Dolby audio technologies have been selected as mandatory formats for both of the new generation of blue-laser optical discs – the Blu-ray disc and the High-Definition Digital Versatile Disc (HD DVD). The DVD Forum has selected Dolby Digital Plus and MLP (Meridian Lossless Packing) for the HD DVD, while the Blu-ray Disc Association has announced that Dolby Digital is to be used.

Dolby Digital Plus, an extension of the Dolby Digital format, offers bit-rate and channel extendibility. Where higher bit rates can be allocated for audio playback, Dolby Digital Plus uses sophisticated perceptual coding to provide higher-quality audio. It also provides coding efficiency where bandwidth is at a premium or limited, for example with next-generation cable, broadcast and satellite systems. In addition Dolby Digital Plus can provide simultaneous streaming of audio content and software playback. This would, for example, enable viewers to watch a movie while listening to artists' or director's commentary streamed directly from the studio website.

MLP technology is licensed by Dolby Laboratories. It enables content providers to encode multiple channels of 24-bit/96kHz-sampled surround sound or 24-bit/192kHz-sampled stereo sound for recording on a DVD.

Chip for mobile digital TV

Texas Instruments is developing a chip, code-named Hollywood, that will enable US users to receive digital TV broadcasts via a mobile phone. The chip will incorporate a tuner, demodulator and channel decoder. Sample chips are expected to be available in 2006. The US currently lacks a standard for mobile TV broadcasting but is expected to adopt the European DVB-H (Digital Video Broadcasting – Handheld) standard.

New LCD technology

Hewlett-Packard has developed a new liquid-crystal display technology that provides high-definition screens in a variety of sizes. Known as Post Aligned Bistable Nematic (PABN), the technology works by placing liquid crystal elements in contact with tiny polymer posts, each less than one micron in diameter, which are printed on a plastic sheet. The liquid crystals align with the posts either horizontally or tilting upwards. When a voltage is applied, the liquid crystals switch from the horizontal position (dark) to tilted (light): when the voltage is removed the liquid crystals retain their position, so no power is required once an image is displayed. The technique is an alternative to the TFT approach.

HP claims that A4-sized screens with a 7,000 x 5,000 pixel resolution are possible using the new technology. A 4 x 3cm prototype has been demonstrated recently. Potential advantages are larger, cheaper displays. Development has been going on for several years, but further research and production engineering technology are required.

New flat-panel display

Canon and Toshiba have announced a joint venture to develop a new type of flat screen for TV sets, known as the surface-conduction, electron-emitter display (SED). It uses some of the characteristics of a CRT to create higher-quality images – the response is quicker than that with LCD and plasma screens. The device is also more energy efficient. For further details see page 72. The plant being set up will have an initial production capacity of 3,000 panels a month by next August, increasing to 3m panels a year by 2010.

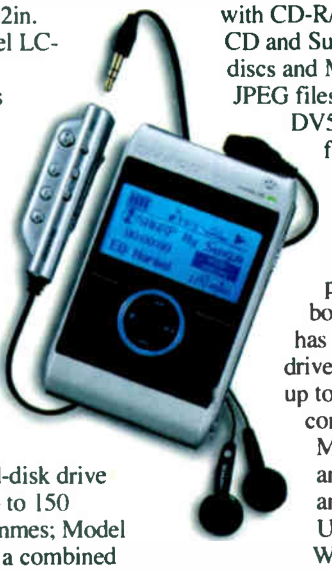
SVP – a new encryption system

A new conditional-access encryption system, secure video processor (SVP), has been developed by NDS in conjunction with STMicroelectronics and Thomson Multimedia. It will also prevent illegal copying of pay-TV material. The system works by encoding the programme content rather than the distribution method. Programming distributed with SVP cannot be viewed via an unauthorised device. Legitimate pay-TV subscribers will however be able to watch SVP-protected programming on second sets or mobile devices as part of a new generation of subscription services linked to the system.

Abe Peled, chief executive of NDS, expects SVP to be adopted by pay-TV companies from early 2006.

Samsung has announced the world's first phone-camera to use a five-megapixel image sensor. It uses a micro lens module, developed in conjunction with the Japanese lens maker Asahi Pentax, that's a twentieth the size of a digital camera lens. According to Samsung the phone-camera is also the first to have a TFT-LCD that can display 16 million different shades of colour.

New from Sharp



Sharp has launched a number of new products, including two Titanium series Aquos widescreen LCD IDTV sets. Model LC-32GD1E has a 32in. screen and Model LC-37GD1E a 37in. screen. Both sets have three scart sockets (two RGB capable), S video and DVI-I inputs, an RS232 port and a PC card slot.

Model DV-HR350H is a combined DVD-RW/R recorder and 120GB hard-disk drive that can store up to 150 hours of programmes; Model DV-RW250H is a combined DVD-RW/R recorder and VCR; and Model DV-NC100H a combined DVD player and VCR.

There are two portable home theatre systems. Model QT-V5E includes a DVD player, a CD player and an FM/AM radio. It can be connected to a TV set via a scart lead and is also compatible with CD-R/RW, Video CD and Super Video CD discs and MP3 and JPEG files. Model XL-DV50H has a five-disc DVD changer.

Model HR-GB201 is described as a personal jukebox recorder. It has a 20GB hard drive that can store up to 5,000 titles; is compatible with MP3, WMA and WAV files; and includes a USB 2.0 port. Weight is just 157g. Price is expected to be about £250.

Sharp's first DAB radio, Model FV-DB1E, has twenty preset stations and can also receive FM transmissions.

Sky+ news

From 16 October football fans have been able to use Sky+ to record highlights of any of the day's Premiership games. Viewers watching Sky Sports Football First via Sky+ can use the interactive recording function to capture extended highlights of a team or game of their choice. To access Sky Sports Active, you go to an on-screen menu by pressing the red button on the Sky remote-control handset.

Viewers can record one video stream while watching another game, or record two scheduled streams while watching another previously-recorded programme from the Sky+ Planner.

Panasonic's plasma advance

Panasonic has started to sell what is claimed to be the world's largest consumer plasma display panel in Japan. Model TH-65DX300 has a 65in. screen and features Panasonic's PEAKS (Picture Enhancement Accelerator with Kinetic System) driver. This is a video signal processing circuit that enables 8·58 billion colours and 2,048 shades of gradation to be displayed. It provides up to 3·62 billion colours and 1,536 shades of gradation in low-brightness areas. A contrast ratio of 3,000:1 is provided by the Real Black Creation technology, while Motion Pattern Noise Reduction reduces motion patterning. Panel life is quoted as approximately 60,000 hours.

The TH-65DX300 weighs 109kg with stand. Its dimensions are 1·6 x 1 x 0·39m (width, height, depth). Price in Japan is the equivalent of about £11,000.

At the Japan CEATEC Show

Japan CEATEC is one of the world's leading consumer electronics shows. This year's event, held in Tokyo, included the latest developments in flat-screen displays, optical-disc technology, hard-disk recording and the convergence of PC and CE devices.

George Cole reports on the highlights

Every October the Japan CEATEC (Combined Exhibition of Advanced Technologies) Show enables the latest mobile telecoms, computer and consumer electronics products to be seen. This year's CEATEC was held in the giant Makuhari Messe (Japan Convention Centre) on the outskirts of Tokyo. There were 728 exhibitors, 266 from outside Japan. Technology convergence is definitely happening, as many of the products on show illustrated. For example there were items that combined computers with consumer electronics products, and some that combined mobile phones with video systems.

Television

The last time I visited CEATEC, over five years ago, large, flat-screen TV sets and displays were novelty items that were still under development – those on show were invariably described as prototypes. All that has now changed, and it was difficult to find a CRT set anywhere. The main flat-screen technologies present were LCD and plasma, though others were being exhibited – see later.

One of the highlights of this year's show was Sharp's 65in. Aquos LCD set, the world's largest LCD TV and a clear indication that LCD is rivalling plasma for large, flat display screens. It's no longer

Sharp's 65in. Aquos LCD set, the world's largest LCD TV.

the case that LCD is likely to predominate at screen sizes of 28in. and below while plasma will remain predominant at screen sizes larger than this. There was very little information on the 65in. LCD set other than that it provides high-definition resolution at 1,920 x 1,080 pixels. The picture quality was certainly impressive. No price details were given but as Sharp's 45in. LCD set, which is due to be launched in the UK by the end of the year, is expected to cost about £6,500 one feels that the 65in. version will sell for £10,000 or more.

The Sharp stand was packed with smaller-sized LCD TV sets, with screen sizes from 13 to 45in., including the IT-TV. This is an LCD multimedia monitor with a built-in tuner and the ability to display graphics from a PC – in fact TV and computer graphics can be displayed on-screen simultaneously. It comes in three screen sizes, 20, 23 and 26in. Japan now has both satellite and terrestrial HDTV services – the Japanese state broadcaster NHK had a large stand devoted to HDTV at the show.

Sony's XMB series sets feature a rather stylish remote-control handset with a thumb-controlled dial for navigating through the on-screen menus and a flip-over design. The sets have lots of connection sockets, including HDMI (High-definition Multimedia Interface), USB and a PC connection. A 37in. LCD TV set, Model LCD-H37MRH4, was a feature of the Mitsubishi stand.

Toshiba showed a series of high-definition LCD TV sets with the curious name Beautiful Face. There were four models with 32 and 37in. screens. All incorporate what Toshiba calls an integrated "meta brain". This is a 64-bit signal processor chip, with Linux-based image processing, to improve picture quality. The new sets are also designed to work with a home network: connection sockets include an Ethernet port, an HDMI (High Definition Multimedia Interface) and a USB link. Japanese consumers can buy an external 300GB hard drive known as a LAN HDD (Local Area Network Hard Disk Drive) that will link up with models that have LZ150 in the number, enabling viewers to record high-definition TV. If an LZ150 set is linked to a PC it can provide an automatic email checking facility. LZ150 models can also record terrestrial analogue broadcasts on to an SD Memory Card, using MPEG-4 compression. All four sets in the range can be used for internet browsing: an integrated LAN terminal can be linked to a broadband internet connection (such as ADSL or fibre-optic cable) with a built-in browser activated. The "net double window" feature means that web pages and TV programmes can be displayed on-screen simultaneously. The USB port can be used to connect an external keyboard. The port can also be used with a digital camera, a mobile phone and memory cards using USB adapters.

Toshiba plans to launch a 20in. LCD set with an integrated satellite tuner. The Toshiba Model RD-17VT is a 17in. LCD TV set with a built-in hard-disk drive and DVD recorder.

JVC showed a giant 70in. rear-projection TV set which uses HD D-ILA (High Definition Digital Image Light Amplification) technology. Sony showed a 70in. rear-projection TV model that uses LCOS (Liquid Crystal on Silicon) chip technology to generate the display.

Sanyo gave visitors an opportunity to watch OLED (Organic LED) displays. These are seen by some as an alternative to the small LCD screens used in devices such as digital cameras, camcorders, in-car navigation systems and PDAs. Sanyo's publicity material explains that OLEDs are made by forming a series of layers on a glass substrate. The layers consist of a cathode, three organic film layers (a hole-transport layer, a light-emitting layer and an electron-transport layer) and an anode. When the organic molecules used in an OLED display are energised, they emit energy in the form of light then revert back to their initial state. When a voltage is applied to an OLED device the holes formed at the anode and the electrons given off by the cathode recombine in the light-emitting layer. The energy

Sharp's IT-TV, which is an LCD multimedia monitor with a built-in tuner and the ability to display graphics from a PC.

JVC's giant 70in. rear-projection TV set which uses HD D-ILA (High Definition Digital Image Light Amplification) technology.

The Sharp 4E-MB1 mobile AV player, which has a 3·6in. LCD screen, is due for a November launch.

Toshiba's DVD/hard-disk recorder, Model RD-X5, has a 600GB HD drive.

generated activates the organic molecules which emit light. OLED displays can be produced in active or passive matrix form.

Sanyo also displayed a 40in. 3D LCD display which doesn't require the viewer to wear special glasses in order to see the 3D effect. The LCD operates like a fast-acting shutter, providing the left and right eyes with slightly different images. The brain uses this difference information to create 3D images. The display works well, but I seem to recall Sanyo showing similar technology a decade ago, suggesting that it remains difficult, and expensive, to create 3D TVs for the consumer market.

Pioneer's stand included a research product referred to as "3D floating video": objects appear to float in front of the screen.

SED

Last September Canon and Toshiba announced a joint venture, due to commence operations in October, for the development, production and marketing of a new type of flat-screen display panel known as an SED – Surface-conduction, Electron-emitter Display. The venture makes use of Canon's electron-emission and microfabrication technologies and Toshiba's CRT technology and mass-production technologies for liquid-crystal displays and semiconductor devices. As with a conventional CRT, the SED relies on electrons striking a phosphor-coated screen to produce light. But whereas a CRT requires an electron gun, deflection coils and a large, evacuated bowl, a SED uses an array of electron emitters.

Fig. 1 compares a CRT and an SED. Fig. 2 shows how the electron emitters are activated by applying a drive voltage to an SED cell. The electron emitters are arranged to correspond with display pixels. Canon and Toshiba say that in addition to high brightness and definition, the SED provides a fast video-response performance, high contrast, high gradation levels and low power consumption.

Canon began carrying out SED technology research in 1986 and, in 1999, began joint development with Toshiba, the aim being commercial exploitation of the SED principle, first for use in large-screen TV sets. There was certainly a lot of interest on the Toshiba stand, with large numbers of people anxious to see the results. The first SED products are expected to go on sale in Japan next year, when Toshiba plans to start producing 3,000 SED screens a month. It will be interesting to see whether the SED does become a viable alternative to LCD and plasma displays.

Mobile video

Many mobile phones sold in Japan, such as the Sharp V602H, have a built-in analogue TV tuner. Digital terrestrial TV services designed for hand-held devices will be launched next year. The mobile DTT service will provide two channels, one for a la carte offerings and the other for news. Using MPEG-4 compression, the video data rate will be 180kbits/sc while the audio stream will operate at 24kbits/sec. PSK (Phase Shift Key) modulation is to be used, the total bit rate being 312kbits/sec. Sanyo and telecoms company NTT DoCoMo both showed prototype mobile handsets with a built-in DTT tuner. NTT DoCoMo's prototype uses a docking station with a 20GB hard drive, sufficient to store up to 80 hours of TV programmes.

On October 20 a satellite service for mobile users, called Mobaho!, was launched by MBCO (Mobile Broadcasting Corporation). MBCO is a consortium of consumer electronics and broadcasting companies that includes Sharp, Toshiba, Sanyo, Canon, Tokyo FM Broadcasting and Nippon

Television Network. The satellite was launched on 13 March, and on 29 March the 12m S-band aerial was deployed. Its footprint covers almost all of Japan, except for a few outlying islands, also Korea though the service will not be available there. Mobaho! offers its subscribers seven video channels, thirty music channels and up to sixty data services. The video channels include live sports broadcasts, news and entertainment. Subscribers pay an initial registration fee then monthly sums for various service packages – audio/video/data, video/data or audio only, the premium sports channel being extra. As the service comes via satellite, mobile video can be watched almost anywhere – on a bus or train, even a ship – the exception being when the user is in a tunnel.

Sharp and Toshiba are the first companies to launch portable AV players for this new service. The Sharp 4E-MB1 mobile AV player, which has a 3·6in. LCD screen, is due for a November launch. It can also be used as an MP3 player, a JPEG photo album and an electronic book reader. There is also an SD card slot. A number of Japanese TV sets have memory card slots that enable viewers to download programmes on to an SD card, using MPEG-4 compression. The card can then be inserted in the 4E-MB1 for playback as and when required. Model 4E-MB1 costs the Japanese equivalent of about £370.

Toshiba's offering is the palm-sized Model MTV-S10, which has a 3·5in. LCD screen and also includes an SD card slot.

One problem with mobile satellite reception is the power required for the aerial. Battery life is currently limited to about 1-1·5 hours when receiving satellite broadcasts, or about twice that when the player is not using the broadcast aerial.

Reception of Mobaho! via a mobile phone won't happen until new chipsets with much lower power consumption have been developed. This is expected to take a couple of years.

Blu-ray and HD DVD

Many prototype Blu-ray recorders were on show. There was also the massive Sony BDZ-S77 recorder, which is already on sale in Japan at the equivalent of about £2,500. Sony also showed a prototype BD-ROM (Blu-ray Disc ROM) recorder. Blank Blu-ray discs cost the equivalent of about £55.

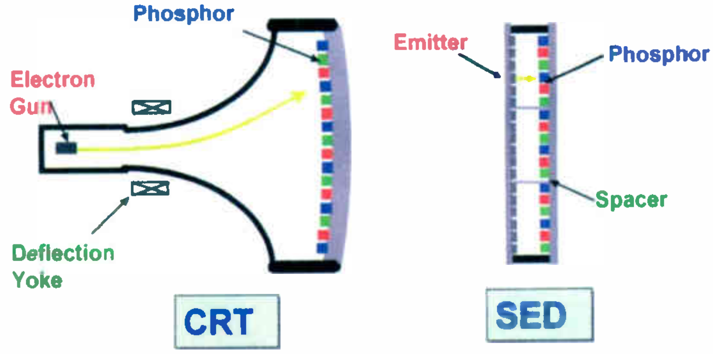


Fig. 1: Comparison between a CRT and an SED. Both rely on electrons striking a phosphor-coated screen to produce light.

Prototype Blu-ray recorders were present on the Sharp, Panasonic, Pioneer and JVC stands.

They were conspicuously absent on the Toshiba stand, because Toshiba, Sanyo and NEC were busily promoting the rival HD DVD system. This uses similar disc technology to standard DVD, with single- and dual-layer discs that can currently store up to 30GB of data – enough for about eight hours of high-definition video. A large stand showed prototype HD DVD players and discs, also a prototype HD DVD computer drive from NEC.

Sadly there is little sign at present of the Blu-ray and HD DVD camps joining forces to provide consumers with a single high-definition, blue-laser optical-disc recording system.

DVD recorders

Most top-of-the-range and mid-range DVD recorders on sale in Japan now include a hard-disk drive as standard. The idea behind this combination is that most video recording is done using the hard drive, then wiped, with the DVD recorder being used for archiving programmes or as a second TV recorder.

The Toshiba RD-X5, which uses DVD-RAM and DVD-R discs, has a massive 600GB drive that's able to store up to 1,071 hours of standard-definition video! It also conforms to the CPRM (Content Protection for Recordable Media) standard, which offers a copy-once recording mode with DVD-R discs. In other words, once a recording has been made on the disc it cannot be copied to another disc. More and more Japanese broadcasters are using the CPRM system in an effort to control digital copying. Toshiba's new RD-RVR120 DVD-R disc can be used with the RD-X5 to make CPRM recordings.

Sharp's DV-HRD200 digital HDTV recorder has a DVD-RW drive and a 400GB hard drive that can store up to 34 hours of high-definition video. Toshiba's RD-XS53 has a 320GB hard drive that can record up to 570 hours of standard-definition video. The Sony

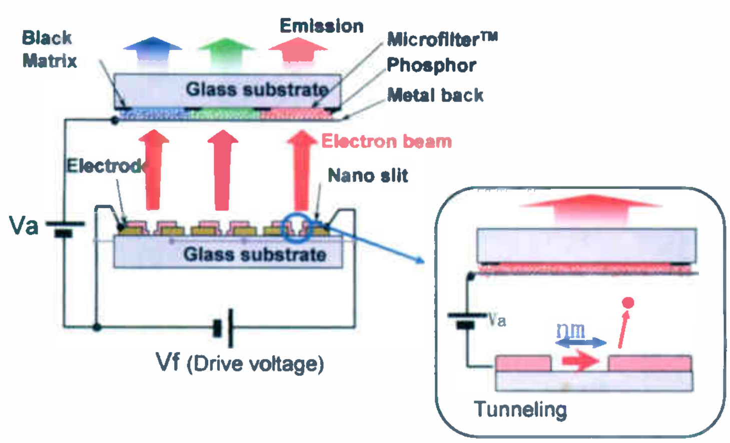


Fig. 2: How the SED electron emitters operate.

There was certainly a lot of interest in the SED display on the Toshiba stand, with large numbers of people anxious to see the results. The first SED products are expected to go on sale in Japan next year.

RDR-HX100 is a DVD recorder with a 400GB hard drive, while Model RDR-HX90 has a 250GB hard drive.

Sony has put a 120GB hard drive in Model RDR-VH80, a combi unit that includes a DVD player and a VHS deck. The Panasonic E330H is a DVD-RAM recorder with a 250GB hard drive, also SD and PC memory card slots. The Hitachi DV-DH400T is a DVD-RAM recorder with a 400GB hard drive.

Branching out

Sony's new PSX multimedia machine created a lot of interest. It can be used as a PlayStation games console, an MP3 player, a DVD recorder and a hard-disk recorder. There are two versions, one with a 250GB and the other with a 160GB hard drive.

Sony also showed the Vaio VGX-X90P, a PC-based home video server that contains four 250GB hard drives and three TV tuners. It can record up to seven TV channels simultaneously and has enough storage space for up to five and a half days of TV programmes! It also has its own electronic programming guide. The price in Japan is the equivalent of about £3,000.

Sony's new PSX multimedia machine can be used as a PlayStation games console, an MP3 player, a DVD recorder and a hard-disk recorder.

Home networking

The Digital Home Working Group (DHWG) has been formed by a consortium of PC, consumer electronics and telecoms companies, including Nokia, Panasonic, Microsoft, Sony, Sharp and Samsung, to set standards so that different devices from different manufacturers can communicate with one another.

Version 1.0 of the DHWG's guidelines was published in July. The guidelines are based on existing standards, such as WiFi wireless networking and IP (Internet Protocol) technology.

The DHWG had a large stand at CEATEC. It demonstrated how 24 different products from different manufacturers could work together using the DHWG standard.

Panasonic's stand provided an example: it featured the TV Client, a monitor which can display content from a home server and other video devices. It looks promising, but one of the biggest hurdles facing the DHWG is to set standards for copy protection and digital rights management systems.

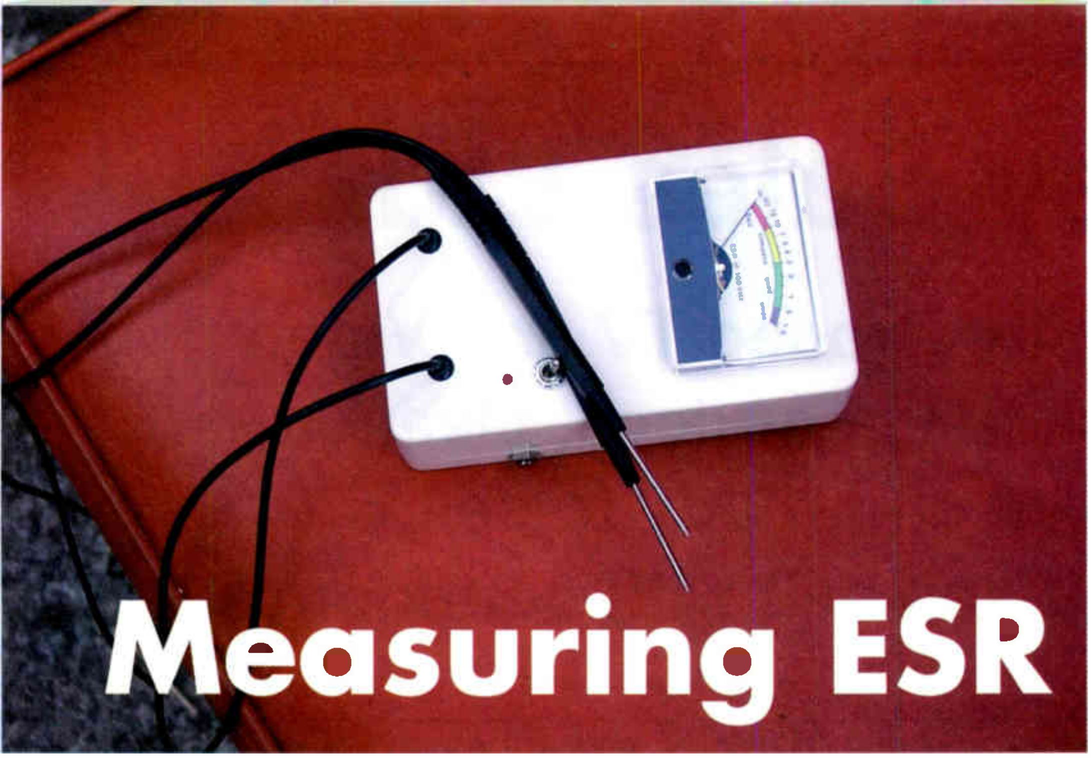
Camcorders

Perhaps I just missed them, but there didn't seem to be all that many camcorders at CEATEC. Sanyo's Xacti Model DMX-C4 stood out from the crowd for its stylish design. This palm-sized camcorder comes in a variety of colours and records on an SD Memory Card, using MPEG-4 compression. Up to 41 minutes of the highest quality video can be stored on a 1GB SD card.

Hitachi showed its DZ-MV580 and DZ-MV550 DVD-RAM camcorders, which use 8cm discs. JVC was busily promoting its Everio Media Camera, which can store up to 60 minutes of DVD-quality video on a 4GB Microdrive card.

Video Scratching

One of the strangest products seen was on the Pioneer stand. This was the DVJ-X1, which can be used by 'video DJs'. The system has lots of controls for manipulating video. For example you can change the speed or direction of the video, or even indulge in some 'scratch video'. Pioneer had mustered a number of budding video DJs who used the system to manipulate music videos from the MTV channel. ■



Measuring ESR

The equivalent series resistance (ESR) of an electrolytic capacitor is a reliable indication of its condition. Alan Willcox's first ESR meter design, published in these pages some five years ago, was very popular. This Mark 2 version incorporates several improvements, in particular a simpler oscillator design and single-battery operation

A simplified equivalent circuit of an electrolytic capacitor, see Fig. 1, is usually shown when providing a brief explanation of what ESR is all about. In addition to the ideal capacitor Xc, a second component is present. It has a significant effect on the capacitor's performance, and is referred to as the equivalent series resistance (ESR). Electrolytic capacitors are used mainly for decoupling and, to a lesser extent, for signal coupling. This being so it's important that, for optimum performance, the impedance (AC resistance) of the capacitor is as low as possible.

An electrolytic capacitor's ESR is mainly determined by the condition of the electrolyte (paste) that separates its foils. The electrolyte increases the component's capacitance but, when it deteriorates, it increases the impedance present. The lower the ESR, the better the capacitor!

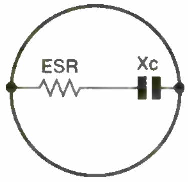


Fig. 1: Simplified equivalent circuit of an electrolytic capacitor. Xc represents an ideal capacitor. Its reactance moves towards zero ohms as the frequency increases. Xc = 1/(2π fc). The value of the equivalent series resistance ESR is determined mainly by the condition of the electrolyte.

Electrolytic capacitors used in switch-mode (chopper) power supplies and those mounted close to heatsinks tend to run hot. Heat is inclined to dry out the electrolyte and, in time, a capacitor may develop a high ESR. This will itself introduce a power loss – and more heat! The effect of failure of this type in a power supply can be catastrophic. For example, if the capacitor is in the HT monitoring section of a TV set's power supply the HT voltage might rise, damaging the line output transistor and maybe the field output IC.

This type of problem is more significant when a set is started up from cold, as the condition of a faulty electrolytic capacitor is worse when cold. Thus cold checks are by far the best approach to testing! Problems with electrolytic capacitors, particularly those used in switch-mode power supplies, are caused not so much by a change of capacitance value as by an increase in the component's ESR. Thus removal of a suspect capacitor to check it with a conventional capacitance meter is largely a waste of time. Furthermore a faulty capacitor may be overlooked because its capacitance value has hardly changed. An ESR meter gets around this problem by using a test frequency (or pulse rate) that's high enough for the capacitive reactance to be almost zero ohms, leaving just the ESR as the measurement.

Measuring ESR

ESR obviously cannot be measured directly, using a conventional ohmmeter, so a means has to be found to 'get to' the ESR that's hidden inside the capacitor. A number of ready-made meter designs and kits are now available for measuring the ESR of an electrolytic capacitor in-circuit, using cold checks. They achieve success and simplicity in varying degrees. Use of a suitable meter enables cold checks to be made without the risk of any further damage occurring. Strictly speaking it is the impedance that's being measured but, over a particular range of test parameters, it can be shown that this presents more or less the same value.

It is all too easy to over-complicate things when it comes to ESR. There are those who argue that ESR meters don't measure the ESR precisely. But, in the real world, how precise does the reading need to be? It really doesn't matter. The service engineer just needs to know, as quickly as possible, which capacitor is causing the trouble. An ESR meter does just that! Once technicians have become accustomed to using an ESR meter, they wonder how they ever managed without one. Although the ESR varies somewhat with frequency, we can in practice regard it as being a constant in-phase component, and calibrate our meter using fixed resistors. This is useful, as the meter will also serve well as a low-ohm meter.

So, if an ESR meter doesn't measure capacitance, what readings can we expect from good and bad capacitors using such a meter? How do you know whether a capacitor is OK or not? The curve shown in Fig. 2 gives a practical idea of the sort of ESR readings that should be obtained with good capacitors of different values. There is no hard-and-fast rule however – it's not an exact science. All it needs is a bit of getting used to. This doesn't take long: just measure the ESR of a few new capacitors. Try 1, 10, 47, 100, 470 and 1,000μF. You will find that values of 47μF and above measure quite low, 0·5Ω or less, with the buzzer coming on (the buzzer turn-on point can be varied, see later). The important point is just how low capacitors with values of 47μF and above measure. At 470μF and over, the reading is close to zero ohms. If, in practice, a 1,000μF capacitor produces a reading as high as 0·5Ω, it's no good!

Analogue or digital display?

Digital methods of measurement and display are generally regarded as providing more accurate results. For many applications this is true, but it's not necessarily so with ESR measurement. There are two ways of interfacing the capacitor being tested and the meter. The capacitor can be connected in parallel with the test signal source, as shown in Fig. 3(a), or in series, see Fig. 3(b).

If a digital ESR readout is used, the capacitor must shunt the test signal. With an ideal capacitor, the result will be zero ohms and zero display: with a bad capacitor there will be a high reading, with little shunting away of the test-signal. We are interested in ESR values of 3Ω or less, but a digital meter gives readings far higher than this. It's not a major problem, but can give rise to superfluous information as far as ESR measurements are concerned. A more important factor is that the parallel method results in a significant increase in the readings obtained because of excessive sensitivity to the inductance of the test leads. This can be overcome by fitting two leads to each probe. It provides cancellation to a large extent, but this solution is a bit clumsy in use and to construct. The series method of interfacing does not suffer from this drawback, so the use of conventional test leads becomes acceptable. I don't know why this effect occurs – I just found out the hard way.

Although we have become used to digital readouts nowadays, for ESR measurement there is little doubt that a moving-coil meter is the best type of display. It gives a rapid, easy-to-interpret indication of the condition of the capacitor. After some experience of using it, one gets to know where the pointer should approximately be with good capacitors of different values. Indeed a meter scale becomes almost unnecessary. I know of people who have used this type of meter quite satisfactorily without ever having taken the trouble to fit a scale dedicated to ESR measurement.

To repeat: it's not an exact science but, with some experience,

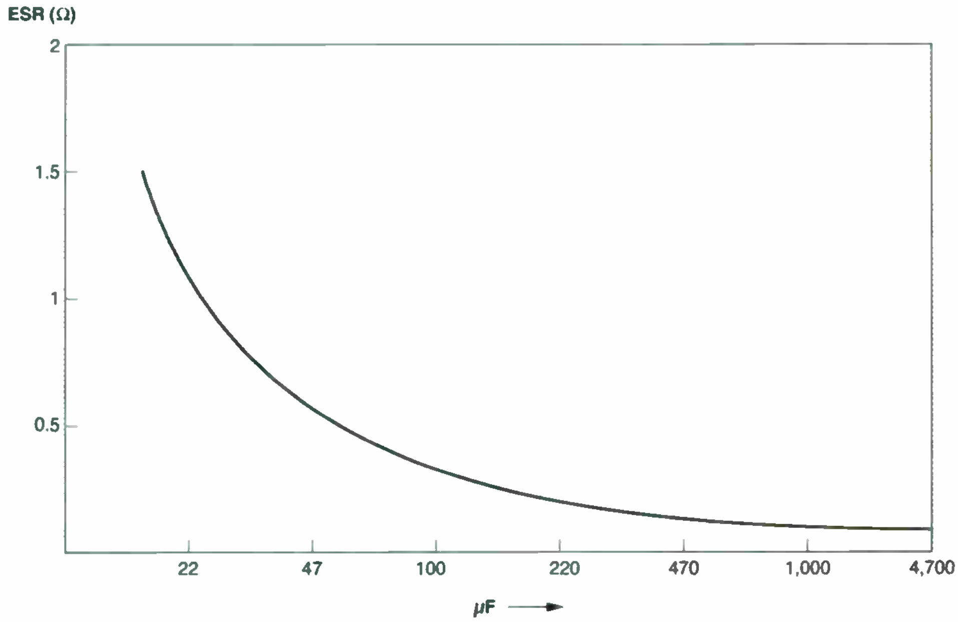


Fig. 2: Plot of ESR vs. capacitance. The curve is typical of 63V working capacitors. With higher voltage ratings the ESR is somewhat higher.

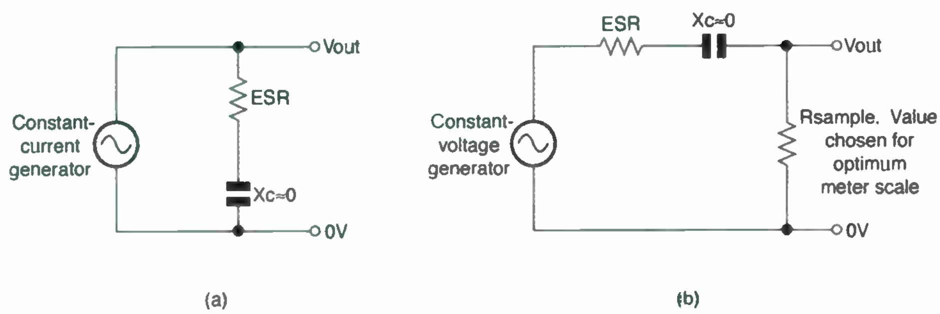
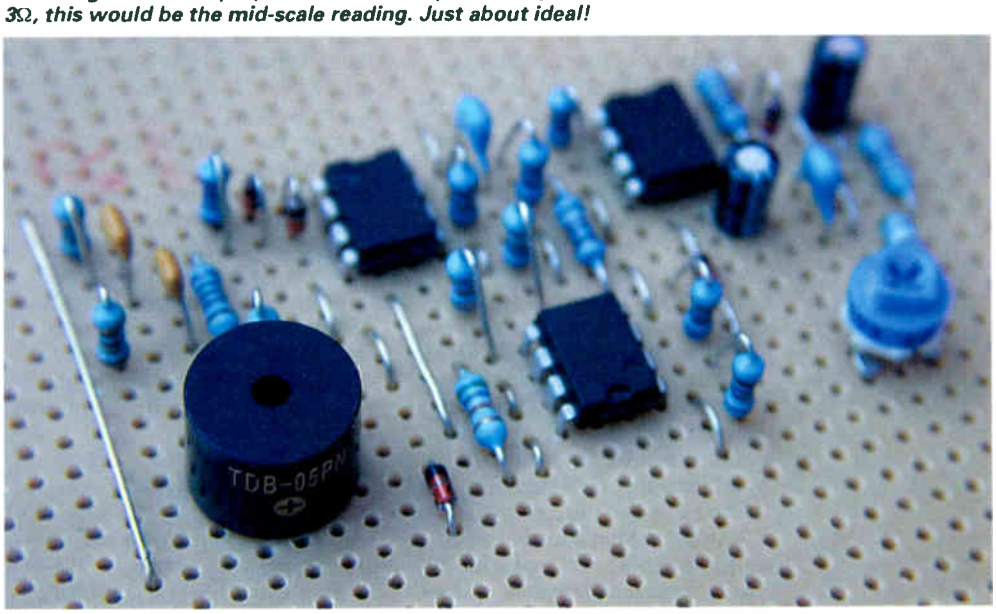


Fig. 3: The shunt type of interface used with a digital display is shown at (a). Zero ESR = zero display. The output is directly proportional to the ESR. This method is sensitive to lead inductance.

The series type of interface used with an analogue display is shown at (b). Vout is non-linear, which is exactly what we require to avoid range-switching. The scale is expanded in the low-ohms region. Vout is proportional to Rsample/(Rsample + ESR). So, if the value of Rsample is 3Ω, this would be the mid-scale reading. Just about ideal!



Layout of Alan Willcox's Mark 2 ESR meter on stripboard. The Mark 2 incorporates several improvements, including a simpler oscillator design and single-battery operation.

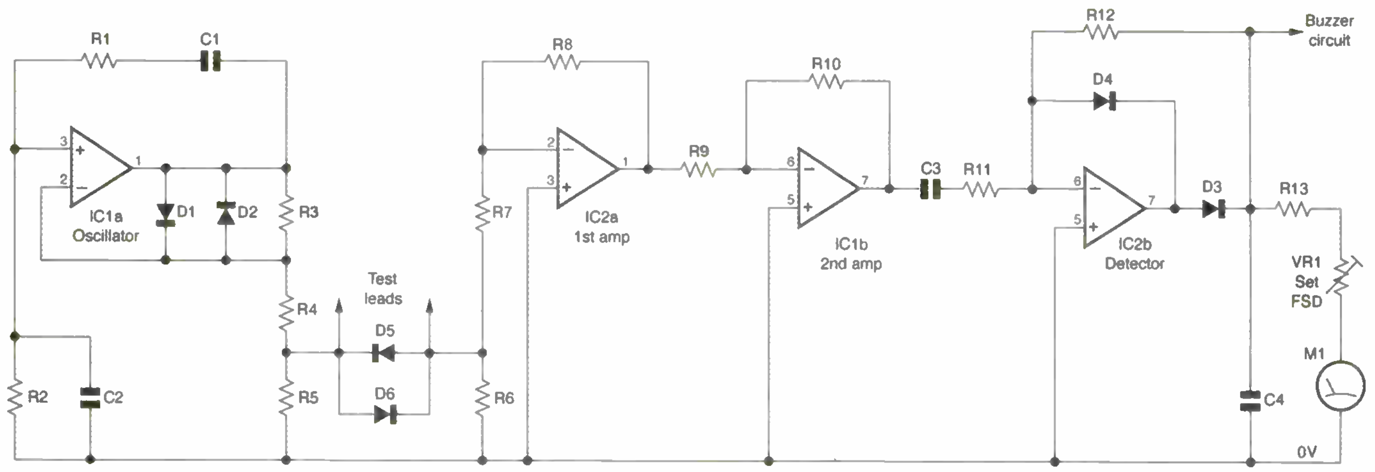


Fig. 4: The basic ESR meter circuit, new version. IC1 and IC2 require positive and negative supplies at pins 8 and 4 respectively. Further circuitry is required, see next month, to generate the split-rail supply and provide a buzzer comparator.

one soon gets to know which capacitor is causing the trouble by knowing roughly where the ESR meter's pointer should be with a good one. One argument that's sometimes put forward against the use of a moving-coil movement is that the movement will be damaged should the meter fall off the bench. I have a solution to this problem. If you are inclined to be clumsy, attach a piece of string between the meter and the bench, long enough so that the meter comes to a halt just before it hits the deck but not so short that you don't get a bit of a jolt to serve as a reminder.

Test-signal parameters

Amplitude: To test for ESR or for actual capacitance there are no constraints on how low the test signal can be as far as the capacitor is concerned. Taking into account power consumption, and the problems associated with low-level signals of the order of microvolts, noise considerations etc., a level of about 5mV peak-to-peak seems to be a good compromise.

Frequency: The time period should be short enough to zero out the capacitive reactance. 100kHz is a popular choice. At about this frequency the ESR and impedance converge with the type of capacitors in which we are interested. Apart from that consideration, 100kHz is about the top frequency at which a predictable gain of up to ten times can be obtained with readily-available, low-cost operational-amplifier ICs.

Remember that if the rate-of-change of the voltage is fast enough, any capacitance will provide negligible opposition (Xc) to it.

Waveform: Analysis of a squarewave has been used, and I've tried this myself. The results are a bit unpredictable however. I had a lot of trouble trying to preserve the waveform intact at the mV level to give a useful, predictable indication. It's not worth the effort. A sinewave is so easy to generate and amplify that I cannot see any justification for incorporating squarewave analysis into the design of an ESR meter.

An improved ESR meter

The meter presented here is similar to the one described in the March/April 1999 issues of *Television*. Since then the use of an ESR meter to check quickly for faulty capacitors has become well established. The original circuit works well and has stood the test of time, but feedback from the trade has prompted me to make some improvements. These include single-battery operation and improved temperature stability. The new circuit remains stable down to 6·2V, and consumes about 13mA. Because of the improved temperature stability of the new oscillator circuit, there is no need for an externally-available set-zero control.

The oscillator circuit

An HF oscillator or pulse generator with a stable output over a reasonable supply voltage range is the heart of every ESR meter. IC1a in the new circuit, see Fig. 4, is the sinewave oscillator in this design. The simplest way of generating a sinewave is to incorporate in the oscillator's positive-feedback path a network originated by Max Wien in 1891. It ensures that the feedback is an in-phase component at only one frequency, which is fixed by the *RC* values used. At very high frequencies C2 presents a low-impedance path, while at lower frequencies C1 becomes an effective open-circuit. At some point in between there will be maximum output from the network C1, R1, C2, R2, which is referred to as a Wien bridge. The *RC* values used here result in oscillation at about 100kHz.

There are two simple methods of stabilising the output level with an op-amp Wien-bridge oscillator. The method traditionally used is to include a bulb in the negative-feedback path (between pins 1 and 2 here). This was the approach used in my 1999 design. There has been some misunderstanding about the bulb, because of the different specifications used in US literature. I went into the matter in some detail in the 1999 articles. The correct specification is 28V, 24mA.

The principle behind the use of a tungsten bulb is that its resistance increases with the current that flows through it. If a bulb's resistance is measured, the small current from the ohmmeter will increase its resistance. When employed correctly in this application the bulb does not come anywhere near incandescence. I decided to use the lamp then because of its elegant simplicity and extremely low distortion figure (0·0025%). With the new design I wanted to reduce the operating voltage of the whole meter so that a single PP3 battery could be used as the power source while still achieving very low power consumption. The problem with the use of a bulb is that in these conditions the bulb's temperature is not sufficiently far away from the ambient temperature to ensure good stability. So this time I decided to use the brute-force method of diode stabilisation (D1, D2).

The idea here is that when the output from the oscillator rises above the conduction point of the diodes the negative feedback increases, the output settling at an amplitude which depends on the characteristics of the diodes. In this case the net result is a sinewave source signal across R5 with an amplitude of about 6mV peak-to-peak. Diode stabilisation introduces greater distortion, but this is not important here. To maintain oscillation, the value of R3 must be over twice that of R4. A preset resistor, adjusted to just sustain oscillation (lowest distortion), is usually used in the R3 position. I decided to use a fixed value that's a few ohms on the high side, to ensure reliable oscillation regardless of distortion.

Interface with the capacitor being tested

The interface with the capacitor being tested is the crucial part of the meter. It took me a long time to get this right. See Fig. 5. The waveform across R5 (the source resistor) is not an ideal, constant-voltage source, because of the need to include the sample resistor (R6), whose value must be comparable to the ESR values in which we are interested. The ESR of the capacitor being tested forms part of a potential divider with R6. Thus if, for example, a good 1,000μF capacitor with an ESR of about 0·1Ω is connected for test, R6 is effectively in parallel with R5. This means that the supply-signal source is less because, when a capacitor is being tested, the constant-current source to R5 is shared with the ESR and R6 in parallel.

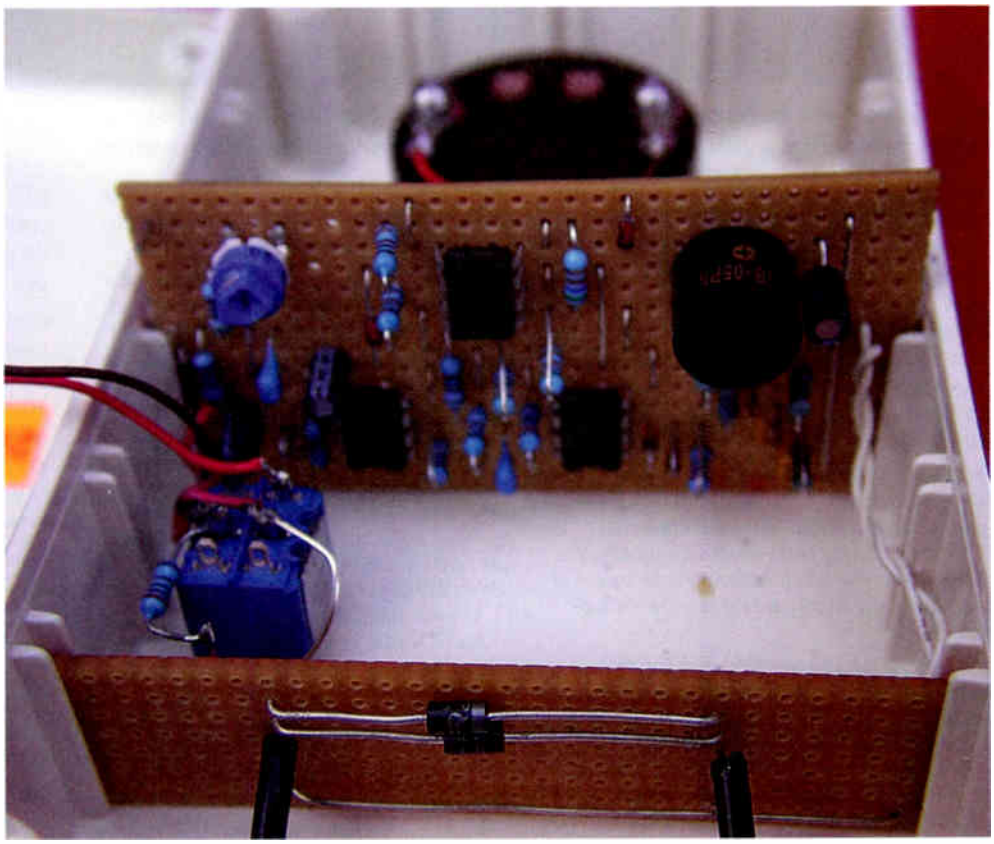
The voltage waveform developed across R6 as a result of the current through the capacitor being tested is amplified and then detected by the rest of the circuit. If the ESR of the capacitor being tested is equal to the value of R6, half of the supply waveform will be passed on. The supply waveform is not independent of the load however. If the ESR is less than the value of R6, as in most cases it is, the waveform voltage across R6 increases.

As the ESR rises above the value of R6, the latter becomes less effective. The result of all this is a non-linear scale, expanded at the lower range and somewhat logged out. This is ideal for the present application, because in some cases it is important to be able to distinguish between a very low value, close to zero, and one of about 0·5Ω.

I have achieved low current consumption and circuit simplicity by using the feedback current and compromising somewhat on the ideal, constant-voltage source.

Next month

In the concluding instalment next month I'll complete the circuit description, deal with some practical points and protection methods, provide a detailed components list and a stripboard layout. ■



Internal view of the new ESR meter. The test lead connections are at the bottom, with protection diodes between them.

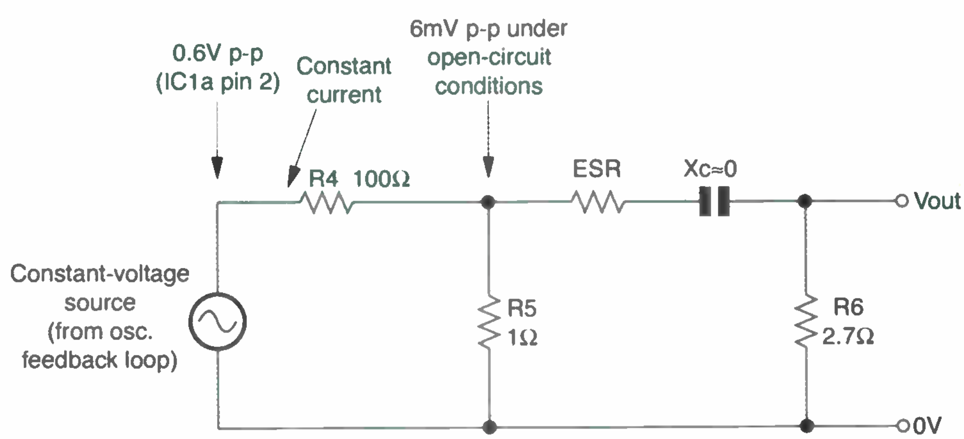


***Fig. 5:** The method of test capacitor interface used in this meter. The source voltage is not a true constant voltage because of the need for R6, whose value must be comparable to the ESR of the capacitors in which we are interested.*

Current economy and circuit simplicity are achieved by using feedback current from the oscillator circuit as the source fed to the capacitor under test. The output is inversely 'logged' out in relation to ESR.

Digital TV confusion

Freeview, Free to View or Free to Air? Martin Pickering provides a quick reference guide to the current options for digital TV reception

Freeview terrestrial: Nothing to do with satellite TV. You need a terrestrial TV aerial and a Freeview receiver. In good reception areas any wideband aerial and Freeview receiver should work, but it depends on local conditions. In fringe areas the choice of aerial and receiver may be critical. No viewing card required – viewing is free and includes ITV2. For local reception conditions check at http://www.satcure.co.uk/ freeview.htm

Top Up TV: With a Top Up TV viewing card and a Freeview receiver with card reader you may be able to watch additional channels. Viewing currently costs about £8 a month. You are not committed to contract and can cancel at any time. Full information at http://www.top-uptv.co.uk

Free To Air (FTA) satellite: You can receive non-subscription channels with a simple digital satellite receiver and dish of suitable size, with universal LNB, correctly aligned. No viewing card or conditional access module (CAM) is required. For reception from 28·2°E any Sky digibox or other digital satellite receiver can be used. Viewing is free and includes all BBC channels. Those outside the UK should check on the dish size required. Further information at http://www.satcure.co.uk/2d

Free To View (FTV) satellite: As FTA but a viewing card is required. For reception from 28·2°E a Sky digibox with suitable card will provide ITV, Channel 4 and Five reception (in addition to the FTA channels including BBC). FTV cards are available from Sky for £20 – phone 08706 061 111. If you already have one you can watch these channels with any Sky digibox. An FTV card will not let you watch some 'free' channels such as ITV2. For this you need a Sky subscription card or a subscription card for one of the minority-interest channels available via the Sky EPG, such as Zee TV or one of the naughty ones.

An FTV card is a Sky one (dark blue with yellow house outline) with one major difference: the phone no. on the back of an early one is 08700 500 744; on a recent card it's 08708 500 033. If there is any other number it's not an FTV card but may be Sky or something else. A common internet auction scam is for someone to cancel a Sky subscription then sell the digibox and card. The card will work as an FTV card for a while but is not guaranteed. It could stop working at any time and remains the property of BSkyB.

Sky Digital via satellite: As above. You will need a Sky digibox, dish/LNB and suitable viewing card which will provide reception from 28·2°E including ITV, Channel 4 and Five. Those outside the UK may be able to receive many Sky Digital channels with a suitably-sized dish, even where the BBC channels and ITV can't be received. It's a breach of contract to use a Sky card outside the UK however.

FreeSat: A new option launched by BSkyB. For a one-off payment of £150 a Sky digibox and satellite dish will be installed and a viewing card provided. It operates in the same way as FTV. The digibox will be connected to the phone line unless you object (it's not mandatory).

Those who already have a fully working Sky digibox and dish can obtain the viewing card for £20. Over 200 digital TV and radio channels are available, also interactive services. FreeSat is a registered BBC trademark.

Reader offer:

x1, x10 switchable oscilloscope probes, only £21.74 a pair, fully inclusive*

*Additional pairs as part of the same order, only £19.24 each pair.

Please supply the following:

Probes

Total________

Name ______________________________

Address ______________________________

Postcode ____________ Telephone ____________

Method of payment *(please circle)*

Cheques should be made payable to Electronics World

Access/Mastercard/Visa/Cheque/PO

Credit card no______________________________

Card expiry date Signed

Please allow up to 28 days for delivery

Seen on sale for £20 *each*, these high-quality oscilloscope probe sets comprise:

- two x1, x10 switchable probe bodies
- two insulating tips
- two IC tips and two sprung hooks
- trimming tools

There's also two BNC adaptors for using the cables as 1.5m-long BNC-to-BNC links. Each probe has its own storage wallet.

To order your pair of probes, send the coupon together with £21.74 UK/Europe to ***Probe Offer, Caroline Fisher, Highbury Business, Media House, Azalea Drive, Swanley BR8 8HU***

Readers outside Europe, please add £2.50 to your order.

Specifications

Switch position 1

Bandwidth	DC to 10MHz
Input resistance	1MΩ – i.e. oscilloscope i/p
Input capacitance	40pF+oscilloscope capacitance
Working voltage	600V DC or pk-pk AC

Switch position 2

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

Switch position 'Ref'

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

Satellite TV distribution systems

Bill Wright describes a slightly more difficult installation to the one described in detail in the first two instalments. This leads to consideration of preamplifiers and other topics

Having completed the description of an installation in a compact block of twelve flats, we'll turn to one that presented rather more problems. This time there are fifteen rather nice large flats, in a building that's essentially a long, thin two-story affair. Eight flats are upstairs and seven downstairs. Alas it's not new build. In fact it's an upmarket development dating from the Seventies, very neat and tidy with low tolerance of visible cables and dishes (not to mention ladders in flower beds!). Instead of an eighth flat downstairs there's a community utility area, at one end of the building.

The Residents' Association had assumed that we would put the new head-end in this area. This wouldn't have been a good idea however, because the downleads would have varied in length from seven up to 90m. A trunk cable and tap-off design was ruled out because the cables all have to run along the front wall, and five CT167 cables with housings at intervals for the tap-off units and multiswitches would look awful. A much better approach would be to position the head-end near the middle of the building, giving a maximum downlead length of about 45m. As luck would have it, there was a convenient under-the-stairs location in the middle entrance hall, with a landlord's mains supply available. Even 45m is a very long download, too long really, but the constraints of a job sometimes necessitate a technical solution that's less than ideal.

Dish location and feeder loss

Unfortunately the dish location presented a problem. It couldn't go on the front wall – that goes without saying – but the front wall is the only one that faces south-east. An ingenious installer will find a solution, which will be finally accepted after several long committee meetings. So the dish was to go on the wall of the garage block, which is to the rear of the main building. As the location is 30m from the main building, there is line-of-sight for the satellite signals over the roof. There's an easy cable route to the head-end, but it runs to 40m.

The four cables from the LNB to the head-end will be type CT125, as will the longest downleads to the flats. We thus have to consider the signal loss produced by 85m of CT125 cable. This will be 21dB at the top of the satellite IF band and 14dB at the bottom. What would be the result if we simply installed a system as previously described? Well, basically, life would be hell the first time there was a bit of bad weather. The signal levels presented to the receivers in the end flats would be just about adequate on a nice, sunny day. But come a few clouds and spots of rain and the installer's phone would start to ring. I don't need to describe the effects of inadequate digital signal levels, nor the subsequent sound of a middle-class lady Residents' Association treasurer who suspects that she has been ripped off. To avoid this tongue-lashing, the installer must provide adequate and accurate compensation for the cable losses.

Preamplifiers

Multiswitches with gain are available but, for flexibility, I prefer to use four line amplifiers fitted at the multiswitch inputs. But don't overdo it. Choose amplifiers with just enough gain. The Labgear CM5220/00 preamplifier provides a gain of 13dB at 950MHz and 18dB at 2,050MHz. This extra gain at the higher frequencies is called equalisation, slope or tilt: whatever name you give it, it's very useful. Lots of line amplifiers are available, with various gain and equalisation levels. The Labgear one just mentioned compensates very nicely for the cable losses in our proposed system.

The outcome would be that the flats farthest from the head-end would have signal levels of about +2dBmV while those nearest the head-end would receive about 16dBmV. These figures allow for outlet plate and flylead losses, and assume a 0dB switch loss. This spread of signal levels might seem a bit wide for those accustomed to carefully-planned UHF systems, but it's quite normal with a satellite IF distribution system.

If you feel uncomfortable about final signal levels that exceed a typical LNB output level, it's acceptable to use low-value attenuators at the switch outputs to the shortest cables. The attenuators must be intended for use at up to 2,050MHz, with F connectors and line-power pass. The attenuation will also affect the terrestrial signals of course. Use only 3dB or 6dB attenuators for this purpose, not higher-value ones. The final signal levels shouldn't really exceed typical LNB outputs (10-15dBmV), because many receivers will start to produce decreased 'signal quality' readouts above that level. It can be instructive to fit a variable attenuator at the IF input to a Sky digibox – some boxes are happier with levels 12dB below the LNB output!

To go back to the line amplifiers for a moment, these are of course powered by the DC supply to the dish. This comes from the multiswitch, so check that the switch is capable of powering four line amplifiers as well as the LNB. Don't fit the line amplifiers at the LNB. They are happier with the lower signal levels at the head-end.

You might be asked to fix a system where there are horrendous signal losses in some or all of the downloads. Maybe someone has used very poor-quality cable, or maybe the system was originally designed for UHF (in 1970?) and someone has added satellite distribution with no regard for cable losses. Maybe some of the downleads are absurdly long. Whatever the reason, think hard before you add line amplifiers to the downleads, either at the switch outputs or half way down the cable. Most line amplifiers don't pass UHF, and no line amplifier passes UHF if it isn't powered, so a resident without a satellite receiver would have no terrestrial reception either.

If the cable is lossy because of age or damp, the losses will gradually increase until they cannot be compensated for with amplification. Losses will be most severe at the higher frequencies: it's possible to have almost normal signal levels at the low end of the band and the top end below the receiver noise – in other words undetectable! This sort of problem should be fixed by using better cables and, if necessary, replanning the system, not by adding more and more amplification. Don't get drawn into providing a cheap fix.

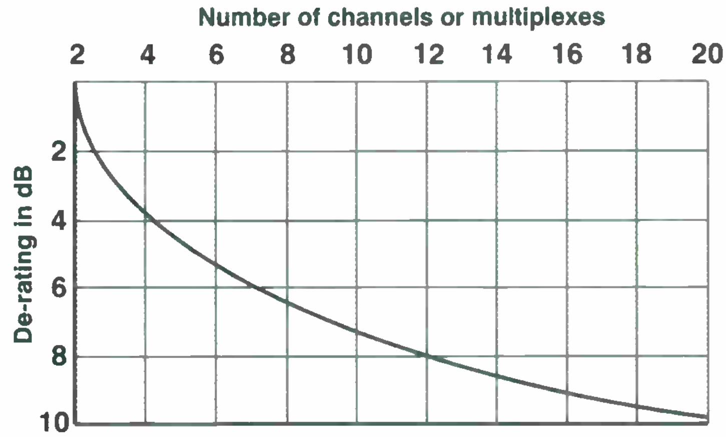


Fig. 19: Assuming that all channels are of the same strength, there is a simple relationship between the number of channels and an amplifier's maximum output.

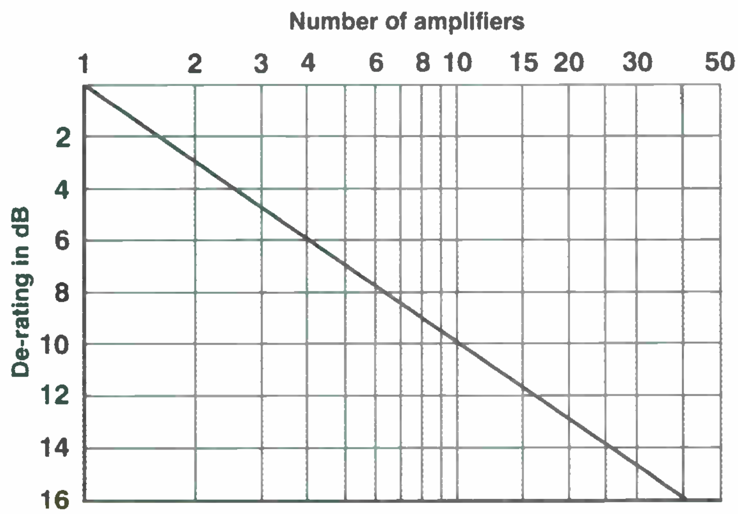


Fig. 20: If you connect four amplifiers in cascade, they must all be derated by 6dB. This is why the end-to-end amplification in a system should always be kept to a minimum.

Cross-modulation

Is it possible to overload the polarisation switches or satellite receivers with signal? Most readers will be familiar with the effects of cross-modulation where analogue TV is concerned – a faint image of one channel drifting across another one, that kind of thing. The effect of cross-modulation in a digital system is simply a reduction in the carrier-to-noise ratio, with a consequent deleterious effect on the BER.

Cross-modulation occurs when, somewhere along the line, an amplifier is overdriven. In brief, there are upper and lower signal

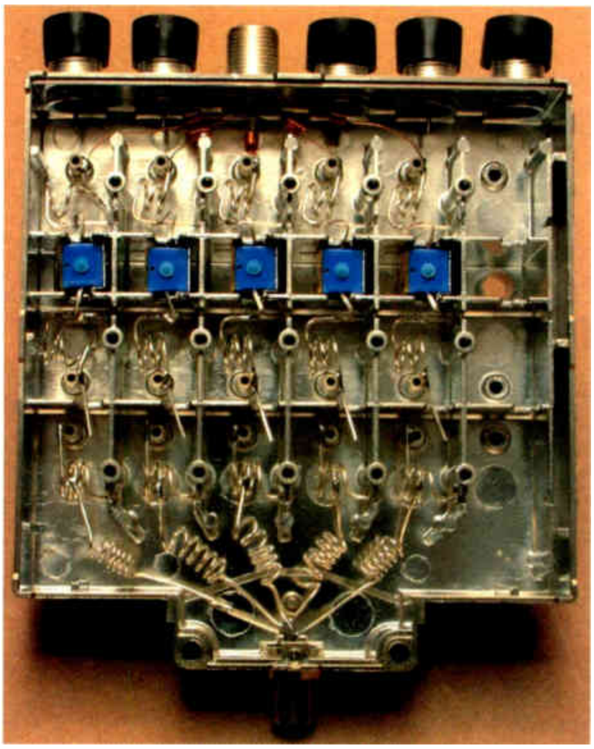


Fig. 21: A five-channel filter unit with the rear cover removed. In this example all five channel paths share one input. From top to bottom, each path has a tuned stage, a variable attenuator (blue) then two more tuned stages.

levels with which an amplifier is happy. These are not sudden, rigid boundaries. At the lower extreme, the weaker the signal the worse the carrier-to-noise ratio becomes (because the amplifier noise is fixed): at the higher extreme, as the signal level approaches the nominal maximum the amplifier starts to become overloaded. When a system is carrying more than one channel or carrier, the latter condition causes cross-modulation – one channel interferes with another.

The more channels or carriers there are, the lower the cross-modulation ceiling becomes, see Fig. 19. The more amplifiers there are in the chain (the gross gain of the whole system), the lower the cross-modulation ceiling becomes, as shown in Fig. 20, and the higher the noise floor becomes. The operational window becomes smaller and smaller. Think of a large system carrying a lot of channels, with repeater after repeater in a long chain. Travelling from the head-end to the last repeater is a bit like working your way through a cave system where the height of each cavern is always less than the last, until you are reduced to wriggling on your belly in the mud. Just as you might encounter a nasty troglodyte at the end of the cave, you can be sure that the very last outlet in the system will be in the living room of some old grumpy-guts who just lives for the Residents' Association meetings.

Digression!

Let me digress slightly (as if I haven't already!) and tell you about the most unsatisfactory period in my career. This was when we were attempting to install analogue satellite distribution systems, in the days of Sky from 19·2°E. Each polarisation and band was absolutely stuffed with channels, all at different levels. There was no way of adjusting the channel levels individually, so the difference between the strongest and the weakest simply had to be subtracted from the height of the operational window. It was hard to find amplifiers that could produce enough output, once they had been derated to allow for the number of channels present. The carrier-to-noise ratio needed was significantly more than it is with digital signals so, near the bottom end of a big system, the operational window was sometimes reduced to a narrow slit! Receivers varied widely in their ability to cope with high or low signal levels (remember the Pace Prima?) and, to be honest, it was almost impossible to make these systems work properly. I was heartily relieved when the digital revolution came.

The problems I encountered in the analogue days can happen with digital reception, but are much less likely. There is less variation in carrier levels, and the fact that digital signal levels are lower than analogue ones makes things so much easier. To say that digital signal levels are lower than analogue ones is, of course, just another way of saying that the carrier-to-noise ratio can be less. Take the output of a normal LNB, lift it 15dB with a line amplifier, and you are still a very long way from driving a multiswitch into cross-modulation. Really this is a potential problem only with large systems, where you might be driving a big head-end amplifier rather hard. I will deal with this later.

Adding terrestrial reception

Obtaining good, clean terrestrial signals can often present more problems than any other part of the job, but this isn't the place to deal with them. Let's assume that the aerial has been installed and is working properly – otherwise this article will go on for ever!

Don't allow the terrestrial part of the job to become a poor relation. Remember that many residents will not have satellite TV. The terrestrial part of the installation should be carried out to the same high standards as the satellite part. So don't use cheap aerials and cable, and make every effort to provide first-class reception quality at every outlet. This means that it is almost always necessary to pass the incoming terrestrial signals through channel filters.

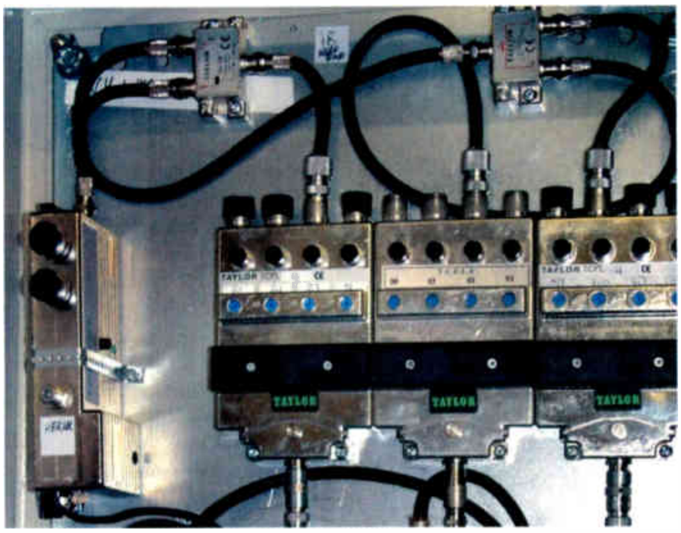
Terrestrial channel filters

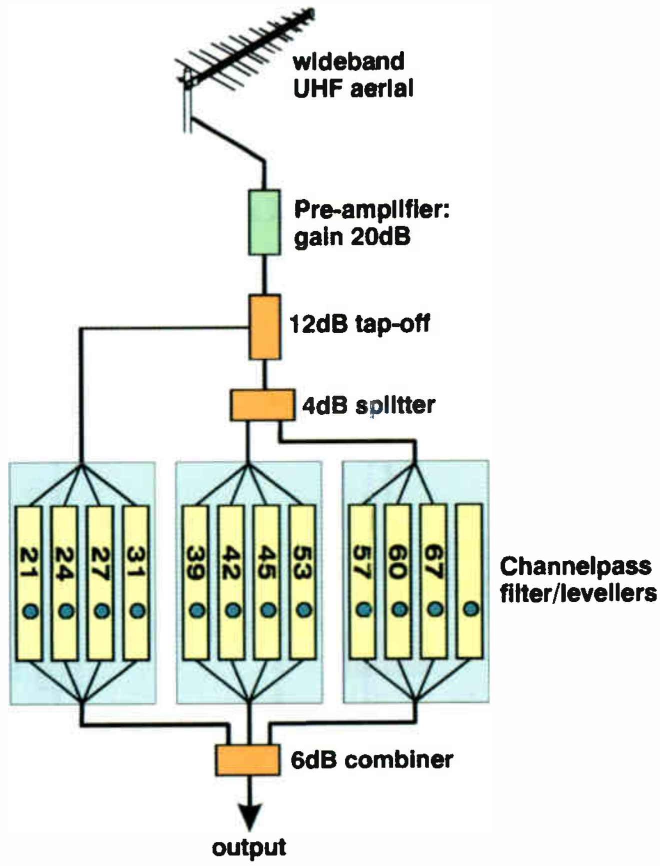
This isn't the place for a full-scale discussion of terrestrial reception and distribution techniques. But the crowding of the UHF band in recent years has made some sort of input filter a must with virtually every system. For this reason I feel I should cover terrestrial input filters here, if only in brief.

There are two reasons for using channel-pass filters at the terrestrial input. First, to provide adjustment of the relative levels of each analogue channel and digital multiplex, and secondly to exclude unwanted signals and interference.

In some circumstances there is no need to use filters. If the UHF aerial is receiving very strong signals and they are all at the correct relative levels, filters may be unnecessary. By very strong I mean that the analogue channels should be at no less than 25dBmV and the digital multiplexes at no less than 5dBmV. Under these circumstances it's unlikely that signals from the aerial at any other frequency will be strong enough to cause problems. But have a good look at the analyser screen to make sure: you don't want anything coming from the aerial that's within 10dB of the wanted signals.

The other essential condition for possibly omitting filters is that all channels are received at the correct relative strengths. This can be the case with some transmitters, where all the analogue channels and digital multiplexes are within the same channel group and the digital multiplexes are 17-20dB below the analogue channels. If everything is within one channel group, there will be no need to equalise the signals for cable losses farther along the system. Nevertheless I would omit input filters only in a small, simple system with no repeaters. A system with no input filters is wide open to problems caused any local idiot with an illegal CB or an unlicensed amateur radio transmitter.





Figs. 22 and 23: An arrangement of channel filter/levellers designed to carry five analogue channels and six digital multiplexes. A preamplifier compensates for the combiner and filter losses. The 12dB tap-off unit helps to equalise the channels. The final 6dB combiner is not shown in the photograph.

In the majority of cases input filters will be essential. Filters are available as units that contain one, two, four or six channel paths. Each channel path has a tuned stage, a variable attenuator, then two more tuned stages. Any configuration of inputs is possible, from one input per channel path to one input for all paths, but the output is always common to all paths. Through loss is about 4dB. Fig. 21 shows a five-channel filter unit with the rear cover removed. Our supplier is Taylor Brothers of Oldham.

Suppose the signals from the aerial are as follows:

Analogue channels 21, 24, 27 and 31 at 28dBmV ± 3dB
Digital multiplexes 39, 42 and 45 at 7dBmV ± 3dB
Digital multiplexes 53, 57 and 60 at 3dBmV ± 3dB
Analogue channel 67 at 11dBmV

These signal levels, typical of line-of-sight reception in Sheffield city centre, must be balanced at the head-end. If the head-end output was at these relative levels, either the group A analogue channels would be too strong at the outlets or the group C/D multiplexes and analogue channel would be too weak. You couldn't provide channel 67 at a level 17dB lower than the other analogue channels!

In addition to the need to correct unequal signal levels from the aerial, where there is a wide spread of channels like this it's necessary to launch the higher channels with a few extra dB to compensate for the greater cable losses at higher frequencies. With the off-aerial signals listed above it might just be possible, with a very small system, to get away with a 10dB equaliser in front of the amplifier. With a larger system, especially where there are repeaters, individual control of each channel is necessary.

Figs. 22 and 23 show a photograph and a schematic of a filtering arrangement that will correct these signal levels. The adjustment range of the variable attenuators in each channel path is 18dB. To increase the effective adjustment range and bring each channel more comfortably into the middle of the range, a 12dB tap-off unit has been used to feed the filter unit used for the strong analogue channels. This makes the input to this unit 7dB lower than that applied to the other units.

A preamplifier will be necessary even with very high signals from the aerial. It needs to have low noise and be capable of quite high output. The filters are passive, so they can only attenuate the stronger channels until they match the weakest one. This means that the carrier-to-noise ratio of the weakest channel determines the carrier-to-noise ratio of all the other channels, all other things being equal. If the weakest channel is at quite a good level, as in the example above, no harm is done.

But a preamplifier is necessary because of the through-loss via the whole assembly. The loss will be about 15dB in a channel where minimum attenuation is applied. In the example quoted above, the channel 67 signal would emerge from the assembly at –4dBmV without a preamplifier, an inadequate level at which to enter the next amplifier. The carrier-to-noise ratio would be effectively set by the ratio between the –4dBmV signal and the noise figure of that amplifier, and no amount of later amplification would improve it. The ch. 67 signal would be noisy throughout the system and so would all the others, because the filters would reduce all other signals to that level.

A more awkward situation arises where the weakest channels are available only at a level where the carrier-to-noise ratio will inevitably be compromised. It's vital not to use filters to reduce all the other channels to the same inadequate level. To reiterate, if that is done all channels at every outlet will have a poor carrier-to-noise ratio.

The answer is to preamplify the weakest signals separately. This will not necessarily help their own carrier-to-noise ratio, but will prevent all the other channels from being afflicted. Fig. 24 shows an

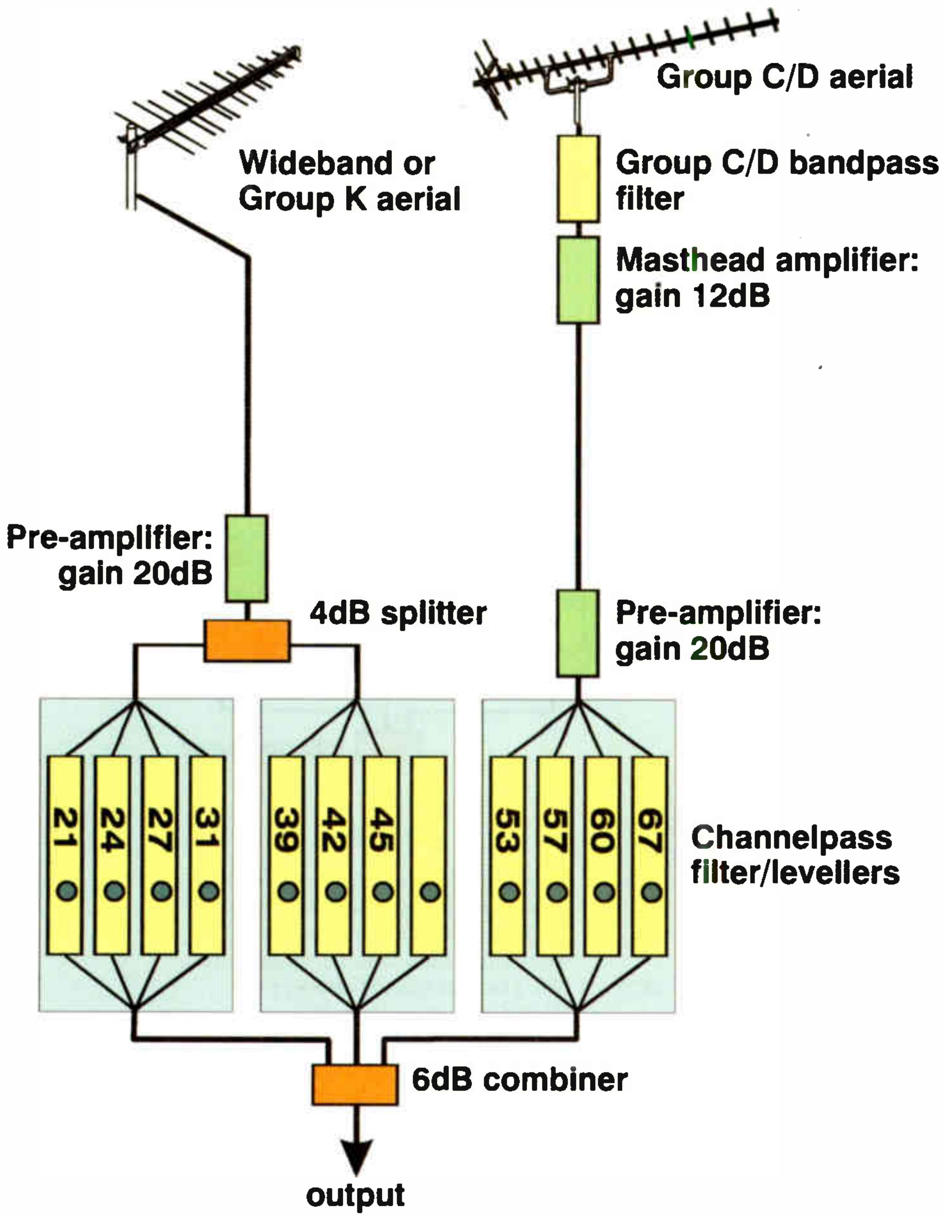


Fig. 24: An input configuration designed to deal with a mixture of adequate and weak aerial signals.

example of an input configuration that will solve this problem. The multiplexes on channels 53, 57 and 60 are only a few dB above threshold: analogue channel 67 is a few dB below it, at about –5dBmV. A masthead amplifier maximises the carrier-to-noise ratio with these channels, lifting them by 12dB. A group C/D bandpass filter prevents the strong group A signals from overloading the masthead amplifier. Where field strength is really poor, it's better to use grouped rather than wideband aerials. Note that the channel-pass filters are configured differently from those shown in Figs. 22 and 23.

Table 4: Recommended signal levels at the outlets

Transmission type	*Minimum*	*Maximum*
Analogue TV	6dBmV	20dBmV
DTT	-10dBmV	10dBmV
VHF FM	-10dBmV	10dBmV
VHF DAB	-20dBmV	10dBmV

Cluster filters

Some main transmitters in the UK have DTT and analogue signals on adjacent channels. Passive filters will not enable you to adjust the levels of adjacent channels independently – their response simply isn't sharp enough. Fortunately most of these transmitters have the multiplexes at quite reasonable levels relative to the analogue signals, so cluster filters can be successfully used. These have a filter path for each cluster of channels. For example the filter paths for Emley Moor are 37, 40-41, 43-44, 46-47 and 49-52. Where three or four channels are handled by one filter path, the through loss will be about 7dB.

Some manufacturers have introduced amplifier packages that attempt to process adjacent analogue and digital channels separately by using passive filters. This is a tall order. So far I haven't been impressed.

Final terrestrial signal levels

The output from the filter assembly will eventually go to the terrestrial input of each multiswitch, probably via further amplification. Adjustment of the signal levels at the filter attenuators should be carried out with reference to the output levels of a multiswitch. This allows for any response unevenness in the switch.

Channels near the top of the band should be set slightly high to compensate for greater cable loss. This adjustment will always be a compromise between the longest and shortest runs.

There is no need to keep digital signal levels 20dB below analogue ones. Even if they are only 10dB below the analogue levels they will not add significantly to amplifier derating. I usually set the digital channels about 14dB below the analogue ones. This does no harm at all to analogue reception, and makes DTT reception that bit more solid.

Table 4 shows the signal levels I recommend at the outlets. The minima are higher than many would advocate, but they will give good protection against interference within dwellings, and some compensation for losses after the outlet plate – such as VCR loopthrough and iffy flyleads. Amplification is cheap: use it!

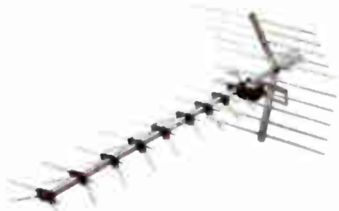
Next month

In Part 4 next month we'll take a look at larger systems. ■

Grandata Ltd

distributor of electronic components

48 Element Digital Compatible Aerial



Receives both digital and analogue signals

For poor to weak strength signal areas

Robust design for low wind loading - 2 peices boom with aluminium wire rod elements

Supplied with F connector and clamp for horizontal and vertical (fits up to 57mm masts)

Ideal for areas with bad picture ghosting

Supplied part assembled - no tools required

Order Code : 27884R **Price : £ 20.00 + vat**

Carriage charged at £ 6.00 + vat

SLx Masthead Amplifiers

UHF TV and FM radio antenna preamplifiers designed for professional aerial installers.

1 way amplifiers come with screw terminals

2 and 4 way amplifiers come with F connectors

Requires 12V DC power supply connected via a download

Description	Gain	Order Code	Price
1 way UHF TV Masthead Amplifier	15dB	27830R	£ 4.30 + vat
1 way UHF TV Masthead Amplifier	26dB	27831R	£ 4.50 + vat
2 way UHF TV Masthead Amplifier	10dB	27837R	£ 9.00 + vat
4 way UHF TV Masthead Amplfier	10dB	27838R	£ 9.50 + vat
4 way UHF TV & FM Masthead Amplifier	10dB	27839R	£ 10.00 + vat
Masthead Amplifier Power Supply	-	27832R	£ 5.00 + vat

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

SLx Distribution Amplifiers

A range of Aerial amplifers designed to allow distribution of TV , Satellite and FM signal without the loss of picture and sound quality.

Available with intergrated Digital bypass - to allow the use of SKY™ digieye (B).

Main Operated , comes with full instructions

Description	Gain	Order Code	Price
2 way	18dB	SLX2	£ 8.00 + vat
2 way with Bypass	6dB	SLX2B	£ 9.25 + vat
4 way	12dB	SLX4	£ 13.00 + vat
4 way with Bypass	6dB	SLX4B	£ 14.00 + vat
6 way	12dB	SLX6	£ 18.00 + vat
6 way with Bypass	6dB	SLX6B	£ 19.00 + vat
8 way	12dB	SLX8	£ 18.50 + vat
8 way with Bypass	6dB	SLX8B	£ 20.00 + vat

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

SLx Distribution Systems

Combines TV , FM , DAB , CCTV & Satellite signals on to one down cable for feeding into a triplexed faceplate.

Return cable from VCR / satellite box to SLx Distribution System feed 8 other viewing locations around the home with AV signals.

Integrated digitial bypass for Sky™ digital feature - Intergrated UHF pre-amplifier - Intergrated power supply

Fully screened - Available in 4 way and 8 way distribution

4 way System
Order Code : 27855R
Price : £ 40.00 + vat

8 way System
Order Code : 27856R
Price : £ 45.00 + vat

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

Coax Plug Aluminium

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

Screw Type Coax Plugs

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

Twist on F Connectors

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

Screened Triplexed Outlet with UK Faceplate

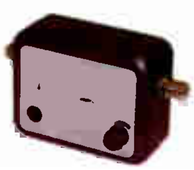
Flush Outlet with satellie F outlet , TV (male) and FM (female) coaxial outlets

Intergral filter seperates FM , UHF and satellite signal from one download

For use with the above distribtuion systems

Order Code : 27965U
Price : £ 4.50 + vat

Satellite Finder



Allows the user to find the best azimuth / elevation settings for a satellite dish , resulting in the best signal reception / picture and sound quality

Compact design - Backlit meter scale - Audible signal strength reading

Adjustable level control - Adjustable sensitivity adjustment

Frequency Range : 950 - 2250Mhz

Order Code : 27860R **Price : £ 10.00 + vat**

Aerial Installation Accessories

K.P. House , Unit 15 , Pop In Commercial Centre , Southway , Wembley , Middlesex . HA9 0HB England

Tel: (020) 8900 2329 Fax : (020) 8903 6126 Email : sales@grandata.co.uk

Grandata Ltd

distributor of electronic components

Transistors / Linear IC's

Part No.	Price
2N2222	£0.23
2N2223	£7.50
2N2369	£0.15
2N2484	£0.15
2N2646	£0.40
2N2857	£1.75
2N2904	£0.20
2N2905	£0.20
2N2906	£0.18
2N2907	£0.18
2N3019	£0.25
2N3053	£0.18
2N3054	£0.40
2N3055	£0.50
2N3055H	£0.75
2N3375	£15.00
2N3439	£0.40
2N3440	£0.45
2N3441	£1.75
2SA1015	£0.10
2SA1016	£0.15
2SA1020	£0.20
2SA1085	£0.50
2SA1266	£0.25
2SA1294	£4.50
2SA1295	£3.00
2SA1302	£3.00
2SA1306	£1.10
2SA1360	£0.45
2SA1492	£2.60
2SA1706	£0.25
2SA1943	£2.75
2SA673	£0.15
2SA872A	£0.20
2SA968	£0.55
2SA970	£0.25
2SA985	£0.35
2SB1109	£0.20
2SB1186	£0.55
2SB1237	£0.20
2SB1243	£0.40
2SB1342	£2.00
2SB1370	£0.25
2SB1429	£2.20
2SB1560	£4.00
2SB324	£0.40
2SB554	£1.50
2SB560	£0.25
2SB631	£0.40
2SB648	£0.15
2SB649	£0.35
2SB681	£1.00
2SB688	£0.70
2SB717	£0.15
2SB772	£0.25
2SB795	£0.25
2SB817	£1.75
2SB824	£0.60
2SB861	£1.10
2SB892	£0.25
2SB942	£0.15
2SB986	£0.30
2SC1384	£0.20
2SC1740	£0.10
2SC1815	£0.10
2SC1846	£0.35
2SC1969	£1.60
2SC2023	£0.70
2SC2026	£0.30
2SC2078	£0.95
2SC2166	£0.80
2SC2238	£0.45
2SC2240	£0.15
2SC2259	£0.40
2SC2314	£0.70
2SC2335	£0.35
2SC2362	£0.10
2SC2412	£0.50
2SC2546	£0.10
2SC2577	£0.60
2SC2621	£0.30
2SC2625	£1.90
2SC2632	£0.35
2SC2655	£0.50
2SC2688	£0.15
2SC2837	£0.90
2SC2921	£2.50
2SC2922	£3.00
2SC2988	£1.00
2SC3052	£0.15
2SC3182	£1.20
2SC3198	£0.30
2SC3203	£0.25
2SC3225	£0.50
2SC3262	£2.80
2SC3264	£3.90
2SC3281	£2.00
2SC3303	£0.20
2SC3306	£1.30
2SC3423	£0.60
2SC3467	£0.70
2SC3506	£1.00
2SC3591	£2.00
2SC3688	£2.00
2SC3795	£0.30
2SC3851	£1.00
2SC3852	£0.25
2SC3856	£0.60
2SC3940	£0.40
2SC3953	£0.20
2SC4123	£1.10
2SC4124	£1.10
2SC4137	£0.40
2SC4138	£0.75
2SC4278	£0.60
2SC4429	£2.75
2SC4758	£6.00
2SC4793	£0.65
2SC4924	£2.50
2SC5027	£1.00
2SC5143	£2.00
2SC5197	£2.00
2SC5200	£3.25

Part No.	Price
2SC5251	£4.50
2SC5297	£3.00
2SC5331	£6.00
2SC5387	£3.50
2SC5411	£3.50
2SC5552	£7.50
2SC5587	£5.75
2SC710	£0.15
2SD1047	£1.80
2SD1207	£0.10
2SD1407	£0.60
2SD1441	£2.20
2SD1554	£1.70
2SD1555	£1.50
2SD1556	£2.25
2SD1577	£2.50
2SD1651	£1.50
2SD1763A	£0.60
2SD1878	£1.60
2SD1879	£2.75
2SD1880	£3.60
2SD1887	£2.25
2SD2144	£0.35
2SD2253	£2.75
2SD2391Q	£0.45
2SD2498	£2.25
2SD2499	£1.50
2SD2539	£2.75
2SD2553	£4.00
2SD2599	£1.50
2SD551	£1.70
2SD600	£0.30
2SD667	£0.20
2SD669	£0.35
2SD718	£0.65
2SD756	£0.40
2SD837	£0.40
2SD863	£0.23
2SD882	£0.25
2SD921	£3.20
2SD947	£0.40
2SD965	£0.35
BFQ162	£1.00
BFQ232	£0.75
BFQ235A	£0.75
BFQ252A	£0.60
BFQ255A	£0.75
BFQ262A	£0.75
BFR90	£0.65
BFR91	£0.99
BFY50	£0.14
BFY51	£0.14
BFY56	£0.25
BFY64	£0.25
BFY90	£2.00
BU108	£1.00
BU1508AX	£1.30
BU1508DX	£1.05
BU180	£1.00
BU184	£1.00
BU208A	£0.75
BU208D	£1.30
BU226	£1.20
BU2506DF	£0.90
BU2506DX	£1.00
BU2508A	£1.00
BU2508AF	£1.10
BU2508AX	£1.30
BU2508D	£1.30
BU2508DF	£1.20
BU2508DX	£1.50
BU2520AF	£1.70
BU2520AX	£1.40
BU2520DF	£2.25
BU2520DX	£2.00
BU2522AF	£2.00
BU2522AX	£1.50
BU2525A	£3.25
BU2525AF	£2.20
BU2525AW	£2.50
BU2525AX	£1.90
BU2525D	£2.40
BU2525DF	£1.75
BU2527AF	£4.00
BU2527AX	£2.50
BU2527DF	£2.00
BU2527DX	£2.00
BU2532AL	£3.25
BU2708AF	£2.00
BU2708AX	£2.00
BU2708DF	£2.00
BU2708DX	£2.00
BU2720AX	£2.00
BU2720DF	£2.00
BU2720DX	£2.00
BU2722AF	£3.30
BU2725AF	£2.00
BU2725DF	£2.00
BU2727A	£2.00
BU2727AF	£2.00
BU2735AS	£11.00
BU326A	£0.75
BU406	£0.60
BU406D	£0.85
BU407	£0.55
BU407D	£0.75
BU408	£0.60
BU408D	£0.75
BU409	£0.85
BU415A	£1.70
BU415B	£1.70
BU426A	£0.70
BU4508AF	£2.00
BU4525AX	£3.00
BU505	£0.90
BU505D	£0.90
BU505DF	£0.90
BU506	£1.00
BU506DF	£1.00
BU508AF	£0.60
BU508APH	£0.60
BU508AXI	£0.90
BU508D	£0.75

Part No.	Price
BU508DF	£0.85
BU508DFI	£2.00
BU508DR	£1.30
BU808DF	£2.10
BU808DFI	£2.50
BU826A	£1.60
BUH1015	£4.25
BUH1215	£4.50
BUH515	£2.00
BUH515D	£2.50
BUH517	£2.75
BUH517D	£1.75
BUH715	£4.25
BUK436 / 800B	£2.75
BUK437 / 400B	£2.75
BUK437 / 600B	£3.00
BUK438 / 800B	£3.10
BUK444 / 500B	£2.00
BUK444 / 800B	£2.00
BUK445 / 600B	£2.00
BUK446 / 800B	£4.00
BUK454 / 800A	£2.00
BUK455 / 600B	£2.00
BUK456 / 200B	£2.00
BUK456 / 600A	£2.00
BUK456 / 60A	£2.00
BUK456 / 800A	£2.00
BUK457 / 600B	£2.00
BUK555 / 60B	£2.00
BUL310	£1.25
BUL381	£1.50
BUL381D	£1.25
BUT11A	£0.35
BUT11AF	£0.35
BUT11AX	£0.50
BUT12	£0.80
BUT12A	£0.80
BUT12AF	£0.90
BUT18	£0.80
BUT18A	£0.80
BUT18AF	£0.65
BUT56A	£0.65
BUT56AF	£2.00
BUZ71	£0.75
BUZ71AF	£1.00
BUZ72A	£1.00
BUZ72AF	£1.00
BUZ73A	£1.50
BUZ73AF	£0.60
BUZ76A	£1.10
BUZ77A	£2.00
BUZ77B	£2.50
BUZ80	£1.35
BUZ80AF	£2.00
BUZ83	£2.00
BUZ90	£1.50
BUZ900	£10.00
BUZ900P	£10.00
BUZ901	£15.00
BUZ905	£10.00
BUZ905P	£10.00
BUZ906	£16.00
BUZ90A	£1.80
BUZ90AF	£2.80
BUZ91A	£2.60
BUZ93	£1.50
IRF120	£2.25
IRF130	£4.75
IRF140	£5.50
IRF230	£5.50
IRF240	£4.25
IRF250	£3.75
IRF251	£6.50
IRF3205	£2.00
IRF330	£6.00
IRF340	£3.25
IRF350	£7.50
IRF440	£5.50
IRF450	£6.50
IRF510	£0.70
IRF520	£0.75
IRF530	£0.75
IRF540	£1.00
IRF5450	£5.00
IRF5740	£3.00
IRF5840	£3.00
IRF610	£0.80
IRF611	£1.20
IRF620	£1.00
IRF630	£0.75
IRF630S	£2.00
IRF634	£1.25
IRF640	£1.50
IRF644	£2.00
IRF650	£2.00
IRF710	£1.50
IRF720	£0.85
IRF730	£1.25
IRF740	£0.90
IRF740F	£3.00
IRF820	£0.90
IRF830	£0.85
IRF830F	£1.60
IRF840	£0.85
IRF840F	£1.75
IRF9140	£10.00
IRF9230	£4.00
IRF9510	£1.50
IRF9511	£1.50
IRF9520	£1.50
IRF9530	£1.25
IRF9531	£2.00
IRF9540	£1.75
IRF9541	£2.00
IRF9610	£0.95
IRF9620	£0.85
IRF9622	£2.00
IRF9630	£1.30
IRF9640	£2.30
IRFBC20	£1.10
IRFBC30	£1.20
IRFBC40	£2.10
IRFBE30	£2.25

Part No.	Price
IRFD120	£1.00
IRFD9120	£1.20
IRFD9220	£1.00
IRFF120	£3.00
IRFIBC40	£1.00
IRFIBC40G	£2.00
IRFP054	£4.00
IRFP064	£5.00
IRFP140	£2.50
IRFP150	£2.40
IRFP240	£3.00
IRFP250	£2.80
IRFP260	£3.50
IRFP340	£2.50
IRFP350	£3.25
IRFP360	£8.00
IRFP450	£2.70
IRFP460	£4.00
IRFP9140	£4.50
IRFP9240	£3.00
IRFPC40	£3.00
IRFPC50	£4.50
IRFPC60	£6.00
IRFPE40	£5.50
IRFPE50	£4.50
IRFPF40	£5.50
IRFPF50	£4.50
IRFS740	£1.75
IRFS840	£1.25
IRFZ42	£2.75
IRFZ44	£1.60
IRFZ46N	£1.50
IRFZ48	£2.75
MJ1000	£1.00
MJ10001	£7.00
MJ10005	£4.00
MJ1001	£2.00
MJ10012	£2.00
MJ10016	£7.00
MJ11015	£2.50
MJ11016	£3.00
MJ11032	£8.00
MJ11033	£8.00
MJ15003	£2.50
MJ15004	£3.00
MJ15015	£2.50
MJ15016	£3.50
MJ15022	£4.00
MJ15023	£4.00
MJ15024	£3.00
MJ15025	£3.00
MJ2955	£0.55
MJE13004	£1.00
MJE13005	£0.60
MJE13007	£1.00
MJE13009	£1.00
MJE15028	£2.00
MJE15029	£2.00
MJE15030	£2.50
MJE15031	£4.00
MJE16002	£3.00
MJE18004	£1.25
MJE18006	£1.20
MJE18008	£1.50
MJE243	£0.60
MJE253	£0.85
MJE340	£0.25
MJE350	£0.80
MJF16206	£4.50
MJF18004	£1.75
MJF18006	£2.00
MJF18008	£1.75
MJF18204	£2.50
MJW16018	£5.50
MJW16206	£6.00
MJW16212	£5.00
P16NE06	£1.25
P16NE06F	£1.50
P3NA60	£1.50
P4NB100	£3.50
P4NB80	£2.50
P4NB80FP	£2.00
P4NB90FP	£4.00
P4NC60	£1.75
P4NC60FP	£2.00
P5NB60FP	£2.00
P5NB80	£2.50
P5NB80FP	£3.00
P6N60	£2.00
P7NB40	£1.75
P7NB60FP	£2.00
P9NB60	£2.00
P9NB60FP	£4.00
S2000A	£1.75
S2000A3	£1.75
S2000AF	£0.90
S2000N	£1.50
S2055A	£1.75
S2055AF	£1.75
S2055N	£1.50
S2530A	£1.00
STA301A	£2.00
STA341M	£1.80
STA401A	£2.20
STA402A	£2.00
STA403A	£2.70
STA434A	£2.70
STA441C	£2.20
STA451C	£2.80
STA471A	£2.00
STA8012	£2.70
STA901M	£2.80
STK0025	£4.20
STK0039	£6.00
STK0040	£5.20
STK0049	£5.10
STK0050	£8.00
STK0059	£5.00
STK0080	£6.00
STK0100 II	£12.00
STK015	£4.40
STK020	£11.00
STK025	£4.00

Part No.	Price
STK040	£7.00
STK078	£18.00
STK080	£5.50
STK082	£20.00
STK084	£6.00
STK085	£9.00
STK086	£10.00
STK1039	£4.60
STK1040	£5.00
STK1049	£5.00
STK1050	£6.50
STK1060	£6.50
STK2025	£6.20
STK2028	£5.00
STK2029	£6.00
STK2030	£7.00
STK2038	£7.00
STK2058 IV	£16.00
STK2101	£5.00
STK2110	£3.50
STK2129	£7.50
STK2230	£7.00
STK2240	£7.40
STK2250	£6.50
STK2260	£9.50
STK3044	£5.00
STK3082	£4.00
STK3152 II	£9.00
STK3156	£5.00
STK350-030	£7.00
STK392-020	£8.00
STK392-040	£12.00
STK392-110	£8.00
STK400-040	£8.00
STK401-040	£7.00
STK401-050	£8.00
STK401-080	£9.00
STK401-120	£10.00
STK401-130	£7.50
STK401-140	£12.00
STK4017	£4.00
STK4019	£3.00
STK402-040	£7.00
STK402-070	£7.00
STK402-071	£7.00
STK402-090	£8.00
STK4021	£3.80
STK402-100	£9.00
STK402-120	£9.00
STK4024 II	£5.50
STK4025	£5.30
STK4026	£4.80
STK4026II	£4.80
STK4036	£4.70
STK4036V	£8.00
STK4038	£6.80
STK4040 II	£6.50
STK4042 II	£8.00
STK4046	£9.50
STK4048	£12.80
STK4048V	£12.00
STK4050 II	£16.00
STK405-030	£7.00
STK405-040	£6.50
STK405-050A	£12.00
STK405-070A	£8.00
STK405-090	£7.00
STK4050V	£15.00
STK405-100	£7.00
STK405-120	£11.00
STK4060	£4.00
STK4065	£6.50
STK407-040	£7.00
STK407-050	£8.50
STK407-070	£8.50
STK407-090	£8.50
STK407-710	£8.50
STK4101	£5.00
STK4111	£3.00
STK4112	£3.00
STK411-210	£10.00
STK411-220	£10.00
STK411-230	£12.00
STK411-240E	£14.00
STK412-010	£12.00
STK412-040	£10.50
STK4121	£4.80
STK412-150	£18.50
STK412-170	£18.00
STK4122	£5.60
STK4130 II	£5.00
STK4131	£3.00
STK4132 II	£6.00
STK4133 II	£7.50
STK4140 II	£4.00
STK4141 II	£4.20
STK4141 V	£6.00
STK4142	£5.30
STK4147 II	£14.50
STK4150 II	£8.50
STK4151	£6.80
STK4151V	£10.00
STK4151X	£10.00
STK4152	£6.50
STK4154V	£14.00
STK4161	£6.50
STK4161V	£8.50
STK4162	£5.50
STK4164 II	£11.75
STK4171	£6.50
STK417-120A	£10.00
STK417-130	£15.00
STK4171V	£8.00
STK4172 II	£6.80
STK4181	£6.80
STK4181V	£7.00
STK4182 II	£9.00
STK4191	£9.00
STK4191 X	£14.00
STK419-130	£15.00
STK419-140	£16.00
STK419-150	£10.00
STK4191V	£8.00

Part No.	Price
STK4192	£7.00
STK4197 II	£9.50
STK4199 II	£6.50
STK4204 II	£7.00
STK4211 II	£10.00
STK4211 V	£8.00
STK4221 II	£8.00
STK4231 II	£10.50
STK4241 V	£12.50
STK4272	£4.00
STK4273	£5.00
STK4274	£3.00
STK4301	£3.00
STK433	£3.00
STK4332	£3.00
STK435	£3.00
STK4352	£2.50
STK436	£4.30
STK4362	£4.50
STK437	£4.00
STK4372	£3.50
STK439	£5.00
STK4392	£4.00
STK442-110	£8.50
STK442-120	£11.00
STK442-130	£11.00
STK443	£7.00
STK4432	£4.00
STK457	£3.00
STK459	£5.60
STK461	£6.00
STK463	£9.50
STK465	£9.00
STK470-040	£10.00
STK4773	£8.20
STK4793	£5.50
STK4803	£9.00
STK4813	£5.50
STK4833	£8.50
STK4843	£7.20
STK4873	£4.00
STK488-010	£8.00
STK488-020	£6.50
STK488-050	£8.00
STK4893	£10.00
STK490-010	£7.00
STK490-040	£5.00
STK490-070	£8.00
STK490-310	£7.00
STK501	£5.50
STK5314	£3.00
STK5315	£4.00
STK5323	£4.00
STK5324	£2.00
STK5325	£3.00
STK5326	£3.00
STK5330	£4.00
STK5332	£1.50
STK5333	£3.00
STK5335	£2.00
STK5336	£2.80
STK5337	£2.00
STK5339	£4.00
STK5342	£1.00
STK5343	£1.00
STK5352	£2.50
STK5353	£2.50
STK5361	£3.75
STK5362	£4.00
STK5364	£1.50
STK5371	£2.50
STK5373	£2.20
STK5383	£3.00
STK5392	£5.00
STK5422	£3.75
STK5431	£4.10
STK5434	£3.50
STK5436	£3.00
STK5441	£2.60
STK5443	£3.00
STK5446	£3.50
STK5451	£3.90
STK5461	£3.00
STK5462	£2.30
STK5464	£2.50
STK5466	£3.00
STK5467	£4.00
STK5468	£3.00
STK5471	£5.00
STK5472	£2.00
STK5474	£2.50
STK5476	£2.00
STK5477	£4.00
STK5478	£1.75
STK5479	£2.60
STK5481	£3.00
STK5482	£1.50
STK5483	£3.00
STK5486	£3.50
STK5488	£3.50
STK561	£3.00
STK563	£3.00
STK5632	£2.40
STK5720	£2.50
STK5725	£2.50
STK5730	£2.50
STK583	£3.20
STK6316	£3.00
STK6324B	£3.80
STK6327	£4.00
STK6328A	£2.80
STK6431	£3.80
STK6607	£4.00
STK6722	£5.50
STK6732	£5.00
STK6822	£6.00
STK6875	£3.50
STK6932	£3.60
STK6962	£2.75
STK6972	£1.80
STK6981B	£3.50
STK6982	£3.00
STK6982H	£3.20

Part No.	Price
STK7216	£2.80
STK7217	£1.50
STK7225	£5.00
STK7226	£17.00
STK7233	£7.00
STK7251	£5.00
STK7253	£6.50
STK730-010	£5.00
STK730-020	£5.00
STK730-060	£6.50
STK730-080	£6.00
STK730-090	£6.00
STK730-110	£6.50
STK7308	£2.00
STK7309	£2.80
STK7310	£2.70
STK73405 II	£3.00
STK73410	£2.00
STK73410 II	£2.00
STK7348	£2.00
STK7356	£4.25
STK7358	£4.40
STK7359	£4.25
STK73605	£3.75
STK73907	£7.00
STK73908	£2.50
STK7402	£4.00
STK7404	£2.00
STK7408	£4.00
STK7410	£6.50
STK7458	£12.50
STK746	£4.50
STK752	£0.70
STK7554	£3.00
STK7561	£6.50
STK7561A	£7.00
STK7562	£10.00
STK7563	£4.00
STK7563F	£4.00
STK7573	£1.80
STK7576	£15.00
STK760	£4.00
STK761	£1.00
STK770	£2.80
STK7703	£10.00
STK7707	£4.00
STK772	£5.00
STK772B	£3.00
STK780	£2.70
STK78603	£5.00
STK78617	£24.00
STK795	£1.60
STK79917	£4.00
STK8050	£16.00
STK8250	£5.00
STK8260	£7.50
STK8280	£4.00
STR10006	£4.50
STR10008	£6.00
STR1096	£2.75
STR11006	£3.25
STR1195	£3.50
STR12006	£3.50
STR1229	£3.25
STR13006	£4.20
STR15006	£4.00
STR16006	£5.00
STR17006	£5.00
STR20005	£4.50
STR20012	£3.00
STR20013	£3.00
STR20015	£3.00
STR2005	£3.00
STR2012	£2.60
STR2013	£2.20
STR2015	£3.50
STR2024	£3.00
STR2105	£4.00
STR2124	£6.75
STR30110	£3.30
STR30115	£2.75
STR30120	£2.50
STR30123	£3.50
STR30125	£2.50
STR30130	£2.50
STR3105	£4.50
STR3113	£2.25
STR3115	£4.00
STR3123	£4.00
STR3125	£4.80
STR3126	£3.50
STR3130	£5.00
STR3135	£2.50
STR3212	£2.75
STR3214	£2.75
STR3215	£2.75
STR3315	£2.75
STR370	£2.50
STR371	£3.00
STR380	£3.50
STR381	£3.90
STR383	£3.10
STR384	£3.50
STR40090	£3.50
STR40115	£3.00
STR4090A	£6.50
STR41090	£3.30
STR4142	£4.50
STR4211	£3.15
STR43111	£4.00
STR440	£3.00
STR441	£9.50
STR44111	£3.50
STR44115	£4.75
STR442	£9.00
STR450A	£5.00
STR451	£8.00
STR45111	£4.00
STR4512	£4.00
STR452	£4.00
STR453	£4.00
STR454	£3.00
STR455	£4.00

Part No.	Price
STR456	£3.00
STR457	£4.00
STR470	£2.00
STR50020	£3.50
STR50092	£5.50
STR50103A	£2.60
STR50112A	£3.00
STR50113	£4.00
STR50115	£5.00
STR50130	£3.50
STR5015	£5.00
STR50213	£3.00
STR50215	£3.50
STR50330	£3.00
STR5100	£5.50
STR51041	£3.50
STR51213	£3.00
STR51424	£7.00
STR5214	£4.75
STR53041	£2.50
STR5315	£5.75
STR54041	£3.20
STR5412	£1.25
STR55041	£3.00
STR56041	£5.50
STR58041	£2.50
STR59041	£3.00
STR60001	£5.25
STR6008X	£5.75
STR6020	£1.20
STR61001	£3.00
STR7001	£6.00
STR80145	£3.00
STR81145	£2.00
STR81159	£4.00
STR8124	£3.00
STR83145	£2.00
STR83159	£4.00
STR9005	£2.00
STR9012	£2.00
STR90120	£4.25
STRD1005T	£3.00
STRD1206	£3.50
STRD1406	£3.50
STRD1706	£2.30
STRD1806	£3.60
STRD1816	£3.50
STRD1906	£3.50
STRD3035	£2.30
STRD4412	£2.00
STRD4420	£2.00
STRD4512	£3.00
STRD5095A	£6.00
STRD5441	£4.75
STRD5541	£3.00
STRD6008	£3.00
STRD6009E	£3.00
STRD6108	£4.50
STRD6202	£4.00
STRD6601	£3.50
STRD6602	£4.75
STRD6801	£2.50
STRD6802	£2.50
STRF5654	£6.00
STRF6454	£6.50
STRF6523	£7.00
STRF6524	£4.00
STRF6535	£6.50
STRF6552	£2.00
STRF6653	£7.00
STRF6654	£4.50
STRF6655	£4.50
STRF6656	£8.00
STRF6707	£8.00
STRG6153	£5.50
STRG6351	£5.00
STRG6352	£6.00
STRG6651	£9.00
STRG6653	£5.00
STRM 6511	£7.50
STRM6511	£7.50
STRM6523	£5.00
STRM6545	£5.00
STRM6546	£5.50
STRM6547	£4.50
STRM6549	£5.00
STRM6559	£3.00
STRS5041	£3.00
STRS5041	£3.00
STRS5141	£3.00
STRS5141	£3.00
STRS5241	£3.00
STRS5241	£5.50
STRS5641	£3.50
STRS5703	£6.00
STRS5706	£6.00
STRS5707	£7.00
STRS5717	£3.00
STRS5741	£5.00
STRS5841	£5.50
STRS5941	£6.00
STRS6301	£3.00
STRS6302	£4.00
STRS6307	£3.50
STRS6308	£4.80
STRS6309	£6.00
STRS6525	£12.00
STRS6533	£4.00
STRS6545	£4.50
STRS6705	£5.00
STRS6706	£6.00
STRS6707	£6.00
STRS6708	£5.75
STRS6709	£5.00
STRZ1502	£11.00
STRZ2152	£10.00
STRZ2752	£6.50
STV0042A	£6.80
STV0056A	£9.00
STV2102B	£5.00
STV2110B	£5.00
STV2112B	£8.50
STV2116A	£7.50

Grandata Ltd

distributor of electronic components

Transistors / Linear IC's

Part No.	Price
STV2118B	£7.00
STV2145	£3.00
STV2151A	£10.00
STV2155	£12.00
STV2160	£6.00
STV2246	£7.00
STV2246C	£7.00
STV2248	£7.00
STV5109	£4.50
STV5112	£3.00
STV5180D	£3.25
STV5730A	£10.00
STV6400	£4.80
STV7778S	£5.50
STV8223B	£2.75
STV8224A	£4.00
STV8225	£2.75
STV9306	£3.00
STV9379	£2.60
STV9379A	£2.60
STV9379F	£4.50
STV9379FA	£4.25
STV9422P	£6.50
SV12004C	£43.00
SVI3101D	£34.00
SVI3102D	£34.00
SVI3204B	£36.00
SVI3205B	£31.00
TA8201AK	£1.20
TA8202	£2.50
TA8202K	£2.50
TA8205AH	£1.20
TA8207K	£1.75
TA8208H	£1.20
TA8210AH	£1.20
TA8211AH	£2.00
TA8213K	£4.50
TA8214K	£1.10
TA8215	£3.00
TA8215H	£2.00
TA8215L	£3.00
TA8216H	£3.00
TA8217P	£0.80
TA8218AH	£4.25
TA8220H	£3.50
TA8221AC	£6.00
TA8221AH	£5.00
TA8223K	£2.25
TA8225H	£4.75
TA8232H	£4.00
TA8233H	£3.00
TA8238K	£2.00
TA8248K	£2.00
TA8251AH	£7.00
TA8255AH	£4.00
TA8256H	£4.50
TA8403K	£1.15
TA8410K	£2.00
TA8410P	£0.60

Part No.	Price
TA8424F	£1.50
TA8427K	£2.00
TA8428K	£3.50
TA8432	£2.00
TA8432K	£0.80
TA8445K	£1.00
TA8449P	£3.50
TA8605N	£1.70
TA8606N	£3.50
TA8607P	£1.60
TA8611AN	£1.00
TA8701AN	£1.40
TA8718N	£4.00
TA8720	£1.20
TA8721SN	£2.00
TA8725AN	£7.00
TA8739P	£3.50
TA8808BN	£8.00
TA8859CP	£4.00
TA8867AN	£3.50
TDA1170N	£0.85
TDA1170N SGS	£4.00
TDA1170N TFK	£3.50
TDA1420	£8.00
TDA1470	£12.00
TDA1514A	£12.00
TDA1547	£2.50
TDA1552Q	£3.50
TDA1553AQ	£3.25
TDA1553CQ	£3.00
TDA1554Q	£3.00
TDA1555Q	£2.00
TDA1556Q	£3.25
TDA1557Q	£3.00
TDA1558Q	£3.00
TDA1560Q	£3.50
TDA1561Q	£3.50
TDA1562Q	£5.50
TDA1580	£4.25
TDA1599	£4.00
TDA1670A	£1.40
TDA1675	£2.50
TDA1675A	£2.00
TDA16833	£2.00
TDA16846	£2.00
TDA1701	£10.00
TDA1770	£7.50
TDA1771	£2.00
TDA1870A	£1.40
TDA1872A	£1.90
TDA1908A	£0.80
TDA1910	£0.50
TDA1940	£1.00
TDA1941	£3.00
TDA2003	£0.85
TDA2004	£0.70
TDA2005	£0.50
TDA2006	£0.50
TDA2007	£1.20

Part No.	Price
TDA2008	£1.00
TDA2009	£1.00
TDA2010	£0.75
TDA2020	£0.70
TDA2030	£0.80
TDA2030H	£1.00
TDA2040	£1.40
TDA2048	£3.25
TDA2050V	£2.00
TDA2051V	£1.50
TDA2052V	£2.00
TDA2054M	£0.80
TDA2107	£0.50
TDA2140	£5.20
TDA2148	£0.50
TDA2170	£8.00
TDA2501	£1.80
TDA2506T	£8.00
TDA2507	£2.50
TDA2510	£4.50
TDA2520-1	£9.00
TDA2521	£8.00
TDA2522	£3.00
TDA2523	£8.50
TDA2525	£4.50
TDA2530	£1.70
TDA2548	£0.75
TDA2549	£1.10
TDA2558	£1.00
TDA2560Q	£5.00
TDA2574V	£3.50
TDA2576A	£9.00
TDA2577A	£2.00
TDA2578A	£2.50
TDA2579A	£2.10
TDA2652	£48.00
TDA2653A	£4.50
TDA2710-1	£4.00
TDA2820M	£1.00
TDA2822M	£0.30
TDA3190	£1.20
TDA3301B	£16.00
TDA3303	£2.00
TDA3501	£1.60
TDA3502	£3.00
TDA3504	£1.00
TDA3507	£4.50
TDA3521	£7.50
TDA3560	£3.00
TDA3561	£1.00
TDA3561A	£3.00
TDA3561B	£1.30
TDA3562	£2.60
TDA3562A	£2.60
TDA3563	£2.60
TDA3563A	£4.00
TDA3564	£2.80
TDA3565	£2.20
TDA3566	£15.00

Part No.	Price
TDA3566A	£3.00
TDA3567	£1.50
TDA3569	£3.00
TDA3570	£1.50
TDA3576B	£10.50
TDA3650	£6.75
TDA3651	£2.00
TDA3651A	£3.50
TDA3652	£1.50
TDA3652TX10	£3.00
TDA3653	£1.50
TDA3653B	£0.80
TDA3653C	£0.85
TDA3653CQ	£1.50
TDA3654	£1.50
TDA3654Q	£1.50
TDA3724	£1.50
TDA3725	£3.00
TDA3730	£2.00
TDA3740	£2.60
TDA3750	£4.00
TDA3770	£7.75
TDA3771	£2.40
TDA3803A	£3.40
TDA4400	£1.10
TDA4420	£0.75
TDA4421	£2.00
TDA4422	£2.00
TDA4427	£3.00
TDA4429T	£20.00
TDA4431	£0.55
TDA4474	£1.60
TDA4480	£3.00
TDA4481	£0.80
TDA4482	£11.00
TDA4483	£1.00
TDA4500	£2.30
TDA4501	£2.80
TDA4502	£4.00
TDA4502A	£4.00
TDA4503	£1.80
TDA4504B	£8.00
TDA4505A	£1.50
TDA4505E	£6.50
TDA4510	£2.00
TDA4556	£2.00
TDA4557	£1.80
TDA4560	£1.80
TDA4565	£1.50
TDA4566	£2.50
TDA4580	£10.00
TDA4600	£2.00
TDA4600II	£1.60
TDA4601	£1.20
TDA4601D	£0.65
TDA4605	£1.90
TDA4610	£2.40
TDA4650	£3.00
TDA4651	£8.00

Part No.	Price
TDA4665	£1.00
TDA4670	£2.50
TDA4671	£1.80
TDA4680	£2.20
TDA4681	£1.75
TDA4685	£1.80
TDA4686	£5.00
TDA4687	£5.00
TDA4700A	£4.00
TDA4710H	£4.50
TDA4714C	£3.50
TDA4716C	£4.50
TDA4720	£6.60
TDA4725	£7.50
TDA4780	£6.00
TDA4800	£3.00
TDA4810	£2.70
TDA4850	£2.00
TDA4851	£1.70
TDA4852	£3.25
TDA4854	£3.50
TDA4855	£2.60
TDA4856	£3.00
TDA4858	£3.50
TDA4860	£1.00
TDA4861	£1.80
TDA4866	£1.25
TDA4880	£4.50
TDA4918A	£17.00
TDA4930	£5.00
TDA4935	£1.50
TDA4940	£1.00
TDA4941	£0.60
TDA4942	£1.10
TDA4950	£1.00
TDA4951	£1.00
TDA5010	£3.00
TDA5400	£6.00
TDA5500	£4.00
TDA5610-2	£7.50
TDA5620	£2.00
TDA5702	£13.00
TDA5830-2	£11.00
TDA6101Q	£1.20
TDA6103Q	£1.00
TDA6106Q	£1.25
TDA6107Q	£3.00
TDA6108JF	£3.00
TDA6111Q	£2.25
TDA6120Q	£5.50
TDA6130	£2.25
TDA6160-2S	£4.75
TDA6160-2X	£2.50
TDA7052	£1.20
TDA7262	£3.25
TDA7263	£3.50
TDA7263M	£4.00
TDA7264	£2.50
TDA7265	£5.00

Part No.	Price
TDA7266	£1.80
TDA7269	£5.00
TDA7269A	£2.75
TDA7293V	£5.50
TDA7294V	£5.50
TDA7295	£4.00
TDA7296	£5.00
TDA7297	£3.50
TDA7300	£5.50
TDA7302	£4.50
TDA7310	£8.00
TDA7312	£4.50
TDA7313	£1.50
TDA7318	£2.00
TDA7330A	£2.00
TDA7340	£8.00
TDA7350	£1.50
TDA7359	£3.00
TDA7360	£1.50
TDA7362	£4.50
TDA7365	£1.50
TDA7370V	£1.30
TDA7372A	£4.50
TDA7374V	£3.50
TDA7375V	£5.25
TDA7376B	£10.00
TDA7377	£4.50
TDA7381	£11.00
TDA7384A	£8.00
TDA7385	£10.00
TDA7386	£11.00
TDA7391	£4.25
TDA7393	£10.00
TDA7394	£2.00
TDA7396	£2.50
TDA7429S	£4.25
TDA7431	£7.00
TDA7439	£4.00
TDA7560	£10.00
TDA8000	£2.50
TDA8116	£3.50
TDA8120B	£3.00
TDA8137	£2.00
TDA8138	£2.00
TDA8138A	£1.30
TDA8138B	£0.75
TDA8139	£0.75
TDA8140	£6.50
TDA8143	£1.60
TDA8145	£1.20
TDA8146	£1.20
TDA8153	£10.00
TDA8170	£3.00
TDA8171	£2.30
TDA8172	£2.00
TDA8173	£1.00
TDA8174AW	£2.00
TDA8177	£3.00
TDA8177F	£3.50

Part No.	Price
TDA8179S	£7.50
TDA8180	£6.00
TDA8190	£1.45
TDA8205	£4.00
TDA8212	£1.50
TDA8214B	£10.50
TDA8215B	£2.25
TDA8215H	£3.00
TDA8217	£2.25
TDA8303	£1.25
TDA8304	£4.00
TDA8305	£2.00
TDA8305A	£2.00
TDA8310	£6.00
TDA8350Q	£2.75
TDA8351	£2.00
TDA8354Q	£2.75
TDA8356	£2.00
TDA8360N3	£8.00
TDA8361AN3	£8.00
TDA8361N3	£9.00
TDA8362AN	£12.00
TDA8362AN3	£7.50
TDA8362BN3	£8.50
TDA8362N3	£12.00
TDA8362N4	£9.00
TDA8362N5	£12.00
TDA8366N2	£15.00
TDA8366N3	£11.50
TDA8370	£5.50
TDA8372A	£16.50
TDA8374	£10.00
TDA8375A	£12.50
TDA8380A	£1.00
TDA8390A	£3.00
TDA8440	£1.30
TDA8442	£2.00
TDA8443	£2.10
TDA8444	£1.00
TDA8560Q	£4.25
TDA8561Q	£5.25
TDA8562Q	£5.00
TDA8563Q	£4.75
TDA8565Q	£11.00
TDA8566Q	£5.50
TDA8567Q	£4.00
TDA8568Q	£6.00
TDA8569Q	£8.00
TDA8571J	£6.00
TDA8579	£1.50
TDA8702	£1.50
TDA8703	£5.00
TDA8708	£3.00
TDA8709	£3.50
TDA8808T	£1.20
TDA8809T	£1.80
TDA8840	£7.00
TDA8841	£7.00
TDA8842	£7.00

Part No.	Price
TDA8843	£15.00
TDA8844	£10.00
TDA9102C	£1.50
TDA9103	£1.70
TDA9105	£3.00
TDA9109	£10.00
TDA9141	£6.25
TDA9143	£2.00
TDA9144	£12.00
TDA9151	£11.00
TDA9160A	£9.50
TDA9162	£11.00
TDA9170	£7.00
TDA9176	£6.50
TDA9177	£8.00
TDA9210	£2.00
TDA9302H	£1.00
TDA9350	£27.50
TDA9351	£14.00
TDA9353	£14.00
TDA9403	£0.80
TDA9500	£7.50
TDA9503	£7.00
TDA9513	£1.50
TDA9610H	£5.50
TDA9614H	£8.00
TEA1060	£2.25
TEA1061	£0.80
TEA1062	£0.55
TEA1062A	£3.00
TEA1064	£1.10
TEA1064A	£1.30
TEA1067	£1.50
TEA1068	£3.50
TEA1080P	£1.00
TEA1081	£1.60
TEA1087	£0.20
TEA1090	£5.00
TEA1091	£3.00
TEA1093	£4.75
TEA2018A	£1.20
TEA2019	£6.00
TEA2025B	£0.75
TEA2026CV	£10.50
TEA2028	£3.25
TEA2028B	£3.75
TEA2029A	£2.00
TEA2029C	£8.50
TEA2031A	£1.25
TEA2037	£1.25
TEA2037A	£1.25
TIPL760A	£1.00
TIPL761A	£2.50
TIPL762A	£2.00
TIPL763	£2.00
TIPL763A	£2.00
TIPL791A	£0.80

Please note that this a very small selection of the transistors and IC's that we stock.
We stock a full range of Japanese Transistors 2SA,2SB, 2SC,2SD,2SJ,2SK series , Diodes , CMOS , TTL Logic ICs , Computer ICs , Zener Diodes...etc

105°c Electrolytic Capacitors

VALUE	CODE	PRICE	PER PACK
6.3 Volts			
220uF	CAP163	£0.70	10
470uF	CAP164	£0.80	10
10 Volts			
100uF	CAP118	£0.45	10
220uF	CAP165	£1.00	10
470uF	CAP29	£1.20	10
680uF	CAP166	£1.20	10
1000uF	CAP119	£1.50	10
2200uF	CAP120	£2.10	10
3300uF	CAP167	£1.60	5
16 Volts			
22uF	CAP121	£0.35	10
33uF	CAP122	£0.35	10
47uF	CAP123	£0.35	10
100uF	CAP124	£0.60	10
150uF	CAP168	£0.65	5
220uF	CAP125	£0.80	10
330uF	CAP30	£1.75	10
470uF	CAP31	£1.75	10
680uF	CAP32	£2.10	5
1000uF	CAP33	£2.10	10
1200uF	CAP169	£1.50	5
1500uF	CAP170	£1.50	5
2200uF	CAP34	£5.25	10
3300uF	CAP35	£5.00	5
4700uF	CAP36	£6.10	10
6800uF	CAP171	£4.50	5
25 Volts			
10uF	CAP37	£0.45	10
15uF	CAP172	£0.45	10
22uF	CAP38	£0.45	10
33uF	CAP126	£0.40	10
47uF	CAP39	£0.48	5
68uF	CAP127	£0.55	10
100uF	CAP40	£0.70	10
120uF	CAP128	£0.85	10
150uF	CAP41	£0.95	5
220uF	CAP42	£1.20	10
330uF	CAP43	£1.40	5
470uF	CAP44	£1.90	10
680uF	CAP45	£3.15	5

VALUE	CODE	PRICE	PER PACK
25 Volts...continued			
1000uF	CAP46	£3.65	10
1500uF	CAP47	£3.90	5
2200uF	CAP48	£2.00	2
3300uF	CAP49	£2.20	2
4700uF	CAP50	£3.65	2
6800uF	CAP51	£3.90	2
35 Volts			
1uF	CAP130	£0.40	10
3.3uF	CAP131	£0.40	10
4.7uF	CAP132	£0.45	10
10uF	CAP52	£0.50	10
22uF	CAP53	£0.45	10
33uF	CAP54	£0.50	5
47uF	CAP55	£0.85	10
68uF	CAP133	£0.55	10
100uF	CAP56	£0.85	10
150uF	CAP57	£0.95	5
220uF	CAP58	£1.45	5
330uF	CAP134	£1.60	10
470uF	CAP135	£1.75	10
680uF	CAP59	£6.50	10
1000uF	CAP60	£4.35	10
1500uF	CAP173	£4.00	5
2200uF	CAP61	£2.45	2
3300uF	CAP62	£10.00	5
4700uF	CAP136	£3.50	2
40 Volts			
2200uF	CAP174	£1.80	2
2200uF	CAP175	£2.00	1
50 Volts			
0.47uF	CAP176	£0.35	10
1uF	CAP137	£0.35	10
2.2uF	CAP138	£0.35	10
3.3uF	CAP139	£0.35	10
4.7uF	CAP140	£0.35	10
6.8uF	CAP177	£0.45	10
10uF	CAP63	£0.50	10
22uF	CAP64	£0.70	10
33uF	CAP141	£0.85	10
47uF	CAP65	£0.85	10
68uF	CAP142	£0.90	10

VALUE	CODE	PRICE	PER PACK
50 Volts...continued			
100uF	CAP66	£0.85	10
220uF	CAP67	£1.75	10
330uF	CAP68	£2.45	10
470uF	CAP69	£4.35	10
680uF	CAP70	£4.90	5
1000uF	CAP71	£5.25	10
1500uF	CAP143	£4.50	5
2200uF	CAP72	£3.25	2
3300uF	CAP144	£3.25	2
63 Volts			
0.22uF	CAP145	£0.45	10
0.33uF	CAP178	£0.35	10
0.47uF	CAP73	£0.35	10
1uF	CAP74	£0.35	10
1.5uF	CAP179	£0.35	10
2.2uF	CAP75	£0.35	10
3.3uF	CAP76	£0.50	10
4.7uF	CAP77	£0.35	10
6.8uF	CAP180	£0.50	10
10uF	CAP78	£0.50	10
15uF	CAP79	£0.95	5
22uF	CAP80	£0.75	10
33uF	CAP81	£0.85	10
47uF	CAP82	£0.95	10
56uF	CAP181	£1.10	10
68uF	CAP83	£1.30	5
100uF	CAP84	£1.20	10
150uF	CAP85	£2.80	5
220uF	CAP86	£2.80	10
330uF	CAP87	£4.00	10
470uF	CAP88	£5.25	10
680uF	CAP89	£5.00	10
1000uF	CAP90	£5.40	5
2200uF	CAP182	£2.20	1
4700uF	CAP183	£4.00	1
100 Volts			
0.1uF	CAP184	£0.80	10
0.22uF	CAP185	£0.80	10
0.33uF	CAP186	£0.80	10
0.47uF	CAP91	£0.50	5
1uF	CAP92	£0.85	10
1.5uF	CAP93	£0.70	5

VALUE	CODE	PRICE	PER PACK
100 Volts...continued			
2.2uF	CAP94	£0.50	5
3.3uF	CAP95	£0.50	5
4.7uF	CAP96	£0.50	5
6.8uF	CAP187	£0.80	10
10uF	CAP97	£0.95	10
22uF	CAP98	£1.05	10
33uF	CAP99	£1.55	5
47uF	CAP100	£1.75	10
68uF	CAP188	£1.30	5
100uF	CAP101	£2.10	10
220uF	CAP102	£6.00	5
330uF	CAP189	£3.00	2
470uF	CAP103	£6.00	5
680uF	CAP190	£3.00	2
1000uF	CAP191	£3.00	1
160 Volts			
0.47uF	CAP192	£0.45	10
1uF	CAP193	£0.45	10
2.2uF	CAP146	£0.45	10
3.3uF	CAP194	£1.00	10
4.7uF	CAP195	£1.00	10
10uF	CAP147	£1.40	10
22uF	CAP148	£1.80	10
33uF	CAP149	£2.30	10
47uF	CAP196	£2.20	5
100uF	CAP150	£3.25	5
220uF	CAP197	£3.00	2
470uF	CAP198	£3.25	1
200 Volts			
22uF	CAP199	£1.60	5
100uF	CAP151	£3.25	5
220uF	CAP200	£2.50	1
330uF	CAP201	£2.50	1
250 Volts			
0.47uF	CAP202	£0.60	10
1uF	CAP152	£0.60	10
2.2uF	CAP203	£1.30	10
3.3uF	CAP104	£1.75	10
4.7uF	CAP204	£2.00	10
10uF	CAP105	£2.60	10
22uF	CAP153	£2.30	10

VALUE	CODE	PRICE	PER PACK
250 Volts...continued			
33uF	CAP206	£1.75	5
47uF	CAP106	£4.35	10
100uF	CAP154	£4.50	5
220uF	CAP155	£2.00	2
330uF	CAP206	£2.50	1
350 Volts			
1uF	CAP156	£0.70	10
2.2uF	CAP207	£1.20	10
3.3uF	CAP157	£1.50	10
4.7uF	CAP208	£1.10	5
10uF	CAP158	£2.25	10
22uF	CAP159	£3.40	10
33uF	CAP209	£2.60	5
47uF	CAP210	£1.50	2
100uF	CAP211	£3.00	2
330uF	CAP212	£5.00	1
400 Volts			
0.47uF	CAP213	£0.60	10
1uF	CAP107	£2.15	5
2.2uF	CAP108	£2.25	5
3.3uF	CAP214	£2.25	5
4.7uF	CAP109	£3.15	5
10uF	CAP110	£4.00	5
22uF	CAP111	£2.50	2
33uF	CAP215	£2.50	2
47uF	CAP112	£3.50	2
68uF	CAP216	£3.50	2
100uF	CAP160	£4.00	2
150uF	CAP217	£3.20	1
220uF	CAP161	£7.00	2
560uF	CAP162	£4.00	1
450 Volts			
1uF	CAP113	£2.80	5
2.2uF	CAP114	£3.20	5
3.3uF	CAP218	£3.20	5
4.7uF	CAP115	£4.95	5
10uF	CAP116	£5.50	5
22uF	CAP117	£4.15	2
33uF	CAP219	£3.00	2
47uF	CAP220	£2.00	1
100uF	CAP221	£3.00	1

Grandata Ltd

distributor of electronic components

Television Repair / Mod Kits

ALBA

MAKE & MODEL	KIT TYPE	CODE
1452T	PSU	ONWAKIT
1427T	PSU	ONWAKIT
1402	PSU	ONWAKIT
1455T	PSU	ONWAKIT
1456T	PSU	ONWAKIT
1458T	PSU	ONWAKIT
1459T	PSU	ONWAKIT
1499Y	STANDBY	MODKIT37
14SLTX	STANDBY	MODKIT37
1799Y	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

MAKE & MODEL	KIT TYPE	CODE
CT1417	PSU	ONWAKIT
CT2159U	PSU	ONWAKIT
CT2162UNT	PSU	ONWAKIT
CT2863UNT	PSU	ONWAKIT

DECCA/TATUNG

MAKE & MODEL	KIT TYPE	CODE
F SERIES	PSU	MODKIT30
TVC563	STANDBY	MODKIT37

GOLDSTAR

MAKE & MODEL	KIT TYPE	CODE
CF25A50F	FRAME	MODKIT36
CF25C22C	FRAME	MODKIT35
CF28A50F	FRAME	MODKIT36
CF28C22F	FRAME	MODKIT35
CF28C28F	FRAME	MODKIT36
CF29C42F	FRAME	MODKIT35

GOODMANS

MAKE & MODEL	KIT TYPE	CODE
147TT	PSU	ONWAKIT
149T	PSU	ONWAKIT
1430RA	PSU	ONWAKIT
1430RS	PSU	ONWAKIT
1430RW	PSU	ONWAKIT
1450T	PSU	ONWAKIT
1455TS	PSU	ONWAKIT
2019R	PSU	ONWAKIT
2029T	PSU	ONWAKIT
2029TA	PSU	ONWAKIT
COMPACT 11	PSU	MODKIT47
F16 CHASSIS	FRAME	GOODKIT1
F16 CHASSIS	LINE	GOODKIT1
F16	PSU	GOODKIT1
F16	VIDEO	GOODKIT1

GRUNDIG

MAKE & MODEL	KIT TYPE	CODE
CUC 2050	PSU	MODKIT48
CUC 2051	PSU	MODKIT48
CUC 2058	PSU	MODKIT48

GRUNDIG..continued

MAKE & MODEL	KIT TYPE	CODE
CUC 2059	PSU	MODKIT48
CUC 2080	PSU	MODKIT48
CUC 7350		GRUNDIGKIT1
CUC 7301/3 (BUZ90)	PSU	GRUNDIGKIT2
CUC 7301/3 (MJF18004)	PSU	GRUNDIGKIT3

HINARI

MAKE & MODEL	KIT TYPE	CODE
HIT14RC	PSU	ONWAKIT

JVC

MAKE & MODEL	KIT TYPE	CODE
AV29SX1EK	FIELD O/P	JVCKIT1
AV29SX1EN	FIELD O/P	JVCKIT1
AV29SX1EN1	FIELD O/P	JVCKIT1
AV29SX1PF	FIELD O/P	JVCKIT1
AV29TSIE1	FIELD O/P	JVCKIT1
C14E1EK	PSU	ONWAKIT
C14T1EK	PSU	ONWAKIT
C21ET1EK	PSU	ONWAKIT
CS21M3EK	PSU	ONWAKIT

MATSUI

MAKE & MODEL	KIT TYPE	CODE
1455	PSU	ONWAKIT
1496R/T (H3N90)	PSU	MODKIT43
1496R/T (BUZ90)	PSU	MODKIT44
1498	PSU	ONWAKIT
2086	PSU	ONWAKIT
2096R/T (H3N90)	PSU	MODKIT43
2096R/T (BUZ90)	PSU	MODKIT44
2098	PSU	ONWAKIT
21V1N (BUZ90)	PSU	GRUNDIGKIT2
21V1T(MJF18004)	PSU	GRUNDIGKIT3
TVR180R/208	STANDBY	MODKIT37
TVR185T	STANDBY	MODKIT39

MITSUBISHI

MAKE & MODEL	KIT TYPE	CODE
AV1 SERIES	PSU	MITSKIT3
CT1M5B	PSU	MITSKIT3
CT21M5BT	PSU	MITSKIT3
CT25M5BT	PSU	MITSKIT3
CT21A2STX	TDA 8178S	MITSKIT1
CT21AX1B	PSU	MITSKIT3
CT21A3STX	TDA 8178S	MITSKIT1
CT21AV1BS	PSU	MITSKIT3
CT25A2STX	TDA 8178S	MITSKIT1
CT25A3STX	TDA 8178S	MITSKIT1
CT25A4STX	TDA 8178S	MITSKIT1
CT25A6STX	TDA 8178S	MITSKIT1
CT25AV1B	PSU	MITSKIT3
CT25AV1BS	PSU	MITSKIT3
CT25AV1BD	PSU	MITSKIT3
CT25AV1BDS	PSU	MITSKIT3
CT28AV1B	PSU	MITSKIT3
CT28AX1BD	PSU	MITSKIT3
CT28AV1BDS	PSU	MITSKIT3
CT29AS1	TDA 8178S	MITSKIT2
CT29A4	TDA 8178S	MITSKIT2
CT29A6	TDA 8178S	MITSKIT2
CT29B2	TDA 8178S	MITSKIT2
CT29B3	TDA 8178S	MITSKIT2

MITSUBISHI..continued

MAKE & MODEL	KIT TYPE	CODE
CT29B6	TDA 8178S	MITSKIT2
CT33B3	TDA 8178S	MITSKIT2
M5 SERIES	PSU	MITSKIT3

NEI/NIKKAI

MAKE & MODEL	KIT TYPE	CODE
CE25 CHASSIS	PSU	NIKKAIKIT1
C289FTXN	PSU	NIKKAIKIT1
C28F41FXN	PSU	NIKKAIKIT1

PANASONIC

MAKE & MODEL	KIT TYPE	CODE
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

MAKE & MODEL	KIT TYPE	CODE
28PT4457/05	PSU	MODKIT50
28PW5407/05	PSU	MODKIT50
28PW6006/05	PSU	MODKIT50
310.10708		PHILKIT3
310.20491		PHILKIT2
310.20496		PHILKIT10
310.31994		PHILKIT6
310.32252		PHILKIT5
310.32253		PHILKIT4
310.32254		PHILKIT9
310.32255		PHILKIT7
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
L01.1E CHASSIS	PSU	MODKIT50

SAMSUNG

MAKE & MODEL	KIT TYPE	CODE
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

MAKE & MODEL	KIT TYPE	CODE
51CS03H	PSU	SHARPKIT1
51CS05H	PSU	SHARPKIT1
56FW53H	PSU & DOLBY	MODKIT45
59CS03H	PSU	SHARPKIT2
59CS05H	PSU	SHARPKIT2
59CSD8H	PSU	SHARPKIT2
59DS03H	PSU	SHARPKIT3
59FW53H	PSU & EW	MODKIT49

SHARP..continued

MAKE & MODEL	KIT TYPE	CODE
66CS03H	PSU	SHARPKIT2
66CS05H	PSU	SHARPKIT2
66CSD8H	PSU	SHARPKIT2
66FW53H	PSU & DOLBY	MODKIT45
66FW53H	PSU & EW	MODKIT49
66FW54H	PSU & DOLBY	MODKIT45
66FW54H	PSU & EW	MODKIT49
76FW53H	PSU & DOLBY	MODKIT45
76FW53H	PSU & EW	MODKIT49
76FW54H	PSU & DOLBY	MODKIT45
76FW54H	PSU & EW	MODKIT49
DA-100 CHASSIS	PSU & EW	MODKIT49

SONY

MAKE & MODEL	KIT TYPE	CODE
SLV715HB	VCR - PSU	MODKIT40
SLV777UB	VCR - PSU	MODKIT40

THOMSON

MAKE & MODEL	KIT TYPE	CODE
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
ICC17 CHASSIS	PSU	MODKIT41
ISS20 (TV-DVD)	PSU	MODKIT46
R3000	PSU	THOMKIT2
R4000	PSU	THOMKIT2
TX92F CHASSIS	EAST/WEST	THOMKIT4

VESTEL

MAKE & MODEL	KIT TYPE	CODE
11AK31 CHASSIS	PSU	MODKIT51

Phoenix

Electronic Upgrade Kits

We are stockist of the Full Range of Phoenix Repair Kits

ORDER CODE	PRICE
GOODKIT1	£ 11.00
GRUNDIGKIT1	£ 10.50
GRUNDIGKIT2	£ 10.50
GRUNDIGKIT3	£ 10.50
JVCKIT1	£ 11.00
MITSKIT1	£ 3.00
MITSKIT2	£ 15.00
MITSKIT3	£ 6.00
MODKIT30	£ 10.00
MODKIT35	£ 9.50
MODKIT36	£ 5.00
MODKIT37	£ 6.50
MODKIT39	£ 8.50
MODKIT40	£ 6.00
MODKIT41	£ 6.00
MODKIT43	£ 7.00
MODKIT44	£ 7.00
MODKIT45	£ 4.00
MODKIT46	£ 12.00
MODKIT47	£ 15.50
MODKIT48	£ 8.00
MODKIT49	£ 13.00
MODKIT50	£ 18.00
MODKIT51	£ 10.00
NIKKAIKIT1	£ 12.00
ONWAKIT	£ 12.00
PANKIT1	£ 15.00
PANKIT2	£ 9.00
PHILKIT1	£ 10.00
PHILKIT2	£ 2.50
PHILKIT3	£ 4.00
PHILKIT4	£ 4.25
PHILKIT5	£ 5.75
PHILKIT6	£ 5.50
PHILKIT7	£ 7.60
PHILKIT8	£ 4.25
PHILKIT9	£ 7.50
PHILKIT10	£ 8.50
SAMKIT2	£ 8.00
SAMSUNGKIT	£ 16.00
SHARPKIT1	£ 11.00
SHARPKIT2	£ 11.00
SHARPKIT3	£ 9.00
THOMKIT1	£ 7.00
THOMKIT2	£ 12.00
THOMKIT3	£ 9.00
THOMKIT4	£ 4.00

K.P. House , Unit 15 , Pop In Commercial Centre , Southway , Wembley , Middlesex , HA9 0HB England
Tel: (020) 8900 2329 Fax : (020) 8903 6126 Email : sales@grandata.co.uk

Grandata Ltd

distributor of electronic components

Replacement Remote Controls

BEKO

Part No.	Code
CTV5230	RC437/HL
TVB3090	RC437/HL

DAEWOO

Part No.	Code
14A5	RC1986/HL
2075	RC1986/HL
20A5	RC1986/HL
2166	RC1986/HL
2172	RC1986/HL
2195	RC1986/HL
CHASSISCP330	RC1986/HL
CHASSISCP760	RC1986/HL
CT512T	RC1986/HL
CT514TN	RC1986/HL
DMQ14A1	RC1986/HL
DMQ14A5	RC1986/HL
DMQ14B1	RC1986/HL
DMQ14D1	RC1986/HL
DMQ2066	RC1986/HL
DMQ2072	RC1986/HL
DMQ2075	RC1986/HL
DMQ20A1	RC1986/HL
DMQ20B1	RC1986/HL
DMQ20C1	RC1986/HL
DMQ20D1	RC1986/HL
DMQ2166	RC1986/HL
DMQ2172	RC1986/HL
DMQ2195	RC1986/HL
DMQ21A1	RC1986/HL
DMQ21B1	RC1986/HL
DMQ21C1	RC1986/HL
DMQ2590	RC1986/HL
DMQ2595	RC1986/HL
DMQ2890	RC1986/HL
DMQ2895	RC1986/HL
DTD2075	RC1986/HL
DTD20A1	RC1986/HL
DTD2195	RC1986/HL
DTD21A1	RC1986/HL
DTD2595	RC1986/HL
DTD2895	RC1986/HL
DTG2895	RC1986/HL
DTT2075	RC1986/HL
DTT20B1	RC1986/HL
DTT20C1	RC1986/HL
DTT2195	RC1986/HL
DTT21A1TFP	RC1986/HL
DTT21C1	RC1986/HL
DTX14A1	RC1986/HL
DTX14B1	RC1986/HL
DTX14D1	RC1986/HL
DTX2066	RC1986/HL
DTX2072	RC1986/HL
DTX2075	RC1986/HL
DTX20A1	RC1986/HL
DTX20B1	RC1986/HL
DTX20C1	RC1986/HL
DTX20D1	RC1986/HL
DTX2166	RC1986/HL
DTX2172	RC1986/HL
DTX2195	RC1986/HL
DTX21A1	RC1986/HL
DTX21B1	RC1986/HL
DTX21C1	RC1986/HL
DTY2590	RC1986/HL
DTY2595	RC1986/HL
DTY2890	RC1986/HL
DTY2895	RC1986/HL
GB14A5T	RC1986/HL
R22	RC1986/HL
R23	RC1986/HL
R25	RC1986/HL
R26	RC1986/HL
T140	RC1986/HL
T142	RC1986/HL
T200	RC1986/HL
T202	RC1986/HL
T204	RC1986/HL
T512	RC1986/HL
T514	RC1986/HL
T594	RC1986/HL
T664	RC1986/HL
TFP14A1	RC1986/HL
TV33	RC1986/HL
TV36	RC1986/HL

GOODMANS

Part No.	Code
1428	RC1986/HL
1428T	RC1986/HL
2018R	RC1986/HL
2028T	RC1986/HL
2045TS	RC1986/HL
205N	RC1986/HL
215N	RC1986/HL
2195T	RC1986/HL
285NS	RC1986/HL
285NSB	RC1986/HL

GRUNDIG

Part No.	Code
CUC1821	RC160/HL
CUC1851	RC160/HL
CUC1881	RC160/HL
CUC1892	RC160/HL
CUC5200	RC160/HL
CUC5301	RC160/HL
CUC5302	RC160/HL
CUC5303	RC160/HL
CUC5305	RC160/HL
CUC5310	RC160/HL
CUC5312	RC160/HL
CUC5350	RC160/HL
CUC5360	RC160/HL
CUC5361	RC160/HL
CUC5511	RC160/HL
CUC6300	RC160/HL
CUC6310	RC160/HL
CUC6851	RC160/HL
CUC6880	RC160/HL
CUC6890	RC160/HL
CUC7851	RC160/HL
CUC7880	RC160/HL
CUC7890	RC160/HL

HITACHI

Part No.	Code
CL2560	RC220/HL
CL2564TA	RC220/HL
CL2565	RC220/HL
CL2860TA	RC220/HL
CL2864TA	RC220/HL
CL2865	RC220/HL
CLE877A	RC220/HL
CLE902A	RC220/HL
CLE902B	RC220/HL
CP2146TAN	RC220/HL
CP2546TAN	RC220/HL
CP2565TA	RC220/HL
CP2841TA	RC220/HL
CP2846TAN	RC220/HL
CP2865TA	RC220/HL
TVC2528TN	RC220/HL
TVC25TN	RC220/HL
TVC28TN	RC220/HL

J.V.C.

Part No.	Code
AV21BD5	RC665/HL
AV21BF5	RC665/HL
AV21BT7	RC665/HL
AV21F1EG	RC665/HL
AV21JT5	RC665/HL
AV21TS1	RC665/HL
AV21TS2	RC665/HL
AV21TS4	RC665/HL
AV24WT2	RC665/HL
AV24WT5	RC665/HL
AV25BD3	RC665/HL
AV25FX11	RC665/HL
AV25FX11EG	RC665/HL
AV25GS1	RC665/HL
AV25S4	RC665/HL
AV25S4E	RC665/HL
AV25VM1	RC665/HL
AV25VM1EN	RC665/HL
AV28GS1	RC665/HL
AV28S1E	RC665/HL
AV28S4E	RC665/HL
AV28VM1EN	RC665/HL
AV28WR2	RC665/HL
AV28WT1	RC665/HL
AV29SX1	RC665/HL
AV29SX2	RC665/HL
AV32WP2	RC665/HL
HRS7000	RC665/HL
RMC663	RC665/HL
RMC761	RC665/HL
RMC771	RC665/HL
RMC792	RC665/HL
RMC793	RC665/HL
RMC794	RC665/HL
RMC795	RC665/HL
RMC870	RC665/HL
TS2E	RC665/HL

MATSUI

Part No.	Code
14V1T	RC160/HL
14VIT	RC160/HL
20V1R	RC160/HL
20V1T	RC160/HL
20VIT	RC160/HL
CUC731	RC160/HL

MITSUBISHI

Part No.	Code
14M1	RC1725/HL
CT1447	RC1725/HL
CT14M1	RC1725/HL
CT14MSIEM	RC1725/HL
CT15MS1ETX	RC1725/HL
CT1903	RC1725/HL
CT2028	RC1725/HL
CT2030	RC1725/HL
CT2030BM	RC1725/HL
CT2030LM	RC1725/HL
CT2040	RC1725/HL
CT2040LM	RC1725/HL
CT21A2STX	RC1725/HL
CT21A3STX	RC1725/HL
CT21A5EST	RC1725/HL
CT21A5LST	RC1725/HL
CT21A5ST	RC1725/HL
CT21A5STX	RC1725/HL
CT25A2	RC1725/HL
CT25A3	RC1725/HL
CT25A3STX	RC1725/HL
CT25A4	RC1725/HL
CT25A4STX	RC1725/HL
CT25A5EST	RC1725/HL
CT25A5ST	RC1725/HL
CT25A5STX	RC1725/HL
CT25AL1	RC1725/HL
CT25B2	RC1725/HL
CT25B2STX	RC1725/HL
CT25B3	RC1725/HL
CT29A4	RC1725/HL
CT29AS1	RC1725/HL
CT29B2	RC1725/HL
CT29B3	RC1725/HL
CT29B3EST	RC1725/HL
CT29B4EST	RC1725/HL
CT33B3	RC1725/HL

PHILIPS

Part No.	Code
21PT1653/00	RC437/HL
21PT442A	RC437/HL
21PT520	RC437/HL
21PT523B	RC437/HL
21PT530	RC437/HL
21PT5301	RC437/HL
21PT5322	RC437/HL
21PT570A	RC437/HL
21PT700B/00	RC437/HL
21ST1130 /02B	RC437/HL
21ST1636	RC437/HL
21ST1730	RC437/HL
21ST2430	RC437/HL
21ST2436	RC437/HL
21ST2630/02B	RC437/HL
21ST2637	RC437/HL
21ST2730	RC437/HL
21ST2731	RC437/HL
21ST2931	RC437/HL
21ST2937	RC437/HL
24PW6302	RC437/HL
25CT2764	RC437/HL
25ET2765	RC437/HL
25MN1350	RC437/HL
25MN1355	RC437/HL
25MN1370	RC437/HL
25MN1553	RC437/HL
25MN1560	RC437/HL
25MN1570	RC437/HL
25PT405A	RC437/HL
25PT415A	RC437/HL
25PT425A	RC437/HL
25PT440A	RC437/HL
25PT4501	RC437/HL
25PT450A	RC437/HL
25PT4512	RC437/HL
25PT451A	RC437/HL
25PT452A	RC437/HL
25PT472 /A/B	RC437/HL
25PT480 A/B/C	RC437/HL
25PT481 /B	RC437/HL
25PT492A	RC437/HL
25PT510 /A/B	RC437/HL
25PT512C	RC437/HL
25PT520 /A	RC437/HL
25PT530	RC437/HL
25PT5301	RC437/HL
25PT530C	RC437/HL
25PT532A	RC437/HL
25PT540	RC437/HL
25PT5403	RC437/HL
25PT540A	RC437/HL
25PT541	RC437/HL
25PT550 /A/B	RC437/HL
25PT562A	RC437/HL
25PT570B	RC437/HL
25PT572A	RC437/HL
25PT620B	RC437/HL
25PT700	RC437/HL
25PT7001	RC437/HL
25PT702	RC437/HL
25PT720	RC437/HL
25ST1627	RC437/HL
25ST1666	RC437/HL
25ST1667	RC437/HL
25ST1704	RC437/HL
25ST1724	RC437/HL
25ST1760	RC437/HL
25ST1761	RC437/HL
25ST1767	RC437/HL
25ST2451	RC437/HL
25ST2454	RC437/HL
25ST2657	RC437/HL
25ST2664	RC437/HL
25ST2759	RC437/HL
25ST2760	RC437/HL
25ST2761	RC437/HL
25ST2860	RC437/HL
25ST2961	RC437/HL
25ST2967	RC437/HL
27CE7596	RC437/HL
28DC2070	RC437/HL
28DC2670	RC437/HL
28MN1370	RC437/HL
28MN1570	RC437/HL
28PT400A	RC437/HL
28PT420A	RC437/HL
28PT4401	RC437/HL
28PT440A	RC437/HL
28PT450A	RC437/HL
28PT4513	RC437/HL
28PT452A	RC437/HL
28PT470 /A	RC437/HL
28PT472 /A/B	RC437/HL
28PT482A	RC437/HL
28PT490A	RC437/HL
28PT510 /A/B	RC437/HL
28PT511	RC437/HL
28PT522 /A	RC437/HL
28PT530 /A/B	RC437/HL
28PT532 /A	RC437/HL
28PT5401	RC437/HL
28PT541	RC437/HL
28PT550 /A/B	RC437/HL
28PT552A	RC437/HL
28PT560A	RC437/HL
28PT570B	RC437/HL
28PW6202	RC437/HL
28PW6332C	RC437/HL
28ST1181	RC437/HL
28ST1281	RC437/HL
28ST1636	RC437/HL
28ST1637	RC437/HL
28ST1687	RC437/HL
28ST1712	RC437/HL
28ST1734	RC437/HL
28ST1770	RC437/HL
28ST1780	RC437/HL
28ST1786	RC437/HL
28ST1789	RC437/HL
28ST1881	RC437/HL
28ST2181	RC437/HL
28ST2471	RC437/HL
28ST2477	RC437/HL
28ST2587	RC437/HL
28ST2687	RC437/HL
28ST2771	RC437/HL
28ST2781	RC437/HL
28ST2784	RC437/HL
28ST2787	RC437/HL
28ST2789	RC437/HL
28ST2861	RC437/HL
28ST2884	RC437/HL
28ST2981	RC437/HL
29PT550	RC437/HL
29PT5501	RC437/HL
29PT600A	RC437/HL
29PT6433	RC437/HL
29PT6773	RC437/HL
29PT702 /A	RC437/HL
29PT720	RC437/HL
29PT721	RC437/HL
32PW6322C	RC437/HL
33CE7533/33R	RC437/HL
33CE7536/30R	RC437/HL
33CE7536/42R	RC437/HL
33CE7539	RC437/HL
37ZZ3233	RC437/HL
41CE8743	RC437/HL
41CE8749/13B	RC437/HL
41KE8417	RC437/HL
41KE8487/16B	RC437/HL
46CE8760/19M	RC437/HL
46CE8761	RC437/HL
46CE8765/19B	RC437/HL
46CE8766	RC437/HL
46KE8637/16B	RC437/HL
46KE8657/18B	RC437/HL
46KE8687/16B	RC437/HL
4822 015 30017	RC437/HL
4822 218 20918	RC437/HL
4822 218 21018	RC437/HL
4822 218 21079	RC437/HL
4822 218 21093	RC437/HL
4822 218 21102	RC437/HL
PT150A	RC437/HL
PT520A	RC437/HL
PT530A	RC437/HL
PT532A	RC437/HL
PT700A	RC437/HL
RC0311	RC437/HL
RC031201	RC443/HL
RC0764/01	RC443/HL
RC22401	RC443/HL
RC283509	RC443/HL
RC5601	RC437/HL
RC5915	RC437/HL
RC6502	RC437/HL
RC6511	RC437/HL
RC6512	RC437/HL
RC6513	RC437/HL
RC6941/01	RC443/HL
RC694101	RC443/HL
RC7301/01	RC443/HL
RC730101	RC443/HL
RC7500	RC437/HL
RC7502	RC437/HL
RC7503	RC437/HL
RC7512	RC437/HL
RC751201	RC437/HL
RC751501	RC437/HL
RC7535	RC443/HL
RC7535/01	RC443/HL
RH6622/01	RC437/HL
RH662201	RC437/HL
RH6820/01	RC437/HL
RH682001	RC437/HL
RP420	RC437/HL
RT230	RC437/HL

SANYO

Part No.	Code
2527	RC815/HL
14M1	RC815/HL
14MT1	RC815/HL
14MT2	RC815/HL
21B1	RC815/HL
21BI	RC815/HL
21D1	RC815/HL
21D2	RC815/HL
21DN1	RC815/HL
21DN2	RC815/HL
21DT1	RC815/HL
21MT1	RC815/HL
21MT2	RC815/HL
21MTI	RC815/HL
2527	RC815/HL
25D2	RC815/HL
25DN1	RC815/HL
25DN2	RC815/HL
25MT1	RC815/HL
25MT2	RC815/HL
25MTI	RC815/HL
25S1	RC815/HL
25SN1	RC815/HL
25XP1	RC815/HL
28B1	RC815/HL
28BN1	RC815/HL
28D1	RC815/HL
28D2	RC815/HL
28DN1	RC815/HL
28DN2	RC815/HL
28HN1	RC815/HL
28MF1	RC815/HL
28MT1	RC815/HL
28MT2	RC815/HL
28MTI	RC815/HL
28S1	RC815/HL
28S2	RC815/HL
28SN1	RC815/HL
28SN2	RC815/HL
28WN1	RC815/HL
28XP1	RC815/HL
751384	RC815/HL
C14EA80H	RC815/HL
C14EA90B	RC815/HL
C14EA90M1	RC815/HL
C14EA95	RC815/HL
C14EA97MT2	RC815/HL
C20EE10	RC815/HL
C21EF13EE	RC815/HL
C21EF25	RC815/HL
C21EF34	RC815/HL
C21EF35N	RC815/HL
C21EF45NB	RC815/HL
C21EF50	RC815/HL
C21EF57B	RC815/HL
C21ES35MT2	RC815/HL
C21ES57DZ	RC815/HL
C25EG25	RC815/HL
C25EG34	RC815/HL
C25EG35N	RC815/HL
C25EG65NB	RC815/HL
C25EG77NB	RC815/HL
C25EP57DZ	RC815/HL
C25EP57NB	RC815/HL
C28EH25	RC815/HL
C28EH34	RC815/HL
C28EH64	RC815/HL
C28EH65NB	RC815/HL
C28EH75MT2	RC815/HL
C28EH85	RC815/HL
C28ER14S2	RC815/HL
C28ER57DZ	RC815/HL
C28H1	RC815/HL
C28W1	RC815/HL
C28WP1	RC815/HL
CB5156	RC815/HL
CB5949	RC815/HL
CB5959	RC815/HL
CBP2572H	RC815/HL
CBP2576	RC815/HL
CBP2580	RC815/HL
CBP2872	RC815/HL
CBP2876	RC815/HL
CEM2876	RC815/HL
CEP1768T	RC815/HL
CEP2151	RC815/HL
CEP2168	RC815/HL
CEP2177	RC815/HL
CEP2181	RC815/HL
CEP2570	RC815/HL
CEP2572	RC815/HL
CEP2576	RC815/HL
CEP2577T	RC815/HL
CEP2578S	RC815/HL
CEP2578SPIP	RC815/HL
CEP2581D	RC815/HL
CEP2582	RC815/HL
CEP2596	RC815/HL
CEP2870	RC815/HL
CEP2872	RC815/HL
CEP2873	RC815/HL
CEP2875	RC815/HL
CEP2876	RC815/HL
CEP2877T	RC815/HL
CEP2878SPIP	RC815/HL
CEP2881D	RC815/HL
CEP2896	RC815/HL
CEP3382	RC815/HL
CEP6032TX	RC815/HL
JXHJ	RC815/HL
JXHM	RC815/HL
JXRC	RC815/HL
JXRG	RC815/HL
JXSA	RC815/HL
JXTA	RC815/HL
JXYB	RC815/HL
JXYC	RC815/HL
JXZB	RC815/HL
RCEDO	RC815/HL
SXMR	RC815/HL
SXMRA	RC815/HL

SONY

Part No.	Code
KL37W2	RC522/HL
KL50W2	RC522/HL
KP41S5	RC523/HL
KP46S4	RC523/HL
KP53S4	RC523/HL
KPS4613	RC522/HL
KV1442	RC522/HL
KV1446TA	RC522/HL
KV1462UB	RC522/HL
KV16	RC522/HL
KV1602GE	RC522/HL
KV1602M7	RC522/HL
KV16WTID	RC523/HL
KV16XMB	RC522/HL
KV16XMC	RC522/HL
KV16XMTA	RC522/HL
KV16XMTU	RC522/HL
KV1902	RC522/HL
KV19XMB	RC522/HL
KV19XMC	RC522/HL
KV19XMD	RC522/HL
KV19XMTA	RC522/HL
KV19XMTC	RC522/HL
KV19XMTD	RC522/HL
KV19XMU	RC522/HL
KV2062EMK2	RC522/HL
KV2062EMK3	RC522/HL
KV2092AM	RC522/HL
KV2092AS	RC522/HL
KV2092E	RC522/HL
KV2092HK	RC522/HL
KV2092MR	RC522/HL
KV2092PT	RC522/HL
KV2093	RC522/HL
KV2096EC	RC522/HL
KV2096UB	RC522/HL
KV2182P	RC522/HL
KV21VX1MT	RC522/HL
KV21VX1P	RC522/HL
KV21XRD	RC522/HL
KV21XRTA	RC522/HL
KV21XRTB	RC522/HL
KV21XRU	RC522/HL
KV25C1D	RC523/HL
KV25C2	RC522/HL
KV25F1	RC522/HL
KV25F3	RC522/HL
KV25T1	RC522/HL
KV27VX1P	RC522/HL
KV27XRB	RC522/HL
KV27XRD	RC522/HL
KV27XRTA	RC522/HL
KV27XRTB	RC522/HL
KV27XRTD	RC522/HL
KV27XRTH	RC522/HL
KV27XRTM	RC522/HL
KV28WS3A	RC522/HL
KV28WX2	RC522/HL
KV29C2	RC522/HL
KV29C3D	RC523/HL
KV29X1D	RC523/HL
KV32WS3	RC522/HL
KV32WX2	RC522/HL
KVA2111	RC522/HL
KVA2112U	RC522/HL
KVA2511A	RC522/HL
KVA2512U	RC522/HL
KVA2531	RC522/HL
KVA2931	RC522/HL
KVA2941A	RC522/HL
KVA3410B	RC522/HL
KVA3411A	RC522/HL
KVA3413	RC522/HL
KVB2511D	RC523/HL
KVB2513	RC522/HL
KVB2521A	RC522/HL
KVB2531	RC522/HL
KVB2911A	RC522/HL
KVB2913A	RC522/HL
KVB2921A	RC522/HL
KVB2931	RC522/HL
KVC2121A	RC522/HL
KVC2160	RC522/HL
KVC2173B	RC522/HL
KVC2181	RC522/HL
KVC250	RC522/HL
KVC2501	RC522/HL
KVC2503	RC522/HL
KVC2508	RC522/HL
KVC2509	RC522/HL
KVC2521D/MKII	RC522/HL
KVC2531	RC522/HL
KVC2560	RC522/HL
KVC2570	RC522/HL
KVC2571	RC522/HL
KVC2573	RC522/HL
KVC2581D	RC522/HL
KVC290	RC522/HL
KVC2901	RC522/HL
KVC2923E/MKII	RC522/HL
KVC2960	RC522/HL
KVC2970	RC522/HL
KVC2971	RC522/HL
KVC2973	RC522/HL
KVC2981D	RC522/HL
KVC2991	RC522/HL
KVD2511	RC522/HL
KVD2921A	RC522/HL
KVD2921D	RC522/HL
KVD2931A	RC522/HL
KVE2531A	RC523/HL
KVE2533	RC522/HL
KVE2541A	RC522/HL
KVE2551A	RC522/HL
KVE2931A	RC522/HL
KVE2933	RC522/HL
KVE2941A	RC522/HL
KVE2951A	RC522/HL
KVE2961A	RC522/HL
KVE3431A	RC522/HL
KVE3433	RC522/HL
KVM14	RC522/HL
KVM1440	RC523/HL
KVM1441	RC523/HL
KVM1450D	RC523/HL
KVM1451D	RC523/HL
KVM16	RC522/HL
KVM19	RC522/HL
KVM2120	RC522/HL
KVM2130	RC522/HL
KVM2131D	RC522/HL
KVM2170D	RC523/HL
KVM2171D	RC523/HL
KVM2531A	RC522/HL
KVM2541	RC522/HL
KVP14D	RC522/HL
KVS2913	RC522/HL
KVS2951	RC523/HL
KVS3411A	RC522/HL
KVS3413	RC522/HL
KVS3431	RC522/HL
KVV1410D	RC522/HL
KVW2813	RC522/HL
KVX210	RC522/HL
KVX2101	RC522/HL
KVX2181	RC522/HL
KVX2501	RC522/HL
KVX2532UB	RC522/HL
KVX2561	RC522/HL
KVX2563A	RC522/HL
KVX258	RC522/HL
KVX2581	RC522/HL
KVX2901	RC522/HL
KVX2961	RC522/HL
KVX2963	RC522/HL
KVX2971	RC522/HL
KVX2981	RC522/HL
KVX2991	RC522/HL
RM342	RC522/HL
RM637C	RC522/HL
RM640	RC522/HL
RM641A	RC522/HL
RM646	RC522/HL
RM650	RC522/HL
RM651	RC522/HL
RM652	RC522/HL
RM654	RC522/HL
RM656	RC512/HL
RM657	RC522/HL
RM658	RC522/HL
RM661V8	RC522/HL
RM662	RC522/HL
RM663	RC522/HL
RM664	RC522/HL
RM665	RC522/HL
RM677	RC522/HL
RM681	RC512/HL
RM682	RC512/HL
RM683	RC522/HL
RM684	RC512/HL
RM685	RC512/HL
RM686	RC512/HL
RM687	RC522/HL
RM687B	RC522/HL
RM687C	RC522/HL
RM694	RC512/HL
RM717A	RC522/HL
RM811(NOPIP)	RC523/HL
RM817	RC522/HL
RM820	RC512/HL
RM833	RC523/HL
RM836	RC523/HL
RM838	RC522/HL
RM841	RC512/HL
RM842	RC523/HL
RM846	RC523/HL
RM860	RC522/HL
RM862	RC522/HL
RM864	RC523/HL

Price : £ 5.50 + vat each

This is just a selection of the HQ Remote Controls that we stock.
Please call us for any models not listed on 020 8900 2329.

K.P. House , Unit 15 , Pop In Commercial Centre , Southway , Wembley , Middlesex . HA9 0HB England

Bench Notes

Adrian Gardiner reports on various faults experienced with recent Hitachi TV models

The Vestel 11AK30 chassis

We have had a large number of new, bottom-of-the-range Hitachi sets in recently, all fitted with the Vestel 11AK30 chassis. Although the following notes would apply to any set fitted with this chassis, we've seen only Hitachi ones with the two faults described below. Model C2126S, a basic 4:3 aspect ratio 21in. receiver, seems to suffer in particular from these problems.

The first fault concerns the remote-control system. The complaint you get is "no remote operation", and indeed a new remote-control unit will cure the problem. There's no need to rush out and buy a bucket load of remote-control units however, as the fault is very easy to fix. The cause of the trouble is data corruption, with the remote-control unit sending out garbage. It's triggered by poor-quality batteries that are flat. But replacing them leaves the unit in its crashed state. To cure the problem, simply short the battery terminals together for about ten seconds, then replace the batteries with good ones. Advise the customer to use good-quality alkaline batteries: this should prevent a recurrence.

The other fault we've had on many occasions is the set stuck in standby. In every case the cause has again been data corruption, this time in the EEPROM chip. Blanking it doesn't work, as the chips are supplied preprogrammed. Order and fit a genuine part. There is no setting up to do: all you need to do is to reprogramme the channels. The set is then ready for return to the customer.

We always read and store the contents of a new-to-us EEPROM. This enables a quick, cost-effective repair to be carried out next time, by loading the correct software into the corrupted set. It's well worth doing this if you repair a lot of modern sets. It can save valuable time and money when you wish to rule out EEPROM trouble as the cause of a fault.

Model CL28WD2TAN (A7 chassis)

I'm sure that most of you are by now familiar with the Hitachi A7 chassis. Thus if the fault description says "switches itself off", what do I hear you say? Dry-joints at those horrible regulators mounted on the big heatsink in the centre of the set, IC951 and IC952! Maybe dry-joints at the field output chip, or at the supply switching transistors Q951 (26V) and Q957 (8V). Not this time however. Been there, soldered up, got the T-shirt – set bounced!

After going over the rest of the set thoroughly, attending to dry-joints, I seemed to be rewarded with good results. So the set went back but once again bounced. Ah, ha! I hear you exclaim, what about that 68kΩ, 1W resistor R950 in the HT monitoring circuit? The value is critical but tends to go high, the result being a high HT output from the power supply. In this model the HT voltage should be 152V (±1V). Incorrect HT will produce erratic behaviour and intermittent shutdown. R950 can eventually go open-circuit, causing instant destruction of the overvoltage protection avalanche diode ZD970. The line output transistor is usually destroyed as well. But I had already checked R950, and its value was spot on.

Checks around the protection circuit chip IC950 (LM339) showed that the set was attempting to start but immediately shut down again. This cycle was then repeated. The normal start-up sequence is as follows:

(1) Power applied. Very little load, so primary side of the power supply operates in the burst mode. The HT and standby 5V supplies are normal. The 26V, 8V and main 5V supplies are switched off.

(2) The microcontroller chip IC001 checks the EEPROM for 'last' status. Assume power on.

(3) The microcontroller chip then switches the power supply on, by going low at pin 24.

(4) Feedback is sent from pin 2 of IC950 to pin 60 of the microcontroller chip to indicate 'power good'.

(5) The line timebase starts to operate.

With this faulty set the power-on signal from the microcontroller chip and the power-good signal from IC950 were oscillating. Naturally the various outputs from the power supply were also oscillating. Because of this it was very difficult to determine what was going on. It seemed logical to assume that the protection-circuit chip IC950 could be the cause of the trouble, with the result that the microcontroller chip thought the power supply was faulty. So I replaced IC950 to rule this out. There was no change to the situation.

Suspecting electrolytic capacitors, I got out the hairdryer. When heat was applied in the vicinity of Q957 and its associated circuitry (8V supply regulation/switching) the set suddenly burst into life. But when I attempted to narrow the possible cause by applying freezer spray I got no farther. Checks with my ESR meter also failed to provide any clues – even though I eventually went round the entire power supply.

Many more checks were carried out, all to no avail. The only clue seemed to be that the set burst into life every time heat was applied to the area of the 8V supply. Then, once it was running, the set remained stable. By this time I was becoming frustrated and decided to rebuild the entire 8V supply circuit. Again this made no difference: the set remained stuck in standby until the hairdryer was brought into action.

Selling the customer a hairdryer seemed a viable proposition, but I was now more determined than ever to get to the bottom of the fault. So I brought the dual-channel feature of my oscilloscope into action to monitor the power-on and power-good lines from and to the microcontroller chip simultaneously. This revealed a very interesting phenomenon. When the microcontroller chip wanted to start the power supply, it switched the supply off! This was reported back as 'power bad', with the result that the microcontroller chip thought that there was a fault. So it attempted to shut the power supply down – by switching it on!

So the action of the power on/off line was reversed! Whatever next! I quickly ruled out EEPROM corruption, as the set worked correctly when the hairdryer was used. Although I suspected that the microcontroller chip itself might be the cause, I decided to inspect it first under a magnifier. This revealed a dry-joint at pin 4, one of the earth connections. I therefore did what I should have done hours before, and reflowed the connections to the 80-pin flat pack chip. Success at last! The set now started up normally every time power was applied.

I boxed the set up and moved it over to the test bench. Then I sat back with that satisfied feeling that you get after finally finding the cause of a difficult fault. Next morning I was pleased that the set still switched on perfectly. About an hour later however the set decided to taunt me and switched itself off. It then proceeded to switch on and off merrily until I finally relented and took it back to my bench.

This time I found that the HT voltage was high at 161V. R950, which had previously been spot on, in the HT monitoring circuit had gone high in value!

Incidentally the power supply and protection circuitry involved were shown in the June issue. See Figs. 2 and 3, pages 465/6. ■

Restoring a Reslo ribbon microphone


Photo 1: The microphone prior to being opened.

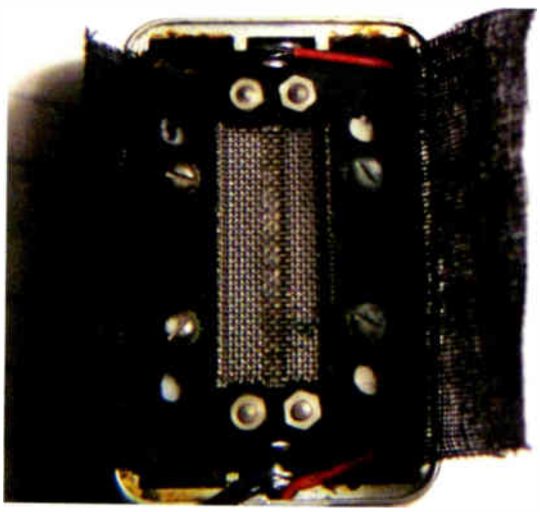


Photo 2: Internal view with the cloth screen pulled aside.

If you check on the internet you will find that there's plenty of interest in famous but now obsolete microphones. J. LeJeune recently acquired a Reslo RBL ribbon microphone that required restoration – and a matching device. The following article describes the work involved

The quality of the Reslo RBL ribbon microphone is legendary. Thus when one came my way recently I eagerly acquired it. The output impedance is only 30Ω, so a transformer would be required to get it to work with a tape recorder or my home-made mixing deck. In addition the output from this type of microphone is very low. The best solution therefore seemed to be to design and build a battery-operated preamplifier that would also provide the impedance change necessary to match my equipment. The preamplifier was built and tried, but there was no output other than bad crackling when the microphone was handled. I checked that the preamplifier was OK by using it with two other microphones – a Reslo RV ribbon unit and a Standard Electric 4021C "ball-and-biscuit" pressure type.

Internal construction

As the microphone didn't work, I had nothing to lose by dismantling it. Photo 1 shows the microphone before it was opened. Prior to being offered to me it had lain in a rarely-used church for some years, so the chances were that it was suffering from the effects of damp and pollution. Removal of a single screw at the top of the casing releases one of the perforated halves, revealing the ribbon unit. This is covered by a cloth gauze screen that opens easily to give access to the inner part of the assembly. Photo 2 shows the screen pulled aside and the wire gauze shield that protects the ribbon. There were clear signs of verdigris and rust.

Testing

The ribbon's impedance is very low, somewhere in the region of 0·5-1Ω, a transformer being required to raise the output impedance to the low figure of 30Ω. Red and blue wires connect the ribbon to the transformer, and my first check was on the continuity of the transformer's primary winding. As a rule the transformer gives little trouble – after all the primary winding is normally a single turn of reasonably heavy-gauge wire. This was checked, after desoldering the leads from the ends of the ribbon-mounting frame, and found to be OK. I was also able to check the ribbon's continuity. This produced the bad news: the ribbon was open-circuit. A check on the continuity of the transformer's secondary winding proved that it was OK, so at least the transformer wouldn't have to be replaced or rewound.

The ribbon

Four round-headed screws secure the ribbon mounting frame to the magnet. These were removed, with some care and much trepidation, but nothing serious happened to stop my heart. The ribbon came out of the gap between the magnet's pole-pieces cleanly, and was clearly in a very fragile state. A further continuity test confirmed that it was indeed open-circuit.

The ribbon is made from very thin aluminium foil, and is 40mm long by 2·5mm wide. There are some indentations, like castellations, at intervals along it to provide added flexibility and prevent strong resonances. Corrosion had created two holes in the fragile aluminium, and the whole length was affected, giving the surface a milky-white appearance. See Photo 3. With my worst fears confirmed, I

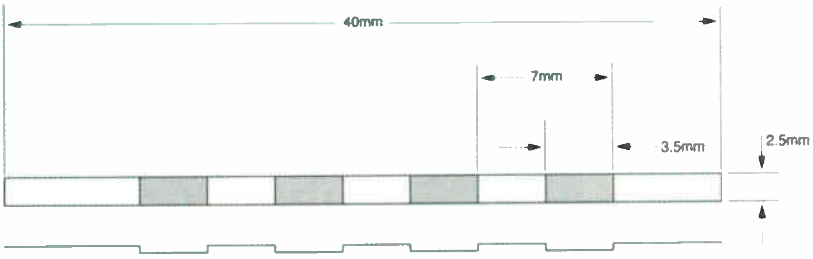


Fig. 1: Details of the replacement ribbon.

attempted to remove the ribbon from its frame by releasing the two pairs of clamping screws. At this point the ribbon disintegrated. Photo 4 shows the remains of the old ribbon element.

Restoration

So to the start of the restoration process. The first task was to ensure that any particles of metal or dirt were removed from the gap between the magnet's pole-pieces. A cotton bud is ideal for this purpose. A stiff-bristle toothbrush dipped in isopropyl alcohol was then used to remove traces of verdigris from the wire gauze that surrounds the ribbon. The ribbon mounting frame was given the same treatment, after which the now spotless parts of the microphone were put aside in a clean, dust-free box while a new ribbon was made. Photo 5 shows the pole-pieces exposed and some corrosion still present.

The choice of material for the ribbon is fairly critical. See note later about this. Baking foil is generally too thick. The extra weight increases the mass and leads to a poor HF response. It may also be too stiff to produce an adequate LF response. The resultant sound would resemble that from a 1940s telephone! Getting it right is rather hit and miss, and requires a good degree of dedication to old microphones.

Foil cutting is best done with sharp scissors, all in one attempt. The indentations required are then made by laying the strip of foil across a sheet of paper on which 3·5mm wide strips of card, of the thickness of a business card, have been glued at 3·5mm intervals. Lay the foil ribbon across the card strips, exactly at right angles, and make the indentations with an extra 3·5mm card strip. See Photo 6. Press the extra card strip down on the ribbon over the gaps between the raised card strips. By making the foil ribbon about 20mm longer than necessary, one end can be secured with adhesive tape to ensure that the foil doesn't move during the indentation process. Hold the other end of the foil in place with a small weight – a 50p coin is suitable. Allow a small amount of slack, as the indentations take up about an extra 4mm of foil strip when complete.

Fig. 1 shows the replacement ribbon details. The ribbon is now ready for mounting in the frame. It must be stressed that fabrication of the foil ribbon is a delicate and time-consuming task. It can be very frustrating when things go wrong. Doing it properly is very rewarding however – as long as time is not money.

Reassembling the mic

Place the finished ribbon in the mounting frame and refit the clamping screws. When fixing the ribbon be careful not to apply too much tension. This could straighten out the indentations, which are important to the successful working of the microphone. Resolder the wires from the primary winding of the matching transformer, then refit the ribbon mounting frame to the magnet's pole-pieces – make sure that it sits centrally between them with an equal gap at each side along the entire length. This can be done with the fixing screws barely loose. Then tighten the assembly and reinsert the microphone in its casing, with the cloth gauze back in place.

Before you replace the outer metal casing, test the microphone to confirm that the output is adequate and the frequency response is good. The LF response will be poor if the ribbon is under excessive tension: the fiddly job of releasing some tension would then have to be undertaken.

If you have infinite reserves of time and patience the choice of aluminium foil can be varied.

Foil type

The foil used in some cigarette packets is an excellent choice, when the paper backing has been peeled away. But any thin and very flexible foil can be used – even that used for wrapping a well-known brand of mints in a tube.

Performance

Ribbon microphones provide excellent performance. For voice use they produce a natural sound and are great for vocals with a band. They are not as rugged as diaphragm-type microphones, but give good service in return for careful treatment. They are not however suitable for the close-miking used by singers today, because the lower frequencies become over-emphasised. This is because of the hemispherical nature of the wave fronts that affect the ribbon: the shorter HF wavelengths tend to cancel out along the ribbon's length. The only exceptions to this rule were the lip-microphones used by sports commentators: these have a different format for the ribbon and the voice path.

When storing a microphone for a long period it's advisable to put it in a plastic

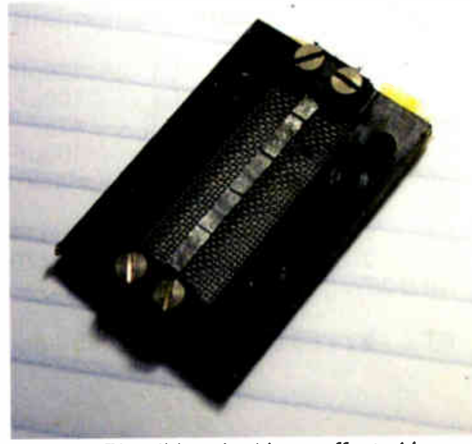


Photo 3: The ribbon had been affected by corrosion, which had created two holes.

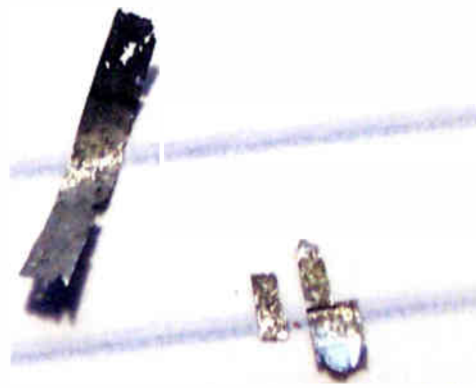


Photo 4: The remains of the original ribbon element.

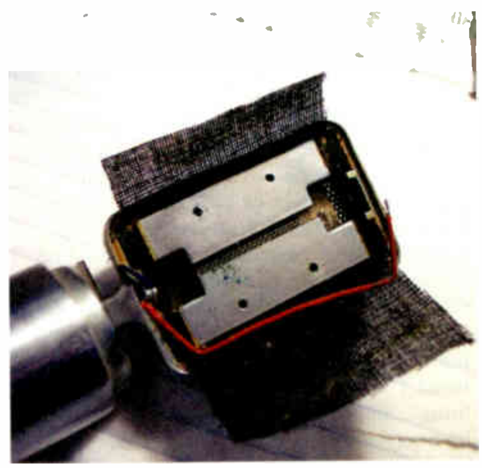


Photo 5: The pole-pieces, with some corrosion still present.

Table 1: Preamplifier component details

R1	1·2kΩ, 5%	C1	100μF
R2	56kΩ, 10%	C2	100μF
R3	5·6kΩ, 10%	C3	47μF
R4	10kΩ, 5%	C4	100μF
R5	39kΩ, 10%	All 16V electrolytic	
R6	10kΩ, 10%		
R7	2·2kΩ, 10%	Tr1	BC114 etc.
R8	2·2kΩ, 10%	Tr2	2N3707 etc.
All 0·25W			
B1	9V PP3 battery	SW1	Miniature SPST slide switch

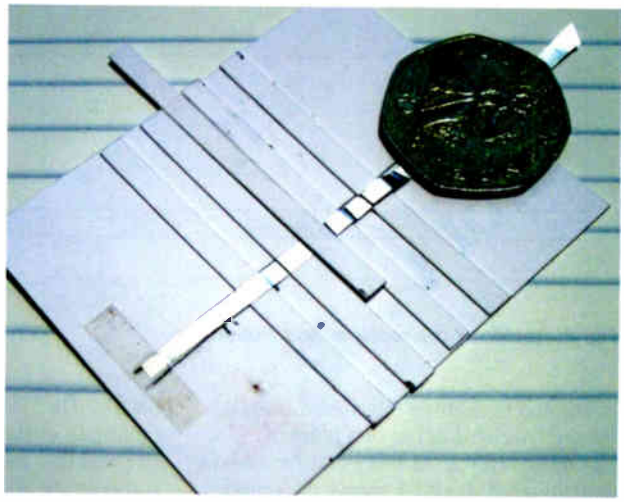


Photo 6: Making the indentations in the replacement foil ribbon.

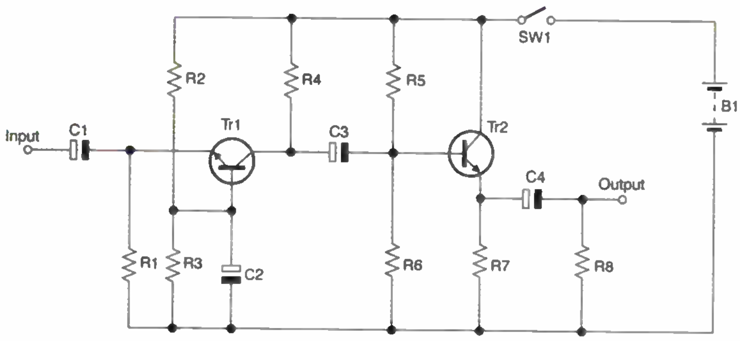


Fig. 2: The preamplifier circuit.

bag along with some silica gel sachets. This will prevent the sort of damage shown in the photographs.

The preamplifier

The preamplifier is a simple design that can be made using any good low-noise npn transistors and a few everyday components. The circuit diagram is shown in Fig. 2. A 9V PP3 battery provides the power required. I built the prototype on a tag board. It worked so well that I boxed it and used it for a time – until the Mark II version was built, on Veroboard, and checked. The layout is not critical. Table 1 lists the component details. Tr1 should be a low-noise transistor, but Tr2 can be any npn type with a current gain of 30 or more. ■

Test Case 504

A Sony, the rental card said. In fact it was a Sony Model KV32FQ75U (AE5A chassis), with the reported symptom of complete failure. When he pulled up outside the house where it lived, Todd fervently hoped that the cause of the fault would be something simple like a fuse, the power switch (he carried them with him) or a 'silly' like the mains or aerial cable having been pulled out by the dog. No such luck! The customer had checked those things, and didn't have a dog. Thank heaven for that anyway, thought our man, but his heart sank when he saw the symptom: repeated double flashes of the set's standby LED. Sony sets with flashing standby LEDs don't have open-circuit fuses or faulty on-off switches.

A phone call to base summoned Cathode Ray to help carry this 70kg set to the van and rig up a loan set for the customer. Back at the workshop it awaited its turn for a day, and was then taken to the hallowed bench of Television Ted. Ted knows a great deal about Sony sets, having had much experience with them. With this chassis the flashing behaviour of the indicator LED gives an indication of the nature of the fault: there are in fact 18 codes, which are explained in a look-up table in the service manual. Two flashes repeated regularly indicate that the excess-current protection system has come into operation, and it didn't take Ted long to find that the line output transformer T6804 was responsible. After a review of this four-year-old set's value and prospects (this happens with all rental equipment now), we decided to go ahead with the repair. The part was ordered, for Cathode Ray to fit on its arrival – Ted would be away for a few days.

Sony's spares delivery service is so good that the transformer arrived the next day. Very soon it was fitted and the set was working. But hang on, successful diagnoses and repairs are not the stuff of our Test Cases, are they? No, you wait for something to go wrong! Well then, very soon Cathode Ray wanted to adjust the A1/G2 potentiometer on the new transformer. This calls for a 170V DC supply from an external power source, something you don't come across on every street corner. Ray's bright idea was to connect a suitable bridge rectifier and reservoir capacitor to the output from the workshop's variac, wind the variac up to get 170V, and use this supply. Coming from the raw mains source the supply would be 'live', but Ray would use an insulated screwdriver and the set itself was connected to the output from the bench isolation transformer.

With the set up and running and a suitable signal being displayed, Ray switched on the variac. There was a huge bang, the mains trip flew up and the workshop was plunged into darkness. In the office, our Pam was well pleased: her computer accounts work had been blown to the skies. What had caused the huge bang? The set was isolated by the bench safety transformer, so there should not have been any untoward current in the mains circuit, should there? So convinced was Ray of his innocence that he decided to carry out a repeat performance: he reset the trip and once more turned on his 'external 170V supply'. The result was a second bloody great bang. What was the cause of these bangs? If you haven't sussed the cause, you'll find the answer on page 123.

DVD

Fault reports from Roger Burchett Chris Bowers and Geoff Darby

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,
Media House,
Azalea Drive, Swanley,
Kent BR8 8HU**

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

Acoustic Solutions DVD451

The power supply in these players is prone to an annoying fault: it doesn't always start up when there has been a mains disconnection. The remedy is to change the chopper transistor (Q1) in the discrete-component power supply. The type originally fitted is an MJE13007F2. I have found that the BUT56A is the easiest equivalent to obtain.

It's also worth replacing the 560kΩ start-up resistors R3 and R4 – the originals are minuscule. **R.B.**

Sony DVP-NS700V

This unit's red power LED would go green and then back to red after two-three seconds or when any of the function buttons was pressed. The cause turned out to be the KHM240AAA optical assembly, part no. A-6062-705-A. A replacement restored normal DVD operation. **C.B.**

Sony HCD-S550

This unit was stuck in the protection mode. The cause was in the power supply, where C921 (2,200μF, 35V) was faulty. A replacement restored normal operation. It seems that an AC mains surge could have been responsible for the failure. **C.B.**

Sony DVP-S336

This DVD player simply didn't operate. Multimeter tests in the power supply revealed that R105 (1MΩ, 0·5W carbon) was open-circuit and D102 short-circuit. The part numbers are 112977411 and 871916078 respectively. Replacements restored normal operation. **C.B.**

Sony SLV-D900G

This unit would play neither DVDs nor CDs and reverted to standby a few minutes after being turned on. The feed assembly motor was the cause of the trouble. When a disc was inserted the optical block stayed in the middle of the sled assembly instead of returning to the centre. A replacement motor, part no. 988503722, restored normal disc playing. **C.B.**

Sony DVP-S336

When this unit was powered the LED flashed from red to green. Power supply checks with an oscilloscope showed that there was ripple on the DC outputs. The cause of the trouble was traced to optocoupler PC101, part no. 874992391. A replacement restored normal operation. **C.B.**

Toshiba SD110E

This DVD player proved the usefulness of the scrap box. Its owner said that it started to play all right then began to stick. I suspected laser trouble but when the fault appeared the result was a total picture and function freeze, which is not the usual laser-trouble symptom with this machine.

When I stripped the unit down and tried to move the laser by rotating one of the large drive gears it moved a small way then became locked mechanically. Closer inspection revealed a crack in the small nylon pinion gear on the sled motor's shaft.

With these machines the laser comes as a complete deck assembly, with all the motors and gears fitted. I've replaced many of these in the past, and a quick hunt through the scrap box revealed a complete used deck from which I was able to obtain a replacement pinion gear. Once it had been fitted the machine was given a long soak test. This proved that the problem had been completely cured. **G.D.**

Pioneer DV350S

The report that came with this unit said "not powering up". This wasn't strictly true. The unit did power up, said all the right things in the display, and the drawer opened and closed when requested. No video was produced however, not even a logo screen, and when the drawer had closed the laser lens slammed up and down violently. The disc didn't spin.

More by instinct than for any technical reason I decided to check the circuit protectors in the power supply. This revealed that CP1 (2A) was open-circuit. As I couldn't find any shorts across its output, I went ahead and fitted a replacement. This restored full operation, and a long soak test over a couple of days confirmed that there were no further problems. **G.D.**

LETTERS

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

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

Spares – a warning

I've been in the consumer electronics servicing business for over 21 years and have found that our spare parts suppliers have, in more recent times, become far more competitive and more reliable. We normally use SEME/CHS/CPC and the fifteen manufacturers with whom we have service accounts. Sometimes however we have to obtain parts from elsewhere, especially for obscure items such as overhead projectors and for some Mickey Mouse-named DVD players, VCRs and /HiFi units. We find that these companies are generally a little bit more expensive and a little slower in their response times. But I would like to draw attention to an unusual experience we had recently.

A customer called us out to repair a Vidikron TGS301 overhead projector. On investigation we found that the EHT tripler was dragging down the line output stage. So we decided to get a quote for a replacement from a company we had not dealt with previously but advertised itself as a dealer for Vidikron projectors. We were astonished at the price quoted, £164.38 including VAT, plus £30 for postage. The job was urgent, so there seemed to be little that we could do. I rang a number of other suppliers in an attempt to get this item at a sensible price, but no one seemed to be able to locate a replacement – even though it looks very much like a Grundig tripler and the part number, BG-1899-641-512, nearly matches Grundig ones.

Subsequently I sent an email to a company called Project Spares (01444 831 769). Because of holidays the company took a few days to respond. When it did, we lost no time in placing our order. The price quoted was £54 including VAT.

So be warned, especially when you need parts for unusual equipment.
A.H. Beard,
Retel Electronics, Carlisle.

TDK tapes

The problem that occurs with these tapes has not been properly explained (Oct. and Nov. letters). When a **new** tape is unwrapped and the cassette is slid from its box the user is often unaware that the new strip of stick-on labels has been packed under the cassette. Consequently the new cassette and label sheet are inserted into the VCR together. The results speak for themselves.

We have encountered this problem on many occasions. A VCR came in for repair this week: upon inspection the mangled remains of a label strip were found jamming the mechanism after the cassette tape had been extracted. It had TDK written on it!
Bob Cole,
Davies & Eason Ltd.,
Faversham, Kent

Russian products

I was interested to read about vintage Russian Yura and Microsonic radio receivers in the October issue. It reminded me of the Russian Vega company that manufactured a range of short/medium/long-wave radio receivers. In the one I had the coils were fitted on small PCBs with edge contacts, mounted on a turret mechanism. They made contact with spring contacts on a PCB, like an old 405-line TV tuner. The contacts used to need cleaning or adjusting for better operation.

The markings on Russian components can be confusing. I had a fault in one of these receivers caused by a broken ceramic capacitor that was marked 47n (the Russian 'n'). I thought this meant 47nF, but it transpired that the Russian 'n' is 'p', so the value was 47pF. You will find the Russian alphabet listed in the US ARRL amateur radio manual.

The small can electrolytic capacitors in the little 'red' monochrome TV sets made by Rigonda often leaked, and the LOPT would go short-circuit. These items were all hard to obtain!
Mark Garton,
Bromsgrove, Worcs.

Aerial antics

There are many stories I could tell about aerial installations in the Fifties and Sixties. At the time I used to sell mainly second-hand sets, and frequently delivered and installed them. The customers naturally expected a good picture in all conditions, but were reluctant to install an efficient aerial. This was difficult to understand. They wouldn't use low-octane fuel in a good car but, after spending a fair sum on a TV set, were convinced that no more than a set-top aerial was necessary.

I spent a considerable amount of time wandering around rooms trying to get a good picture on both channels (no BBC2 then). Any suggestion of using an outdoor or loft aerial was dismissed. Their neighbours didn't have them, so that was that.

One engineer I knew well despaired of the public attitude. He once spent about ten-fifteen minutes walking around a loft in an area well known for requiring an outside aerial. Eventually, after tripping over a suitcase, he dropped the aerial. There was an immediate shout from the lounge – hold it, that's perfect! What could he do but leave it where it fell?

I once delivered a set to a new customer who had no previous set and no aerial. He produced a wire that came through the window and was originally part of an efficient outside radio aerial, with insulators, insisting that this would do. I reluctantly connected it to the inner of the coaxial aerial socket – and obtained crystal-clear pictures! Any suggestion that a proper aerial should be used was dismissed. How could I possibly argue about it? I recall that the aerial was about 60-70ft long. There wasn't even any sound-on-vision to mar the picture! The customer is always right, I suppose!
Philip Bearman,
New Barnet, Herts.

B&O 38XX chassis

I was interested to read Dave Gough's fault report on a B&O Model L2502 (November, page 45). Failure of the field output IC in this chassis is quite common, especially as the sets are now old. The TDA2170 originally fitted has long since been replaced by a modified device, part no. 8008536. There are some other components that should be replaced when this fault occurs. These are the flyback diode

4D41, and the electrolytics 4C44/5/7 (100μF), 4C48 (1μF) and 4C49 (22μF), especially if they are the original dark red ones.

This information applies to the L and LX models, both 25 and 28in., and the previous range that used the 37XX chassis. One should also, when working on one of these sets, make sure that all the line output transistor reliability modifications have been carried out, otherwise you might get a recall sooner than you expected! These modifications are covered by kits that are available from B&O.
Nick Beer,
Bideford, North Devon.

The *Television* colour portable revisited

Way back in the late 1950s my grandparents bought an Ekco TV set. It was in constant use until about 1972, when it

failed yet again (don't ask me what was wrong, I was only a teenager!). So they decided to buy a more modern Philips set, which sat on top of the Ekco one until 1980. That was when, having built a 26in. set based on the 1979 *Television* project, I decided to build a 22in. version of the *Television* colour portable project, housing it in the Ekco cabinet. It has been repaired a couple of times over the years, and a couple of modifications have been carried out. But otherwise it's as built twenty four years ago.

Dismantling the Ekco set was remarkably easy. Once the back and the on/off/volume and channel-selector knobs had been removed the top could be taken off after undoing some wing nuts, then the chassis complete with CRT could be withdrawn. The old set had a thick glass screen in front of the CRT to provide user protection should the tube implode. It slid down from the top, into grooves at each side of the cabinet. This feature proved to be remarkably useful, as the grooves would support a 3/8in. plywood front that held the new CRT. The front was prepared by carefully cutting out a hole for the face of the CRT, fixing four wooden blocks at the corners to hold the mounting screws, then spraying it brown. From what I remember, Rover russet brown matched the walnut veneer of the rest of the cabinet. The top of the cabinet was carefully modified to take a strip of aluminium, again painted brown. This held the controls, under the original flap.

The accompanying photos show the set. It's built on a metal chassis which is mounted into the cabinet. The colour decoder and RGB output stages, which

were originally next to the line output stage, are mounted vertically. This was done to avoid interference from the line output stage, the symptom being vertical striations. I also found it easier to carry out RGB grey-scale adjustments with the panel mounted vertically.

I tried to use the original loudspeaker, but its impedance was 2Ω. The audio output stage didn't like that! The volume control circuit was also modified, as I didn't like the way the original circuit operated.

Now for the sad part. My grandmother has had to go into a home, and I have no room for the set in my workshop. It certainly can't stay in the house, so a good and loving home is needed. I would be heartbroken to see the set go on a tip. I could advertise it on eBay but, as I said, I want it to go to a good home.

The set is heavy and very bulky, so it would have to be collected from me in NW London. If anyone is interested in purchasing this unique television set, please contact me (Michael Maurice) at michael.ali@btinternet.com
Michael Maurice,
London NW.

HELP WANTED

Wanted: Working cartridge/stylus for the Hitachi CED system video disc player, Model VIP202P. D.Perry, 1 Lyndhurst Road, Corringham, Stanford-le-Hope, Essex, SS17 7SJ. Phone 01375 677 419.

Wanted: Any information on how to bench test the current VW Beta and Gamma car stereos, specifically in connection with the 'K-BUS' connection at pin 3 of the ISO power connector. VW seems to use this to ensure that the units will power up only when installed in a recent VW vehicle. Any help would be gratefully received. Nicholas Arnold, 30 Mere Road, Oxford, OX2 8AN. Phone 01865 556 991 or 07960 646 061, or email nicholas_arnold@hotmail.com

For sale: *Radio and Television Servicing* books from start to finish, 37 of them in all. £50 or offer. N. Childs, 30 Chobham Road, Knaphill, Woking, Surrey, GU21 2SX. Phone 01483 472 011.

Wanted: Good video head (DSR21R) for the Sony SL-C9 Betamax VCR, also a Philips VCR2324 (late Video 2000 type) for spares. Can anyone suggest a cure for heavy, dark raster striations (line ringing, covering a third of the screen width) with a Philips TV Model 21PT522B/05 (GR2.4 chassis). Alan Stubbings, 7 Church Road, Saxilby, Lincoln, LN1 2HH. Phone 01522 702 601.

Wanted: Has anyone circuit information for, or has anyone repaired, a Kocom video door phone/video security intercom system type KVM-500F, sold by Maplin and made by Korea Communications Ltd.? The door phone video monitor has no picture or raster. All voltages, EHT, the CCTV camera unit and audio are OK. The monitor used was sold by Maplin in 2000 as a project module. It's a flat monochrome CRT module, type MON2W1, made by Velleman. A circuit diagram, service manual or help would be appreciated – or maybe someone could write on the subject for the magazine. D. Lee, 16 Devonshire Place, Claughton, Birkenhead, Wirral, Cheshire, CH43 1TU16.

Wanted: Quad 33, 34 or 44 preamplifiers, 405 power amplifiers and FM3 tuners for spares, also boards and modules for these. Contact Mike on 0175 861 3790.

For sale: Rank Bush Murphy colour receiver Model 179 dating from the mid-Seventies, with A66-140X CRT. Ex-factory, in original cradle. Complete kit of boards etc. – everything except the cabinet. Bought as an interesting project – seemed a good idea at the time! Reasonable offer please. Phone Brian Close on 020 8570 8564 or email brianclose@onetel.com

Wanted: Service manuals for two Roberts Radios, Models RT8 and R700. Good photocopies would do. Please phone Denis on 35351 086 828 2840 or email andersond@eircom.net

DX and Satellite Reception

Terrestrial DX and satellite TV reception reports. Broadcast and satellite TV news. Specialised aerials, including loops. Roger Bunney reports

A BT feed via the London Teleport and Eutelsat W1 (10°E).

Most of September's DX reception occurred during the period of high pressure and warm weather in the early part of the month. This produced good-quality pictures throughout Band III and the UHF bands from Germany, Norway, Sweden and the Benelux countries. As Cyril Willis (King's Lynn) comments, the signals were "wall to wall and most were overloading". He spent a lot of time seeking the more distant signals seen in years past, e.g. from Poland, the Czech Republic, Slovakia, Austria and as far as western Russia, but unfortunately nothing was received from there, probably because of the increased use of the UHF bands nowadays.

During this period Cyril was on a DXpedition at Sizewell, Suffolk with colleagues John Faulkner and Ian Kelly, in a caravan loaded with aerials and equipment. There was time to check for DAB as well, in Band III. Several multiplexes were received, including DAB Klassic from Germany and Danish stations. A video buzz was heard in ch. R10, at 207·255MHz, but the signal was insufficient to lock in pictures.

Peter Schubert (Rainham, Essex) logged most Benelux channels during this period, also various French system L channels, both at his home and at East Mersea (on Mersea island). Here at Romsey, in the Test Valley, French UHF stations caused interference to local broadcasts and were present in free channels.

Gary Smith (Derby) has been on holiday in northern Italy. He found, in an area between two parts of Switzerland, that four-element Band I arrays were being used in several villages. Band I is still alive and in use – somewhere!

Satellite sightings

There is limited access to live news across the North Atlantic since the CNN Newsource feed started to use encryption earlier this year, following the WNS Reuters service in this respect. Both feeds are carried by NSS 7 (21·5°W). The GlobeCast package via Atlantic Bird 1 (12·5°W) carries mainly sport and a few west-to-east interviews. But a check on Telstar 12 (15°W) revealed a constant NBC feed. It carries news feeds, news programming for retransmission by Sky etc., the occasional US TV station output, sports from the US, and reverse-direction feeds from Europe and the Middle East to New York. Recent examples have been output from al Jazeera and night views of the Baghdad skyline from the NBC news bureau. Transmissions may be PAL or NTSC. Check at 11·521GHz H, SR 3,746, FEC 7/8. The service identification is DAD 5: the 'hidden ident' that RSD receivers show within their own menu is NBC News.

Long-standing readers will recall the Balkans aerial surveillance system that provides live images from high-flying aircraft and drones. These are downlinked to a ground site for uplinking via Telstar 11 (37·5°W) to the US Intelligence base at the Cheyenne Mountain Operations Center, Colorado. The pictures were in the clear, and provided riveting viewing as on-board cameras zoomed in on suspect vehicles, figures etc. Unfortunately, as a result of publicity, the images started to be encrypted and were thus lost to enthusiasts. Interesting that these surveillance feeds have been transferred to Telstar 12, along with other US services. The original surveillance circuits were C-12 Mars, Air Scan, Quad UAV and AFDL. These and a couple of CNN circuits have moved to a multiplex here: the line-up for this multiplex adds CNN HDLN, CNN Live, P3/Pentagon and Fox News.

The Cheyenne Mountain Operations Center is an active military base that dates from the Cold-War period – and a tourist spot! There's a website at
https://www.cheyennemountain.af.mil/csp.htm
It provides a profile with internal views, information, and you can send questions, make contact and obtain information on public visits. A very interesting site.

There has been an odd 'Iraq' evening programme via Eutelsat W1 (10°E) at 10·992GHz V (3.100, 3/4), with a looping video of vases and other artefacts, Arabic captions and appropriate music. Another siting via this satellite was BT5 carrying Millwall v.

Feren Cvaros (Hungary) in the clear. Audio was unusual, with FX on all tracks and commentary only on track 2. This was at 11·081GHz V (5,632, 3/4). Rare to see football in the clear via a BT circuit!

Odd to see Batman clambering over Buckingham Palace on September 13. Sky News had its reporter on the pavement outside, updating viewers on developments. This was seen via Eutelsat W2 (16°E) at 12·562GHz H. Down the dial a little Sky News was covering the TUC annual conference at Brighton. Live reports were carried by 'Service 01' at 12·525GHz H. There was breaking news on September 26 when the Greek Olympic Airlines flight 411 was subject to a bomb alert while in flight from Athens to New York. The jet was diverted to Stanstead, where it made an emergency landing. Sky News was soon uplinking live pictures from a corner of the airfield away from Stanstead's main operations. This was at 12·554GHz H. When evening came, floodlighting was rigged up to provide overnight illumination. Meanwhile it was the eve of the Labour Party conference at sunny Brighton. Tony Blair was answering questions from a large group of Labour supporters. This was also uplinked live, for any UK broadcasters that wanted to take the coverage. Linking was via 'SIS 12 8MB T D' at 12·510GHz H. These Sky feeds all used 5,632 SR and 3/4 FEC.

Iraq continues to occupy the headlines, with skirmishes, explosions and hostage taking. The usual balcony backdrop for reports, a mosque near the hotels where the media teams stay, was seen on September 10 with a reporter preparing to speak to his TV network. There was gunfire nearby, and explosions. The reporter ducked – the brightly-lit reporting balcony is an obvious target – and the instruction came over talkback to clear down the balcony 'now'. The crew cleared, the lights went out and the APTN Baghdad ident on colour bars replaced the mosque at night. This was seen via Eutelsat W1 (10°E) at 10·967GHz H (4,167, 5/6). A TV channel called Iraq has been noted via W1 as mentioned above. It appears in the evening at 1900 hours GMT transmitting pictures of vases and other items. This is perhaps preparation for a new service.

The period under review started with the tragedy at the Beslan school. Russian TV media led their news with the hostage/massacre but the local UTR network, via Express AM22 (53°E), devoted perhaps four minutes to the siege, followed by an eight minute VTR package about a fatal car crash in Kiev and what the authorities were doing about the resultant traffic problems.

The Caribbean region was struck by a series of hurricanes. Fidel Castro was seen, with IR thermal imaging and various Meteosat high-elevation pictures, ordering those affected to move out of the region using the government-provided coaches. This was via the PAS 9 (58°W) Cubavision feed at 11·612GHz H (3,670, 3/4).

Alan Richards (Skegness) reports seeing the Greek Alpha Olympics channel just visible on threshold at 54·8°E. Tuning details were 11·131GHz V, SR 3,125, FEC 5/6. The satellite turns out to be Intelsat 702 – there have been some changes recently in this crowded section of the Clarke belt.

Adrian Howman (Norfolk) mentions that the previously-reported 'mystery hidden signal' via PAS 3R (43°W) is TV Frad from XHTV-4, Mexico City. Pictures are good using an Invacom C120 0·3dB noise LNB, but won't lock up with Coship or Humax receivers. Adrian rates Invacom LNBs highly. Roger Shaw (Bardney, Lincs) also reports superior performance when using the Invacom LNB with his 1·1m dish.

Broadcast news

US: The start of the Pentagon Channel will provide more TV for US forces and others. It will operate 24 hours a day, with government and Congress news, distributed via satellite for local terrestrial transmission around the world, mainly to military bases and those with a suitable satellite receiving system.

The AFRTS has added the Movie and Family channels to its worldwide offering for American forces, bringing the totals to ten TV and twelve radio channels. Transmitter and cable systems serve bases in 177 countries and many ships at sea.

Radio and TV Marti has resumed US transmissions to Cuba, this time from specially-adapted C130 aircraft. The previous transmissions, from two balloons stationed at 10,000ft above Key West, Florida, had been too easy to jam. The aircraft provide a flexible transmission base that's more difficult to jam.

Marcus Giles, an American football player, looking into the camera. Seen via Telstar 12 (15°W).

An SBC feed from Hollywood received via Telstar 12 (15°W).

China: The first digital terrestrial and satellite TV test transmissions will start by 2006. Although there are experimental digital TV services in several cities, the authorities have yet to decide on a national digital TV standard. There are plans to end analogue TV transmissions by 2015.

Some thirty DTT channels are expected to be available in Taiwan by the end of 2005. By that time the present five analogue networks should have become linked to a DTT system. Phase 1 test transmissions started in early July.

Spain: DTT was test marketed by Televisio de Catalunya during January-June, with widescreen programming, high-quality audio and interactive services. Public reactions are being analysed to determine how best to move from analogue to digital transmission. To date, Spanish viewers have shown little interest in digital TV.

Serbia: Six terrestrial TV channels are being given network status, allowing them to transmit throughout Serbia and Montenegro. Those involved are B92, BK-TV, TV Pink and the three RTS (Radio Television Serbia) channels. The government is providing extra frequencies for these and two further channels.

Satellite news

Intelsat is to provide satellite distribution for RTP (Portugal) radio/TV channels across Europe, Africa and America, using the 907 (27·5°W), 706 (53°W) and 805 (55·5°W) craft. The contract was signed at the IBC, Amsterdam and will run for three years.

The French are pushing ahead with an international news channel backed by government funds. There has been concern that money would be diverted to prop up the international TV channel TF1-France Television and the RFI radio services.

NSAT, a new South African TV channel, has appeared via Sky at EPG no. 837. Its content is uplinked from Johannesburg via Europe*Star-1 (45°E), with English and Africaans sound. The service is intended for South Africans living in the UK and is currently FTA. Once a reasonable audience has been established NSAT will hit the encryption button!

Broadcast publication *IBE* reports that increasing use is being made of fibre rather than satellite links for sport. Terrestrial fibre can provide enhanced bandwidth with better quality, HDTV, VOD and additional services, plus absolute security. The EBU is expanding its fibre network across Europe to link main cities – London, Geneva, Brussels, Paris, Rome, Hamburg and Mainz are already connected, with hard-wired transatlantic circuits to Washington and New York now available. Local networks for broadcasting companies are also being installed, for example WDR in Germany and Broadwing in the US. Satellites will continue to be used for OBs and news circuits since fibre isn't available everywhere and immediacy, which only sat trucks can provide, will always be needed. In the longer term sat-phones may take over for live news feeds as compression techniques improve, reducing costs as the only crew required is the reporter.

Last month I commented on the use of in-line amplifiers for satellite reception. Most of the units available have a model number that begins with the letters SA. According to the September issue of *SatFACTS* these are made by a company called Zinwell. The company's catalogue provides information on these amplifiers and other satellite hardware.

Specialised aerials

Aerials of various types are a favourite topic amongst DX enthusiasts. We've covered numerous types in these pages in the past, from SHF aerials for satellite use to those for the relatively low Band I frequencies. This month I'm going down to almost DC! But first a note from Garry Smith, a partner in HS Publications, Derby. This firm nowadays concentrates on DX aerials and related hardware, such as the D100 TV-DX tuner.

In recent years there's been growing interest in low-band transatlantic reception, both TV and FM. During the past three years or so several DXers have been successful with this. Recently David Hamilton in Scotland ordered from HS Publications a wide-spaced six-element wideband Yagi aerial for the US low-band channels A2-4 (55·25-71·75MHz). As the accompanying photograph of the array shows, the aerial uses the Antiference Tru-match dipole matching technique. The forward gain of this aerial must approach 2-4dBd at the low end of the band, rising to perhaps 6-7dBd at the high end. It's a monster aerial, with the boom extending to 14ft. As David Hamilton notes, "it's very lively in ch. E3 in comparison with my normal receiving system".

SpE reception of low-band US TV from the eastern seaboard states happens several times a year in the UK. When conditions are good, the MUF can rise into Band II, giving FM reception. There have been many examples of identified reception, both in mainland UK and in Northern Ireland. I'd recommend that those interested in transatlantic FM reception, and DXing in general, check the *Skywaves* website of the British FM and TV Circle. You will find this at
http://www.skywaves.info

There has been much interest in recent times in very low-level VHF signal reception – signals far below 'scanner' level – using the Icom PCR1000 software/hardware package in conjunction with a PC. There is now an updated version, PCR1001S. It's possible, using very narrow-band techniques (down to a few Hz), to receive signal traces from very distant VHF transmitters. These are 'traces' rather than very weak signals but, using known frequency offset information, it's possible to identify specific transmitters. A recent *Skywaves* bulletin mentions that the Band I transmitters at Grunten, Germany and Bantiger, Switzerland are at present constantly receivable in the UK Midlands using narrow-band equipment of this type. A full description of the PCR1000 low-level signal-reception technique appeared in the August and September 2002 and September 2004 issues of *Skywaves*. There's more on this at the website.

Loop aerials

I see from the HS Publications catalogue that the company markets a 'square' loop aerial, with sides approximately 0·7m, at £29.95 including stand and carriage. I recall that J-Beam once marketed a Band I loop aerial that was basically a half-wave dipole bent into a loop, with a sleeved gap at the top and a tapped 75Ω matching stub at the base. I can't be sure but I think it was called the Q-Beam.

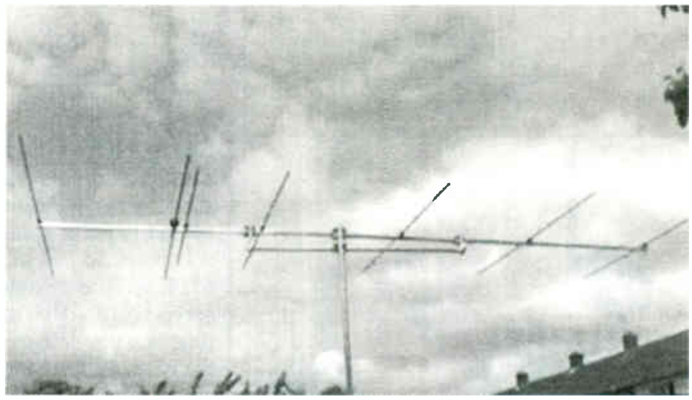
From Band I down to almost DC, MW reception in fact, another of my varied interests. Some years ago I bought a Wellbrook Communications MF/HF broadband active loop aerial, Model ALA1530, and have only recently got around to erecting the system. Two factors encouraged me to do so. First, some comments from a colleague who lives in a noisy location (electrical interference and a small garden). He built his own tuned square loop for the 80m amateur band, using copper water pipe and 90° copper bends obtained from B&Q. The sides, tuned by a series air-spaced capacitor in the upper limb, are only 45in. or so. You would have thought this totally inefficient for the wavelengths involved, but the aerial provides signal levels only two S points down compared with a half-wave dipole and has the advantage that, by rotation, the general background interference can be easily nulled out.

The second reason to get busy with my Wellbrook aerial was to try to establish the source of local high-level MW interference. It consists of a form of data pulsing that seems to come from an industrial estate about a third of a mile away. An initial check, with a small 'deaf' hand-held radio, located a side road where chronic interference levels across the entire band are present. It's received along the whole side road, not any specific point, suggesting radiation from BT cables. This will be investigated further when time permits – roll on retirement!

The loop responds to a signal's magnetic (H field) rather than its electrical (E field) component, and should thus tend to ignore local electrical interference – from domestic equipment, computer sash, etc. And perhaps, despite my usual views about aerial positioning, it would work happily at a low height, making it ideal for use in modern gardens and where there are difficult neighbours. I was sceptical about all this. Then, one sunny September morning, I erected an inverted washing line stand on my back lawn, with an aerial rotor on top. A prepared bracket enabled the ALA1530 to be bolted at about 7ft high, see photo. It's an active device, providing amplification and matching the output to 50Ω coaxial cable at a BNC socket. The rotor turned the 0·95m diameter loop, and 12V was sent down the feeder from the power supply provided. The receiver was switched on and connected to the loop. Everything worked.

I was surprised, to say the least! The initial daytime check was with Radio Guernsey (1,116kHz) and Radio Jersey (1,026kHz). Signal levels were impressive, in excess of those from my 3m vertical whip at 30ft high and a 60ft long wire with connection to the house via a magnetic balun and screened cable. When the loop was rotated to another distant MW station, Radio Devon at Barnstaple (801kHz), this was also received with improved strength and quality in comparison with my conventional aerials. Perhaps most noticeable was the very low background noise, with absence of domestic clutter. There are houses on three sides at my location, with open country, pretty well screened, to the north beyond the brick garage.

As the loop is rotated, the signals change. It has a figure-of-eight polar response, with a null at 180° and a broad peak at the other 180°. Rotation across about 200° therefore covers the full 360°. Unless you have a receiver with switched (on/off) AGC, there will be a rise in receiver gain as the loop is rotated away from the signal peak, compensating for the signal fall-off. This tends to broaden the polar response. As the null is aligned with a given signal or interference source there is a drop in signal/interference. The ALA1530 has a claimed 30dB null. In signal-strength meter terms, with both my Yaesu receivers an S9 signal falls to S2. A practical example here at Romsey is Classic Gold, Reading, at 1,431kHz and 140W. This is a strong signal from a distance of 40 miles away. Chichester Hospital Radio, some 36 miles away over an obstructed, hilly path, also transmits at 1,431kHz, with 1W fed to a 30ft high top-capacitance loaded aerial. When Reading is aligned for the maximum null, CHR is heard fluttering above the noise floor. Impressive. Reviews at the Wellbrook site suggest that the nulls are less effective when the aerial is mounted at a greater than a lower height – a 20m tower is quoted.



David Hamilton's six-element Band I Yagi array. Intended mainly for transatlantic reception, the coverage is chs. A2-5 (55·25-71·75MHz). The massive aerial, with 14ft boom, was supplied by HS Publications.

The Wellbrook Communications ALA1530 wideband MF/HF active loop aerial, mounted at 2·2m. Results have been excellent.

The magnetic loop aerial seems to challenge the idea that a dipole at a good height provides optimum results. A low mast works well at a screened location. My interest is mainly MW, but the ALA1530's coverage extends to 30MHz, and I suspect that there is some response in Band I. It's certainly a different approach that, for me, provides a performance far in excess of expectations. The ALA1530 could be helpful for those who are unable to erect larger aerials, or who suffer from local electrical interference. Mine will shortly be T-and-K bracketed at the end of the garage, farther away from housing and with open country to the north. It sells at about £169 including VAT, plus £10 post and packing (UK). An upgraded version has recently been introduced. For more information go to
http://www.wellbrook.uk ■

AUDIO FAULTS

Reports from Geoff Darby, Chris Bowers, J.S. Ogilvie, Steve Roberts, Bob Bradley and Chris Avis

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,
Media House,
Azalea Drive, Swanley,
Kent BR8 8HU

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

Sony HCD-H51M

To start with this unit wouldn't play CDs at all. A replacement KSS240A laser assembly got it going again, but playability was poor. So I went straight to the three $47\mu F$ surface-mounted capacitors on the servo board – I've mentioned them several times on previous occasions. As is so often the case, all three were faulty: two of them gave high ESR readings while the third was open-circuit. When I unsoldered the latter one there was an ominous hiss and a smell of fuming electrolyte.

I cleaned the board in this area with isopropyl alcohol, giving it a good scrub with a toothbrush, then carefully examined it for signs of corrosion. As none was apparent I replaced the capacitors, reassembled the unit and tried it out. The symptoms were now even worse! Although the unit did eventually find focus and play, prior to this the lens slammed up and down with real violence.

The cause of this behaviour turned out to be three open-circuit through-plated holes in the vicinity of the capacitor that had leaked. Needless to say, they all came through under a large, surface-mounted IC. The reason why I hadn't spotted them when examining the board is that each hole is covered by a blob of silk-screening paint. They had probably been 'hanging on by a thread' prior to getting the toothbrush treatment, and this cleaning action had finished them off. The unit behaved normally once they had been wired around.

Just in case it had been OK, I refitted the original laser assembly. But it proved to be faulty, as originally diagnosed. **G.D.**

Genexxa SCT37

The owner's complaint with this ageing dual-cassette deck was "records in mono only". A few recording tests revealed that this wasn't strictly true: it seemed to be recording only one channel. When headphones were plugged in I found that both source channels were present, while the record-level LED bars both responded normally. This proved that all the early record-processing circuitry was OK. Playback of one channel was very low, with the tape played back via either deck, indicating that the channel affected had definitely been badly recorded.

Many faults can cause this symptom, including a bad record amplifier, a bad record/playback switch where this is a mechanical type, a bad or clogged head or, quite often, bad head wiring – particularly where, as in this machine, the head is a flip-over type. More rarely these days bad recording can be caused by a bias-oscillator fault, though this usually affects both channels. It is however possible to have a faulty bias-coupling capacitor to one channel.

There's a very quick way to check out the head itself and its wiring – it works for almost any cassette deck. Set the affected deck to play, with the door open. It may be necessary to fool the system control into thinking that a tape is loaded, by holding a finger on the appropriate switch above the tape compartment. Once you've got it playing, wave the tip of a screwdriver a few mm above the surface of the head. The residual magnetism in the screwdriver's shaft will cause a "whump-whump" noise in both headphones as it moves across the head. This proves that the head is not open-circuit, that its wires are all connected and intact, and that the head works – even if it's clogged.

If this test clears the head and its connections of suspicion the next move, before suspecting a record-amplifier or switching problem, should be to swab the head with isopropyl alcohol, even if it looks clean as this one did. Chances are, as in this case, that it will restore normal recording without any further attention being required. **G.D.**

Sony HCD-CP101

This turned out to be an interesting problem. The job card said "CD stops and starts". When it was set to play I found that it did exactly this, with sudden stops and skips in the music. It always recovered, and carried on playing to the end of the disc.

This sort of behaviour is often caused by the sled servo not moving the laser unit along its slides smoothly, by rolling the motor when the lens approaches the maximum bend on the two-axis device in the optical block. This can easily be checked by marking a spot on one of the sled drive gears with an indelible pen and watching what happens during normal play. What should happen is that about every three-five seconds the sled motor rolls over one armature pole. This should make the observed gear move slowly, in one direction only, by a few teeth.

If the period without motor rotation is much longer than about seven seconds, the drive voltage will have ramped up sufficiently so that when the motor does eventually move it rolls over several armature poles, because of inertia: as a result the laser overshoots its correct position. You can see this as the marked gear shoots round by perhaps as much as a tenth of a turn, then starts to move back the other way to compensate for the mis-positioning. The usual cause is either a defective motor or a mechanical problem with the gear train that drives the sled.

When I watched the gear in this machine the better part of fifteen seconds passed before anything happened. By this time the two-axis device had just about run out of movement range and the lens was displaced as far as it would go mechanically. This led to a loss of data read from the disc, and thus loss of servo lock, with the result that the music stopped. With the servo out of lock, the motor would then suddenly roll over, causing the sled to lurch forwards, then work back while the servo re-established lock and the loss point was found again by the system-control chip, whereupon the music returned.

When I removed the deck I was able to examine the mechanics. The whole mechanical system felt wrong when I rotated the drive gears by hand. It was tight, and had a 'lumpy' feel to it. Something didn't look quite right about the way in which the two parts of the spring-loaded anti-backlash rack on the laser were lying. With the laser in the middle of its track, I repositioned the upper, moving part of the rack to re-establish the one-tooth offset with respect to the fixed part. This maintains light spring pressure between the rack and its drive gear in both directions. Once this had been done everything felt normal.

Once the laser had been wound back to its 'home' position however it had again become tight, and the rack was once again incorrectly positioned. The cause of this was found to be damage to the very last tooth of the lower rack section, which is part of the laser case moulding. When the laser is fully home just this tooth, and one from the upper, spring-loaded rack part, are in contact with the drive gear. When the damaged tooth reached the drive gear it allowed the lower part of the rack to jump out of line with the upper part. As a result the two parts became, to quote a phrase often used by my dear old mum, "completely lock-buffered".

The only cure, unfortunately, is replacement of an otherwise serviceable laser assembly. Once this had been done the operation was smooth with no dropouts. I also cleaned the laser-home switch while the deck was out, in case the damage to the tooth had been caused by motor run-on. **G.D.**

Sony HCD-H881

There was a volume-control fault with this unit. When the volume-control knob was turned clockwise the sound level decreased; sometimes when it was turned anticlockwise the volume increased; and the volume display didn't match the turning of the knob. The cause of the trouble was a faulty volume rotary encoder switch, part no. 1-473-392-11, which is on the front panel. A replacement restored normal volume-control action. **C.B.**

Sony HCD-HP7

There was no sound in the tuner mode. Meter checks on the main board revealed a faulty diode, D102. When I checked with Sony technical I found that a modification would be needed. Remove D102 and replace it with a zero-ohms resistor chip, part no. 1-216-864-94. Remove jumper wire JW415 and replace it with a 10EDB40-TA1B2 diode, part no. 6-500-522-01. This action restored the tuner sound. **C.B.**

Sony HCD-ED1

There was a weak LCD screen illumination problem with this unit. Voltage checks on the volume/power board revealed the cause. The +10V supply was missing because R501 (2·2Ω, 5%, 1W fusible) was defective. A replacement restored normal illumination. **C.B.**

Sony HCD-RG20

This unit's CD tray didn't open. Checks inside showed that the 'lever change' was broken. There's a new improved type, part no. X-4954-616-1. Once a replacement had been obtained and fitted the tray opened and closed normally. **C.B.**

Sony HCD-H771

This unit's CD tray didn't rotate. The cause was a crack across flat wire 258, which is connected between the connector board and the motor turntable board (CN702 and CN703). A replacement, part no. 1-776-042-11, restored normal operation. **C.B.**

Samsung MAX-980

The customer who brought in this hi-fi system said it just hummed and then no sound and so on. So the first thing I did was to check for any voltage at the speaker connections. The amplifier was pushing out 73V on both channels. This suggested that there was something wrong with the STK411-240E audio output chip IC1, and when I disconnected it there was no voltage at the output terminals. A replacement cured the fault. I asked the customer to check the speakers as these had probably been fried. **J.S.O.**

Kenwood RXD-25

There was no sound at all from this music centre. After checking everything in the output stage I started to look elsewhere. On removing the front control PCB I found the cause of the problem, a very fine hairline crack right across the bottom of the volume control. A replacement control was the only solution. **J.S.O.**

Denon UD-M30

This CD/receiver came to us because there was no volume control operation. It was fine when the remote-control unit was used. The cure was to strip the unit down and clean the nasty grease from the volume control. A straightforward fault for a change. **J.S.O.**

BT Contour 50 payphone

These payphones are widely used in community centres, guest houses, etc. One cause of a dead phone is failure of the internal 3V lithium battery. It's a solder-in type, so an engineer is required to fit a replacement. As the phones sell for about £185 a £3 battery repair is well worthwhile. I've replaced several of them – unfortunately you have to remove the main PCB to do this.

No service information seems to be available for these units. Thus if the fault isn't a dead battery the unit cannot be repaired. A pity, as they are not cheap. **S.R.**

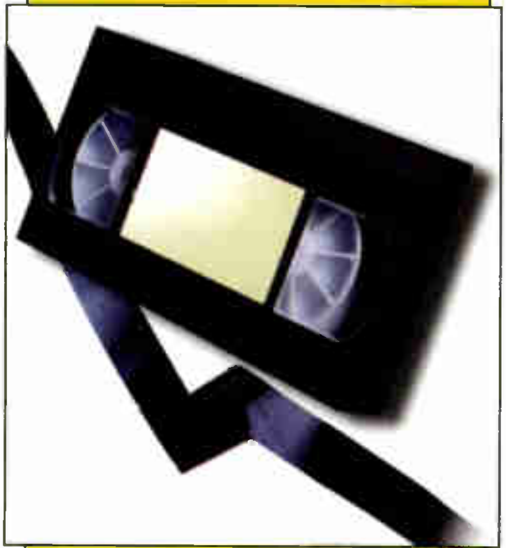
Roberts R984

The reported fault with this personal three-band radio was that it wouldn't receive FM transmissions, either mono or stereo. It worked all right on the LW and MW wavebands. When I stripped the unit down to carry out some checks I found that some of the contacts in the waveband switch, circuit reference S1, had worn out. A quick call to Roberts Radio resulted in a pro-forma invoice and a part no., 984.1011. Replacement of this item cured the problem. **B.B.**

Pioneer XC-L11/M11

These elegant-looking CD-tuner/amplifier/display units would power up briefly then die, with no display. Voltage checks during the brief sign-of-life period revealed a missing –35V supply. It is derived from a voltage tripler that's driven by an oscillator which also powers the display filament. This electronic tropical jungle runs hot under a screening can that doesn't aid ventilation.

Several of the many low-profile electrolytic capacitors involved had raised ESR values. So C5603/04/08 and C5610-17 inclusive were all replaced, together with the hot-running driver transistors Q5605/06 (I used types BC659 and BC640). This restored the –35V supply and normal operation. **C.A.**



VCR CLINIC

Reports from Martin McCluskey Gary Laidler David I. Scott Chris Bowers and M.J. Abbott

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

Bush VCR906SL (Daewoo deck)

This machine would accept a cassette and play normally. But if stop was selected after fast-forward or rewind the tape would start a slow rewind for a few seconds then the VCR would shut down with 'Err' in the display. Normal operation was restored by cleaning the lubricating the mode switch (these switches seem to have excessive amounts of grease inside). **M.McC.**

Sharp VCA30HM

This elderly machine's rewind was very poor, with the capstan belt slipping as the tape reached its starting point. When I fitted a new belt the capstan motor ground to a halt before tape rewind had finished. The cure was to clean the felt pad on the take-up hub's soft-brake assembly. **M.McC.**

Daewoo DVK985P

The owner had unplugged this VCR when he went on holiday. On his return he found that it wouldn't work properly. It would accept a cassette, but there was interference on the EE picture as the loading motor turned; playback consisted of blank horizontal bands accompanied by a buzzing noise instead of the sound; and in addition I found that I couldn't tune in any stations above ch. 35. Everything worked fine once all seven electrolytic capacitors in the small power-supply module had been replaced. **M.McC.**

Portland AVR2300

This supermarket special was dead. It didn't take me long to find that R803/4, both 390kΩ, were open-circuit. To save a come-back I also replaced C806 (1μF, 160V). One good point about this machine is that there is access to all the carriage screws. This was handy as there was a cassette stuck in the machine. **G.L.**

Saisho VR1600

This oldie, which is fitted with an Orion deck, had been put aside by its owner several years ago in favour of a new Nicam TV/VCR outfit. It was now needed again, following theft of the Nicam VCR which, apparently, hadn't been insured. Fortunately the Saisho machine had been stored in its original packaging. So, apart from a broken front flap, it was in reasonable condition.

All the mechanical functions worked correctly, but when play was selected there was only snow on the screen. I suspected dirty heads, and cleaning them restored the picture – for just a few seconds. Further examination revealed the culprit: this was the back-tension band, which had disintegrated to become a gooey mess, much of which was stuck on the supply reel. As a result the back tension was way too high, with the inevitable head clogging.

A thorough clean of the mechanism, followed by replacement and adjustment of the back-tension band, restored normal operation. The front flap was repaired with superglue and, as a precautionary measure, a new belt set and pinch roller were fitted.

The owner was pleased, and it was obvious that there was still plenty of life in the machine. **D.I.S.**

Sony SLV-D900E

During playback of VHS tapes in the mono mode, or when a stereo tape dropped into the mono mode, this combi unit produced low sound via the modulator. After ruling out the possibility of the scart lead causing bounce-back I decided to contact Sony technical. The advice was to remove the flush-mounted jumper W629 from the component side of the VCR main board and replace it with a 60mm jumper wire, keeping it at a distance of 2mm from the board. Once this had been done there was normal mono sound output again. **C.B.**

Panasonic NVSJ220BS

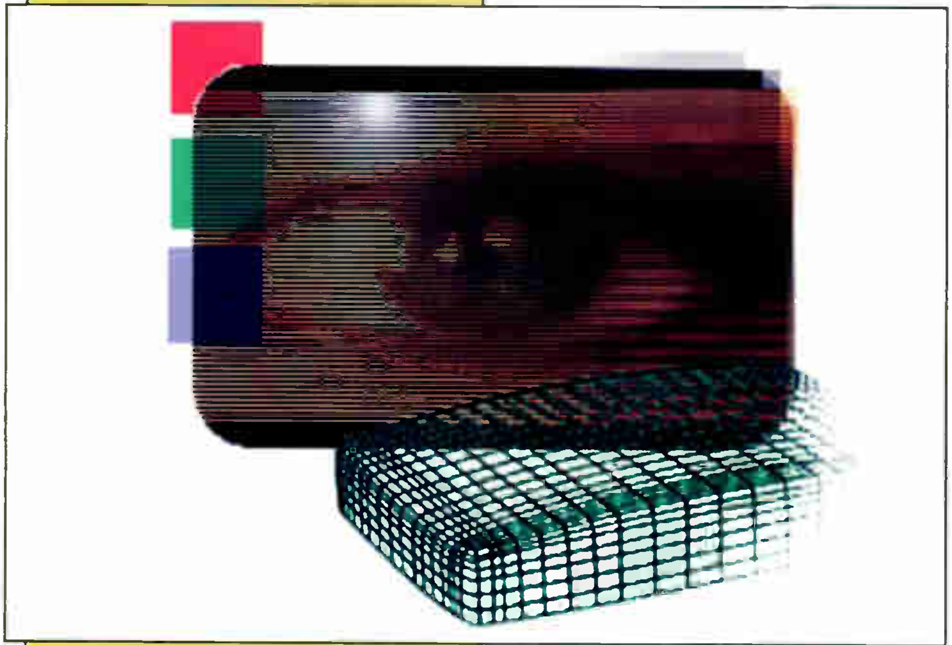
The customer complained about tape chewing. When a cassette was ejected a loop of tape was left out, suggesting a wind-mode problem. During a soak test I found that a tape would wind all right for a while after which it would stop. The tape protection system then prevented operation of any transport key until it had timed out. After that the functions would return for a while, then the same fault would recur on fast-forward or rewind. On occasions a tape would be fast wound to the end but would stop there rather than reversing.

The cause of the fault was found to be a dry-joint at pin 1 of the mode switch S501. Vibration from the capstan motor made the joint go open-circuit intermittently. It's advisable to desolder all the mode-switch joints then resolder them, to ensure good joints.

Other main board areas where dry-joints tend to occur are at the voltage regulator IC1 in the power supply section, and at the pins of the chopper transformer.

The capstan motor can cause odd faults. Under close inspection I have found that the solder cream has not flowed properly. After treatment with rework flux the parts subject to dry-joints can be reflowed, using a hot soldering iron. Items to check are the connector, transistor, two chip capacitors and the FG sensor.

If a tape has been snagged during ejection it's worth checking whether the back-tension guide is straight. This will affect playback of some prerecorded apes, giving mediocre results. The back-tension control arm is made from very soft material and bends easily. **M.J.A.**



TV FAULT FINDING

Reports from Michael Dranfield, Philip Salkeld, Charles Ritchie, Chris Avis, L. Gare, Les Mainstone, Ashley Burrows, Dave Packham and Eugene Trundle

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, Media House, Azalea Drive, Swanley, Kent BR8 8HU

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

Philips 32PW6006/05 (L01.1E chassis)

When this set was switched on from cold the picture width was incorrect. The set took a long time to warm up. I suspected dry-joints, but couldn't see any. Then I noticed that the line output transistor ran red hot after only a couple of minutes' use. When I traced back from its base I came to the three-legged line-driver transformer. Next to it, connected to pin 3, there was a 47μF, 25V electrolytic capacitor (C2455) whose ESR was high. A replacement cured the fault.

This capacitor couples the output from the complementary-symmetry line driver transistors Tr7461/7463 to the driver transformer's primary winding. **M.D.**

Grundig CUC2059 chassis

I've had several of these sets in, all dead with 1·6AT fuse blackened and the IRFPC50 chopper FET short-circuit. The basic cause has always been that one or both of resistors RP60001 (220kΩ) and RP60007 (120kΩ) has been high in value. **M.D.**

Decca D28N440

If one of these sets is stuck in standby, check for dry-joints at the TDA8133 chip ICP3. **M.D.**

Sharp DV5105H (Deco-4 chassis)

This set was tripping. The cause this time was not a faulty line output transformer but field collapse. The 28V supply at pin 2 of the TDA8175 field output chip IC500 was missing because safety resistor R612 (3·3Ω) was open-circuit. **M.D.**

LG WE32K10P

I've not come across one of these sets before. This one was dead. When I removed the back I noticed that C488 (10μF, 250V) had blown its top. As I didn't have a circuit diagram I decided to check the capacitors in the line output stage. This revealed that C492 (220nF, 400V) was open-circuit. All was well once C488 and C492 had been replaced. **P.S.**

Sony KD28DL10U

You can get some horrible faults with Sony sets, but this one was fairly straightforward. The customer said that the picture width was jumping in and out. There's a small upright panel, called board D2, on the main PCB. Q8801 on this panel had burnt a hole in it. The only solution was to order a new D2 board, part no. A1642285A. **P.S.**

Sharp 28JW73H

This fairly new set would revert to standby every hour. The customer must have persevered with it, because there was an ion burn in the centre of the tube. This suggested a line timebase fault. The cure was found at the Sharp technical website: replace Q601 (2SC2482), part no. VS2SC2482-1. This transistor seems to have been upgraded – to the one you now get under this part no. **P.S.**

Bush 14971TV/3

This portable is also equipped for internet operation. It was stuck in standby. Don't be fooled this 'fault': the set is in some kind of child-lock mode. There's a flap on the large remote-control unit. You will find instructions for initialising the keyboard here. Note that the front controls are inoperative with this fault. **P.S.**

Sharp 66GS62H (GA10 chassis)

The usual fault with these sets is stuck in standby, the cause being a dry-joint at C619. This in turn blows the line output transistor. When you find that Q601 (BUH515D, part no. TX0226BMZZ) and Q602 (2SK2843, part no. TX0236BMZZ) are both short-circuit, Sharp recommends that the heatsink, part no. PRDARA018WJFW, is also replaced. This will provide a more permanent repair. The original heatsink is 65mm high, the replacement being 110mm high. **P.S.**

Bush WS6674 (PT92 chassis)

This set was stuck in standby. A quick in-circuit check on the BU2525AF line output transistor TD02 produced a 45Ω reading between its collector and emitter, but when it was removed and tested it proved to be OK. In this chassis the HT feed to the line output stage is routed through the plug and socket for the line scan coils. Disconnection here proved that the power supply was OK. At this point I was beginning to suspect a short in the line output transformer, but when pins 1 and 2 were disconnected the short remained. When I lifted one leg of CD18 (2·2nF, 2kV) the short disappeared. A replacement capacitor brought the set back to life. **C.R.**

Panasonic TX21JT1 (Z7 chassis)

Intermittent failure to switch on was the customer's complaint with this set. I had it on soak test for a week before the fault put in an appearance. When it did, the front LED blinked dimly and the standby voltage at the cathode of D1202 (1N4150T-77) measured only 2·1V instead of about 7·5V. There was 8·4V AC at the anode of D1202. The diode had gone high-resistance: when it was replaced the set sprang to life. A 1N4005 is a suitable replacement in the D1202 position. **C.R.**

Sharp 51DT25H (CA1 chassis)

The customer's complaint was "no picture and a noise from the speaker". When I got the set on the bench I found that it was stuck in standby. The front LED was on, and all the outputs on the secondary side of the power supply were present though low. At the primary side the voltage across the mains bridge rectifier's reservoir capacitor C706 (100μF, 400V) was only 220V instead of 315V. When it was checked with an ESR meter the reading was 30Ω. A replacement cured the stuck-in-standby problem, but I now had the fault the customer had described.

C712 (220μF, 16V) in the 10V supply also had a high ESR. Once it had been replaced the set worked perfectly. **C.R.**

Sharp 28JW73H (GA20 chassis)

I was told that this twenty-month old set had gone off with a smell. After removing the back I spotted a split 100nF capacitor, C807, by the line output transformer. The circuit diagram shows that it decouples the earthy end of the transformer's EHT split-diode winding, so it seemed likely that the transformer was the culprit. This was confirmed by my HR tester.

The trail led from C807 to the UPC358C EW correction chip IC501 via three burnt surface-mounted resistors, R514 (1kΩ), R513 (6·8MΩ) and R512 (1kΩ). There was also a small burnt board area around R513. The Sharp transformer is very pricey, so the much cheaper and more reliable HR8829 equivalent was fitted. The burnt area of board was cleaned and cut away, and the damaged resistors were replaced. I used a standard 0·25W, 6·8MΩ resistor for R513, wired across the hole. IC501 had almost certainly been damaged and was replaced with the equivalent LM358, which is available from Wiltsgrove at about 16p!

Trepidation turned to delight when I switched on and, after A1/focus adjustment, obtained a good picture. No EW adjustment was required. **C.A.**

Matsui 28WN05

The problem with this set, whose chassis was unfamiliar to me, was EW bowing. Fortunately I quickly spotted a very sick-looking capacitor, C409 (10μF, 100V). It was in the designers' preferred position, next to a heatsink. Not surprisingly, this bulging and discoloured specimen had an ESR of 90Ω. I fitted a 105°-type replacement and, to try to reduce the line-frequency ripple voltage heating effect, added a small 0·22μF polyester capacitor across it under the board. Hopefully the capacitor will remain as bulge-free as the picture is now. **C.A.**

Toshiba 210T6B

Repairs to such a vintage stalwart are worth reporting, if only for the bizarre nature of the experience. The owner said it wouldn't come out of standby, but when I tried it on the bench it worked perfectly. When I moved it to the soak-test bench and switched it on it was stuck in standby.

The two-section chopper power supply is quite involved, so the easiest thing was to start by checking the ESR of all the electrolytics. Six of them produced very high readings, and three were completely open-circuit! But after replacing all nine I still had standby-only operation, with the output voltages from the standby section of the power supply reduced to about half. It took replacement of two zener diodes, D826 (13V) and D828 (20V), and Q809 (BC557B), all in the primary side of the standby circuit, to finally wake the set up. It then produced an 'as-new' picture, to put plasma in the shade. But how had it managed to work the first time? **C.A.**

Alba CTV3469 (11AK20S chassis)

This set was dead with two of the bridge rectifier diodes short-circuit and the 2·2Ω surge limiter resistor open-circuit (the fuse was intact of course!). After carrying out this straightforward repair I found that there was just snow on the screen, and that no signals could be tuned in on any channel. When tuning was attempted the OSD showed that the set was going through the motions, but there was no varying voltage at the relevant tuner pin.

There was a correctly varying tuning voltage ramp at the collector of Q505, but the surface-mounted, 15kΩ tuning-line decoupling resistor R524 had disappeared, leaving clean and undisturbed solder pads! A replacement resistor restored normal tuning, but not my understanding of how such strange faults can come out of the blue. **C.A.**

Lodos 14T DVD (11AK46 chassis)

The complaint with this TV/DVD combi unit was no blue in the picture. When I carried out checks on the CRT base panel I found that R912 was dry-jointed. **L.G.**

Beko 30328T (AT3 chassis)

The cause of no results turned out to be no line drive. R815 (22Ω, 2W) had burnt out because the BC639 line-drive transistor TR801 was short-circuit. C801 (220μF, 25V) and C811 (220μF, 16V) should also be replaced. **L.G.**

Beko 16328NX

The picture went when this set had warmed up, leaving a dim raster with purity errors. The cause of this was found to be a faulty field output thyristor. As a replacement I used one obtained from a scrap Ferguson chassis. **L.G.**

Bush 2868NTX (11AK19 chassis)

There was no field scanning because the TDA8351 output chip IC701 had failed. When I fitted a replacement all I got was three auto grey-scale lines. I then found that the 45V supply at pin 6 of IC701 was missing, because the feed resistor R704 (100Ω, fusible) was open-circuit. This supply is derived from pin 5 of the LOPT. **L.G.**

Beko 30328T (AT3 chassis)

There was very severe tuning drift, with the 33V tuning supply low at only 2V. Checking back to source I found that R61 (100kΩ) was open-circuit. It's mounted at the rear of the set, between the IF can and potentiometer P701. **L.G.**

Matsui 28N03A

This set would shut itself down intermittently. The cause of the problem was quickly traced to TSP67, the scan-coil feed connector to the PCB. It was badly dry-jointed. **L.M.**

Grundig ST70-708 (CUC2030 chassis)

At switch on the raster flared up to a brilliant white then the set shut down. A quick visual check on the CRT base panel revealed that the 200V supply feed resistor R24081 had burnt out. A resistance check showed that there was a short to chassis from the output end of this resistor. All three drive ICs had to be removed before the short cleared. The cause turned out to be IC24030 (TDA6106Q). A replacement brought the set back to life. **L.M.**

Matsui 32WN03SIL/Tatung T288W440

The customer had used this set for several days with partial field collapse. As usual, I was called in when the set died. Before attempting to switch on I carried out a visual check on the field output stage and found that CF6 (22μF, 35V) had completely disintegrated. I replaced this along with the TDA8350Q field output chip ICF1 and RF1 (33Ω, safety) which was open-circuit. Then I checked the power supply and the line output stage, and found that the S2000AFI line output transistor TL4 was short-circuit. Once this had been replaced I brought the set to life via a variac.

The line output transformer started to arc badly when the supply reached 160V. Fortunately the customer accepted the estimate to replace it. The set then worked nicely. **L.M.**

SEG CT7951GB (11AK19P chassis)

There was no action with this set. A visual check on the power supply section showed that several components were in a sorry state because of overheating. But the main culprit was D825 (BA159) which had split open. It provides the supply for IC803. A replacement diode and a good resoldering job restored normal operation. **L.M.**

JVC AV32WFP1EK

The problem with this monster was lack of width with EW bowing. A poor joint at pin 1 of transformer T521, which is part of the scanning circuitry, was the cause. In fact all the connections to T521, both at the top and on the PCB, were dry-jointed. **L.M.**

Panasonic TXW28R3 (Euro-3 chassis)

This heavyweight set gave me a bit of a run-around. The relay in the standby power supply (there are two power supplies in this chassis) ticked loudly at switch on. When a current meter was connected across the relay's load connections the set started up and behaved for a few moments, but the relay continued ticking.

Once the set is up and running a 12V feed from the main power supply is fed back to the standby power supply. This is done to reduce the load on the standby transformer, which can provide only a maximum of 90mA. The problem was that the 12V supply was low at only 8·2V. It comes from a 2SD1474 series regulator transistor, Q3801, which is mounted on a heatsink on board E. The set behaved normally once a replacement transistor had been fitted. **L.M.**

Hitachi C28W410SN (A7 chassis)

A teletext fault you can get with these sets is that the luminance level of the characters varies though the background level doesn't vary. The cause is poor 5V regulation. IC951 is either dry-jointed or faulty or the connections to Q957 are poor. **A.B.**

Hitachi C28W410SN (A7 chassis)

If there's no picture, just a blank raster, but teletext is OK the EPROM may have become corrupted. Go to the service mode then try E2 shipping to see if this will correct the symptom. If it doesn't, try E2 factory. Note down all the current values and service-menu options before you take this action: it will save you ages afterwards in setting up. **A.B.**

Sharp 66GS62 (GA10 chassis)

If Q701 in the power-factor correction circuit fails at switch on, or intermittently, check the surface-mounted resistor R705 (8·2kΩ). It goes either high in value or open-circuit. **A.B.**

Sony KV28DS20 (BE3E chassis)

Failure to come out of standby can be caused by a new start-up routine. Each time the set is switched on a start-up procedure, which takes about two-three seconds, is initiated. If the set is switched to standby while it's carrying out this routine, it will switch out of standby only by pressing the standby button. Press the green standby button on the handset. **A.B.**

LG 25A50F

The customer said this set "had gone bang". It certainly had. The bang had been caused by the STRS6709 chopper IC blowing its front off. Surprisingly, the mains fuse was intact. A replacement IC restored normal operation. **D.P.**

Toshiba 32ZP18Q

This set produced a confusing array of symptoms. At switch on there was a blank raster with no sound. If the set was switched off at the mains and left for a few seconds, then switched on again, the picture and sound were both present. But a few seconds later remote control stopped working and, if the set was left, it reverted to standby. If the set was then turned back on again there was sometimes a picture but the set would intermittently go to standby.

The text panel, part no. 23786696, is the cause of the trouble and should be replaced. I have Toshiba technical to thank for solving this one. **D.P.**

Goodmans 205N

The cause of intermittent operation was traced to dry-joints on the chopper transformer. As always, I also resoldered the connections to the line driver transformer and made sure that the capacitors in the line output stage were firmly soldered. **D.P.**

Sony KVM2151U (BE2A chassis)

The picture was too wide for the screen and there was EW pincushion distortion. The preset controls for horizontal amplitude and pincushion adjustment had little effect on the display. I found that C806 (0·047μF, 250V) in the EW diode modulator network was open-circuit. **E.T.**

Samsung CI593CN

We've had a couple of these sets that have failed to work at all, on a permanent or intermittent basis, because of a dry-joint at point EY30. This is the link to the primary winding of the chopper transformer in the power supply. **E.T.**

Pioneer SD21-AV1

The sound continued while the picture spasmodically came and went. A check on the tube's heaters showed that they remained alight throughout this coming and going. The cause of the trouble was dry-joints at the connections to the RGB transistors T24, T34 and T44 on the tube base panel. After tweaking, the picture was surprisingly good for a set of this age. **E.T.**

Samsung WI28W5

This set is fitted with a variant of the S51A chassis. The one we had in recently did nothing except produce a very gentle pumping effect in its power supply. As so often with this type of fault, the line output transistor (Q403) was short-circuit. A check with Samsung technical brought the information that there is no common cause for its failure – unlike some chassis! Fitting a replacement KSD5703 transistor, obtained from Samsung, restored normal operation. The part no. is 0502-001136. **E.T.**

TELEVISION BOOKS

AND HOME ELECTRONICS REPAIR

The Television Book Service offers access to our team of specialist publishing experts. We can order any book or CD-ROM currently in print from *War And Peace* to the *Newnes Guide to Television and Video Technology*. All books are delivered free of charge within the UK unless otherwise stated. Contact us at the numbers below:

Telephone: **01737 812727** or **01737 812676**

Fax: 01737 813526

Email: salesteam@boffinbooks.demon.co.uk

CLOSED CIRCUIT TELEVISION: CCTV INSTALLATION, MAINTENANCE AND OPERATION

Joe Cieszynski

CCTV surveillance is one of the fastest growing areas in the security industry, and this is a thorough guide to the technical side of CCTV – including installation, maintenance, video recording, cameras and monitors. The second edition is fully dual-standard for PAL and NTSC systems.

2nd edition ▲ Sept 2003 ▲ 256 pages
Glossary ▲ Index ▲ PB ▲ Published in UK

Code 0 7506 5728-6 **£24.99**

DICTIONARY OF VIDEO AND TELEVISION TECHNOLOGY

Jack Tsatsoulin

This work provides comprehensive and contemporary information on the essential concepts and terms in video and television, including coverage of test and measurement procedures. The CD accompanying the text includes an electronic version of the book.

Sept 2002 ▲ 365 pages & CD-Rom
Published in UK

Code 1 878707-99-X **£29.99**

DVD PLAYERS AND DRIVES

K F Ibrahim (College of North West London)

This text is based on hands-on experience and acts as a guide to DVD technology and its application, with a special focus on design issues. The principles of the subject are introduced from the basics, and DVD applications are illustrated by genuine technical information.

Aug 2003 ▲ 256 pages ▲ Glossary ▲ Index
PB ▲ Published in UK

Code 0-7506-5736 7 **£24.99**

ELECTRONIC CLASSICS: COLLECTING, RESTORATION AND REPAIR

Andrew Emmerson

This text encompasses all aspects of buying, collecting, restoring, repairing, sourcing parts, professional services, clubs and societies. The first part covers technical aspects of restoration and details where components can be found; the second presents useful information for collectors.

Aug 1998 ▲ 256 pages ▲ Index
10 halftones ▲ 50 line illustrations ▲ PB
Published in UK

Code 0-7506 3788 9 **£21.99**

INTRODUCTION TO DIGITAL SYSTEMS

John Crisp

This self-study text introduces digital electronics from first principles, before going on to cover all the main areas of knowledge and expertise. It covers the practicalities of designing and building circuits, including fault-finding and the use of test equipment.

Feb 2000 ▲ 302 pages ▲ Glossary ▲ Index
PB ▲ Published in UK

Code 0 7506 4583 0 **£18.99**

NEWNES DICTIONARY OF ELECTRONICS

S W Amos; R S Amos

Aimed at engineers, technicians and students working in the field of electronics, this dictionary provides clear and concise definitions, including TV, radio and computing terms, with illustrations and circuit diagrams.

4th edition ▲ Mar 2002 ▲ 394 pages
100 illustrations ▲ PB ▲ Published in UK

Code 0 7506 5642 5 **£12.99**

NEWNES GUIDE TO TELEVISION & VIDEO TECHNOLOGY

Eugene Trundle

An exploration of television and video technology. It covers the fundamentals of digital television (satellite, cable and terrestrial) and digital video, as well as providing a grounding in analogue systems.

3rd edition ▲ Feb 2001 ▲ 432 pages ▲ Index
PB ▲ Published in UK

Code 0 7506 4810 4 **£17.99**

NEWNES GUIDE TO DIGITAL TV

Richard Brice

Covering all aspects of digital television, this text encompasses the electronics of the equipment, data compression, television production, servicing and the different transition methods - terrestrial, satellite and cable. The text has been updated with developments since the 2000 edition.

2nd edition ▲ Oct 2002 ▲ 304 pages ▲ Index
45 illustrations ▲ 15 photographs ▲ HB
Published in UK

Code 0-7506 5721-9 **£24.99**

PRACTICAL ELECTRONIC FAULT FINDING AND TROUBLESHOOTING

Robin Pain (Design Engineer, Cotag International Ltd)

A text using simple circuit examples to illustrate principles and concepts fundamental to the process of analog and digital fault finding. It aims to help the reader tackle any job, from fixing a TV to improving the sound of a hi-fi. A digital multimeter and oscilloscope are needed for these jobs.

Apr 1996 ▲ 284 pages ▲ Index
50 line illustrations ▲ PB ▲ Published in UK

Code 0 7506 2461 2 **£21.99**

PRACTICAL ELECTRONICS HANDBOOK

Ian Sinclair

A collection of all the key data, facts, practical guidance and circuit design basics needed by a spectrum of students, electronics enthusiasts, technicians and circuit designers. It provides explanations and practical guidance, and includes new sections on SHF techniques and intruder alarms.

5th edition ▲ Feb 2000 ▲ 571 pages
Illustrations ▲ PB ▲ Published in UK

Code 0 7506-4585 7 **£16.99**

RSGB RADIO & ELECTRONICS COOKBOOK

Radio Society of Great Britain

Only a basic knowledge of electronics is assumed for this collection of electronics projects, and it is ideal for all electronics and DIY enthusiasts and experimenters. Designed by the RSGB, the UK radio amateurs federation, the projects are clearly explained step by step.

Nov 2000 ▲ 336 pages ▲ PB ▲ Illustrations
Published in UK

Code 0-7506-5214-4 **£17.99**

REFERENCE DATA FOR ENGINEERS: RADIO, ELECTRONICS, COMPUTERS AND COMMUNICATIONS

Mac E Van Valkenburg; Edited by Wendy Middleton

Written by professionals for professionals, this is a complete reference for engineers. As well as addressing radio technology data, it covers digital electronics, computers and communications.

9th edition ▲ Aug 2001
1568 pages & CD-Rom ▲ 1385 line illustrations
HB ▲ Published in UK

Code 0 7506 7291 9 **£90.00**

SERVICE ENGINEER'S POCKET BOOK

Lewis & Sinclair

This title aims to provide the service engineer with all the necessary information to carry out work on domestic electronics equipment. The coverage ranges from satellite reception to NICAM. Both analogue and digital equipment are covered, and there are chapters on common problems.

Jan 1998 ▲ 238 pages ▲ HB

Code BUTO-7506 3448 0 **£14.99**

SERVICING TV, SATELLITE & VIDEO EQUIPMENT

Eugene Trundle

A practical hands-on guide for service engineers, installation technicians and servicing students, this text emphasises the practical business of fault diagnosis and repair of TV, satellite and video equipment.

Revised 2nd edition ▲ Nov 2001 ▲ 336 pages
Symptom index ▲ PB ▲ Published in UK

Code 0 7506 5507 0 **£21.99**

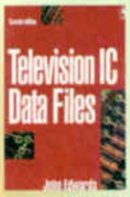
TELEVISION MICROPROCESSOR IC DATA FILES

J Edwards

Microprocessor ICs are the most complicated part of TV equipment and present special problems to the engineer. This text covers the most popular microprocessor ICs. Each device is presented graphically with the relevant data information given against each pin.

Mar 1997 ▲ 240 pages ▲ 200 line drawings
PB ▲ Published in UK
Code 0-7506-3335-2 **£19.99**

TELEVISION IC DATA FILES



J Edwards

A compendium of data on all the most common integrated circuits used in televisions. Each device is illustrated with a pin-out diagram, and all the measurements and signal data in the book were taken under actual working conditions. This second edition contains over 70 new ICs.

2nd edition ▲ Jan 2000 ▲ 245 pages
PB ▲ Published in UK
Code 0-7506-4581-4 **£18.99**

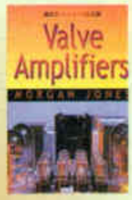
TV FAULT-FINDING GUIDE

Edited by Peter Marlow

A distillation of the most-used fault reports from 11 years of *Television* magazine. Arranged by make and model, it features over 200 reports on over 300 models of television, including diagnosis and repair advice.

Mar 2000 ▲ 387 pages ▲ Illustrations
PB ▲ Published in UK
Code 0-7506-4633-0 **£20.99**

VALVE AMPLIFIERS



Morgan Jones

The author's straightforward approach, using as little maths as possible, should be of use to those with only a limited knowledge of the field as well as being the standard reference for experts in valve audio. Design principles and construction techniques are also provided.

3rd edition ▲ Aug 2003 ▲ 624 pages ▲ Index
PB ▲ Published in UK
Code 0-7506-5694-8 **£29.99**

VCR FAULT-FINDING GUIDE

Edited by Peter Marlow

A distillation of the most-used fault reports from 11 years of *Television* magazine. Arranged by make and model, it features over 2000 reports on over 200 models of VCR, including diagnosis and repair advice.

Mar 2000 ▲ 447 pages ▲ Illustrations ▲ PB
Published in UK
Code 0-7506-4634-9 **£20.99**

VCR IC DATA FILES

J Edwards

This text aims to provide the workshop technician and the field engineer with a convenient method of fault-finding without the need to consult workshop manuals. The most popular ICs used in video recorders are covered. Each device is presented graphically with data given against each pin.

Jul 1998 ▲ 448 pages ▲ 200 line illustrations
PB ▲ Published in UK
Code 0-7506-3993-8 **£20.99**

VIDEO AND CAMCORDER SERVICING AND TECHNOLOGY

Steve Beeching

A comprehensive guide to domestic VCR technology and repair techniques. This edition brings the information fully-up-to-date, with expanded coverage of camcorders, sections on DVD equipment and the latest VCR technology.

5th edition ▲ Apr 2001 ▲ 323 pages
Illustrations ▲ PB ▲ Published in UK
Code 0-7506-5039-7 **£20.99**

VIDEO DEMYSTIFIED

Keith Jack

This edition has been updated to include information on digital television, datacasting, interactive video, digital camcorders and VCRs, and video interfacing. Coverage is international, including European, Asian and North/South American video standards, methods and techniques.

3rd edition ▲ Jul 2001 ▲ 784 pages & CD-Rom
References ▲ Glossary ▲ Index ▲ PB
Published in UK
Code 1-878707-56-6 **£50.00**

THE DIGITAL SATELLITE TV HANDBOOK

Mark E Long

A handbook and CD-ROM pack on digital satellite television. It provides an overview of all the digital TV platforms in use world-wide. It includes satellite coverage maps and transmission parameters that readers will need to receive digital TV services from any location in the world.

Sept 1999 ▲ 207 pages & CD-Rom ▲ PB
Code BUT 0-7506-7171-8 **£41.99**

NEWNES GUIDE TO RADIO AND COMMUNICATIONS TECHNOLOGY

Ian Poole

This is a guide to the technology and applications of modern radio and communications equipment. The author's approach provides a useful foundation for college students and technicians seeking an update on the latest technology.

Jul 2003 ▲ 352 pages ▲ Index ▲ PB
Published in UK
Code 0-7506-5612-3 **£16.99**

VALVE RADIO & AUDIO REPAIR HANDBOOK

Charles Miller

A practical manual for collectors, dealers and service engineers of valve audio and radio equipment. This edition includes new material on restoration and valve amplifiers.

2nd edition ▲ Apr 2000 ▲ 280 pages
▲ 10 halftones ▲ 50 line illustrations ▲ PB
Published in UK
Code 0-7506-3995-4 **£20.99**

NEWNES TV & VIDEO ENGINEER'S POCKET BOOK

Eugene Trundle

This updated text provides a pocket tool for service engineers. It presents a range of essential information in a compact form, covering television reception, satellite and cable television, video recorders, colour camera technology, teletext and fault-finding.

3rd edition ▲ Oct 1999 ▲ 512 pages ▲ HB
Code BUT 0-7506-4194-0 **£17.99**

TELEVISION ORDER FORM

Please order or search the following:

Code	Description	Qty	Price

POSTAGE & PACKING **FREE** IN THE UK* TOTAL

Name Daytime Tel

Address

Postcode

I enclose a cheque/postal order value £ .... payable to 'Boffin Books Ltd'

Please debit my Access/Visa/Switch/Delta card (delete as applicable) Issue number (Switch only) ....

Card Number .... Expiry Date ....

Signed ....

*Postage charges outside the UK available upon request or email: salesteam@boffinbooks.demon.co.uk

Post to: **Boffin Books Ltd, 24 Walton Street, Walton-on-the-Hill, Tadworth, Surrey KT20 7RT, UK**

If you are ordering by credit card, need further information, or would like to use our search facilities, call

01737 812727 Fax 01737 813526

The order/helpline is open from 9am to 5pm, or leave your order on our out-of-hours answerline or email us at *salesteam@boffinbooks.demon.co.uk*

When placing orders please quote • Name • Address (home & delivery) • Daytime telephone number • Debit/Credit card number • Expiry date • Details of order. Please note that prices may change, but are correct at time of going to press.

Extended Fault Reports

Reports from
Michael Dranfield
Arthur Jackson
Martyn S. Davis
Martin McCluskey
Uel Harte
Martin J. Abbott and
Charles Ritchie

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,
Media House,
Azalea Drive, Swanley,
Kent BR8 8HU

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

Daewoo GB2898ST (CP775 chassis)

This set was tripping. Not, this time, because the line output transistor and transformer were faulty. When I carried out a visual examination I found that the TDA8351 field output chip I301 had a hole burnt in it. In addition the 16V supply rectifier D407 (use an RGP15J as the replacement) had turned to charcoal, while the print to the 16V supply had all burnt up.

The supply is derived from the line output transformer. When I traced the print back to the transformer I discovered why there had been so much damage. There was no sign of a safety resistor to protect the 16V supply. After replacing all the associated faulty components I removed wire link J016 and fitted an 0·22Ω, 0·5W safety resistor in its place.

I do this with all these sets that come in now, regardless of the actual fault. **M.D.**

Akura ATPTV028WSS (PT92 chassis)

This set's housebound owner said it reverted to standby after eight hours of continuous use. It had been returned under warranty, but the fault was still present. I noticed that the microcontroller and EEPROM chips has been replaced.

When I eventually saw the fault I found that the line drive had disappeared, leaving sound but no picture and the green LED at the front alight. Extensive checks failed to reveal a cause of the problem, but I noticed that a lot of heat was being generated during the long soak-test periods.

With nothing to lose, I decided to reduce the HT voltage by 5V in an attempt to make the set run a little cooler. That was six months ago, and the customer tells me that all is well. So, hopefully, it cured the trouble. **M.D.**

Toshiba VTV1400

This 14in. TV/VCR combi unit was dead. Initial checks showed that the mains supply was being rectified and reached the power regulator IC502. The power supply in this model is entirely on a small PCB that's mounted above the main board/deck assembly and is easily removable for cold checks. When I removed it I saw that the STR-G6653 chopper chip IC502 had split part and that two nearby resistors were burnt and read open-circuit.

Fortunately a power supply circuit could be downloaded quickly to be able to check on the problem area. The two defective resistors were R503 (3·3kΩ, 0·5W) and R543 (680Ω, 0·25W fusible). They couple feedback from the optocoupler IC506 to IC502. No other component faults were found. So I replaced IC502, R503, R543 and the optocoupler (type LTV-817M-VB). This completed the repair. **A.J.**

Thomson 32WF45E (ICC20 chassis)

Set dead was the complaint with this 32in. superflat CRT model. It was a first for us, as all the previous problems we've had with this chassis have been in the line output stage. Initial checks in the power supply showed that the mains input fuse had blown and that the chopper FET TP020 was short-circuit. Further cold checks revealed that RP053 (4·7Ω) was open-circuit. This resistor couples the drive from pin 14 of the TEA2262 chopper control chip IP050 to the gate of TP020. In addition pin 14 of IP050 was short-circuit to chassis.

There is generally a repair kit for the power supply in Thomson models, so I checked with technical. In this case the kit is part no. 35134130. When I had fitted all the parts in this reasonably-priced kit the set worked first time. A soak test confirmed that all was well. **A.J.**

Philips 32PW9534 (Cool Green, MG2.1E chassis)

There was nothing "cool green" about this set! It was dead with the front LEDs flashing. I have to admit to being intimidated by these large, complicated sets. My Philips service tool and compair both indicated errors 67, 68. This means that there are no 5V and 8V supplies.

As there didn't seem to be any sign of squealing or tripping, which might have indicated a fault farther downstream, I decided to go for the power supply. I fitted the power supply service kit (part no. 4822 310 11234) and replaced a few other bits and pieces – Tr7000, Tr7001, C2505, R3517, C2525, D6521, D6525, D6524 and relays 1002 and 1010 – basically anything that stood the slightest chance of having failed!

When I switched the set on I was

rewarded with the lovely sound of EHT rustle. After a suitable soak test the set was returned to its owner. **M.S.D.**

Schneider STV2802

The picture produced by this receiver was excellent but after twenty minutes there was line tearing, giving a double-vision effect that varied with beam current. Older readers may recall a problem like this with the Decca Bradford hybrid chassis: it was caused by a faulty PCF802 line oscillator valve. But back to the Schneider set. Blasting the line driver transistor with freezer cleared the fault for a few minutes, but it returned as the transistor warmed up again.

To cut a long story short, I found that C304 (0·15μF, 63V) was open-circuit. It's a small red capacitor near the line driver transformer. I think it's part of an *RC* network that damps the transformer's primary winding. A replacement capacitor restored normal operation. **M.McC.**

Grundig A8600 (CUC720 chassis)

Yes, I know that this set is over twenty years old! But the customer had kept it because he likes the wooden cabinet and the excellent sound quality produced. In fact the sound was the problem. At switch on there was usually no sound at all. Banging the cabinet would sometimes restore normal operation for a few minutes.

In the early Eighties Grundig thoughtfully put a neatly folded circuit diagram inside each of its TV sets. Over the years these would be 'robbed' by visiting engineers, but this one was still there, covered in a thick layer of dust. I soon discovered that there was no +G supply (31V) at pins 9 and 10 of the plug-in audio output module. This voltage comes from the power supply and is one of five secondary supplies that are switched on by a large relay when the set is brought out of standby.

The cure was to remove the relay from the board, carefully clean it and retension the offending contacts. **M.McC.**

Toshiba 28CZ33B

The fault report said no picture. I found that the set produced a snowy raster and that the picture was OK with a scart input. It didn't take me long to discover that the tuning voltage supply was missing at pin 7 of the tuner. As this was a new chassis to me I required service information. Manuals from Toshiba are now supplied as PDF files, though some are still on CD-ROM. When the download had taken 28 minutes I began to grow impatient and decided to trace the VT supply back to source.

This chassis has two main PCBs. The 32V tuning supply is fed to the signals panel via pin 6 of connector A10BB, where the voltage was still missing. When I traced back to the power supply, via wire links, I discovered a 22kΩ, 1W resistor that was open-circuit. It's situated at 45° to a glass fuse. Replacement of this resistor cured the fault, and I still had five minutes left of the download. It will take me longer to do the warranty claim form. **U.H.**

Grundig MW70-3699

This set had been elsewhere. There were screws missing, disconnected plugs and in addition there was no line output transistor. As I had cleared up for the day I decided to have a go. After fitting a new line output transistor I found that the set remained in standby, with HT present at the collector of the line output transistor. This indicated loss of line drive. A check at regulator IC61040 showed that the +E (8V) supply was missing. In addition the 5V supply at pin 2 of IC61050 was low at 2·9V.

I came to the conclusion that something had to be pulling either the 8V or the 5V supply down, and decided to check the 5V supply first. When I checked across C61052 for shorts I obtained a reading of 82Ω. The 5V supply travels all over the place in this chassis, but as a start I disconnected pin 7 of the tuner. The reading across C61052 then rose to 769Ω and, when I reached for the remote-control unit, I was able to bring the set out of standby. A replacement tuner cured the fault. **U.H.**

Hitachi C2567TN (A4 chassis)

When this set had been switched on after a period of disuse there was field collapse. The cause appeared to be a CRT flashover as ZD602, which protects pin 41 of the IF/colour decoder/timebase generator chip IC201, had gone short-circuit. This pin is the linearity feedback input from the field output stage: a transient had probably passed down this route. Field scanning was restored once IC201 had been replaced.

A TDA8361-N5 chip was obtained from Charles Hyde & Son Ltd. It's listed as a TDA8361A, intended for use in the Toshiba Model 2140TB. The A4 chassis uses either a 3Y or type 4 version of the chip.

If you use the version I fitted to replace a 3Y version there will be noticeable east-west dithering. A simple modification cures this: change the value of R523 from 47kΩ to 8·2kΩ. You will find this resistor next to ZD601 and ZD602. The problem is caused by an incorrect level at pin 34, which is for use with a 3·58MHz crystal (not used in European sets).

To improve the flashover protection I changed the rating of ZD602 to 10V, and added a 1N4148 diode in parallel to improve the clamping of negative-going transients. **M.J.A.**

Thomson 14MG15ES (TX807C chassis)

There were two problems with this set, neither of which was a genuine fault – rather like the earlier TX807 chassis that would refuse to come out of standby because child lock was activated. The field scanning was reduced, and there was very poor sound – like a set tuned off station. In addition there was a whistling noise whose pitch could be altered by varying the signal strength. This whistle would also break through on the AV input.

When the manual tuning screen was checked it said the receiver standard needed to be changed to UK. To do this, enter UK, press OK to memorise then tune in a channel. Auto-tuning may also clear the fault. To get into the service mode, enter standby, switch off then switch on while pressing the magenta button on the remote-control unit. The same procedure took the child lock off the TX807.

A TX807C/CS service manual is available from Charles Hyde & Son Ltd. under order code 20104SY. It's intended for Model 28DG17U. The manual shows a different chip set on the mother board, but there's useful information on the service mode. **M.J.A.**

Ideal ID14T3 (PT92 junior chassis)

This 14in. set is fitted with a scaled-down version of the PT92 chassis. The fault symptom was reverting to standby after a few seconds. Before it reverted to standby I heard the EHT rustle up. This proved that the line output stage was operational, but I didn't hear a buzz from the field scan coils. I turned up the A1 control setting and continually pressed a channel-selection button. This confirmed that basic fault was field collapse.

Checks in the field output stage failed to reveal anything amiss. The 16V and 45V supplies were present, and a replacement TDA8357J field output chip (ID50) didn't make any difference. But I noticed that there appeared to be loss of field drive at pins 1 and 2. When I moved over to the microcontroller/text/jungle chip IV01 I found that there was no 8V supply at pin 14, though it was present at pin 39. There was a break in the track near the tuner. Bridging it with an insulated wire link cured the fault. **C.R.**

WHAT a LIFE!

More reports from the workshop, about line output transistor failures in particular. Early experiments with telephony. The printer problem. Donald Bullock's monthly commentary

Our current visit to the UK has turned out to be longer than we originally anticipated, and naturally it's expected that I should carry out my share of duties in the shop. So here I am, waiting to serve the Great British Public.

"Out' the way, out' the way" came the voice from the 28in. Proline set that was staggering towards our open shop door. "'E's 'eavy, y'know, 'e's very 'eavy."

When the set reached the counter I saw Mr Lovejoy behind it. "It's 'ot" he complained. "Dunno why they makes 'em so big."

Once I'd got the details Mr Lovejoy departed. It was a Model 28N1, which is fitted with the Formenti F19 chassis. He said it was dead. When I tested it I found that it was tripping away merrily. This suggested trouble in the line output stage, so the obvious thing to do was to check the S2055N line output transistor, TR16. It was leaky base-to-emitter. As there's usually a cause for this sort of thing, I carried out some further checks and discovered that the 9·1nF, 1kV tuning capacitor C68 was short-circuit.

Once these two items had been replaced I switched on and found that the set worked a treat. Which was just as well, as I spotted Old Cocker Cooper approaching. He'd just got down from the cabin of his straw wagon.

Cider and suchlike

"Hello Mr Bullock" he said to Greeneyes, who was on her way out to the shops again. Then he did his best to focus his bright blue eyes on Paul. "Fourteen pints o' cider is a lot for a chap like you" he commented.

"But I haven't had fourteen pints of cider" Paul protested.

"No?" Cocker continued, "we'll say no more about it then. 'Bin negotiating for old Ferris's paddocks of grassland. 'E takes a long time over it. Goes for that rough cider while 'e's about it."

"You had a glass or two yourself" Paul suggested.

Cocker stood up as straight as he could. "Not in the least" he replied, then added "squeals like a pig 'e do. Just like a pig!"

"Who does?" asked Paul.

"My telly of course" Cocker replied, "it's in the wagon."

We found his set buried in straw. It was a 15in. Toshiba Model 15V31B.

When we tried the set it was certainly squealing – in standby. This suggested more line output stage trouble. The output transistor in this model is a 2SD2499, Q401. It was short-circuit, and further tests failed to reveal any other shorts in this area. So we fitted a replacement and switched on. Our replacement transistor immediately departed to join its predecessor.

"I suppose it led a good life" Paul remarked, "they say the best die young."

"We didn't check for dry-joints" I said, "so we rather asked for it. Look, there!"

There was a nasty, grey dry-joint on T401. When we resoldered it and fitted another transistor Old Cocker's set was perfectly all right. Not sure about Old Cocker though.

Maggie Lake

It was going to be our day for dead line output transistors. Our next customer was Maggie Lake. I like her: she's a no-nonsense shootin' and fishin' type. Also likes her gin and lime, and goes everywhere in a four-wheel drive that's full of 12-bores and assembled fishing rods.

"Hook me Samsung out the wagon, Donnie-boy, there's a dear" she said through her cheroot smokescreen, "dead as a pond-pike it is."

The set was a 28in. Model WS28W63N (KS3A chassis). Steven got busy with this one and soon found that the 2SD5703 line output transistor Q401 was short-circuit. After checking for any other associated shorts he fitted a replacement and switched on. There was a raster for about a second, then the transistor blew again. He noticed that the line output transformer had got hot. A replacement, type HR8585, was fitted, and a BU2520AF was used this time as the output transistor. When the set was tried again it worked well enough.

"Good show!" Maggie's smokescreen said as we carried the set out to stow it amongst the fishing rods and a monster trout. "Look at that one! Caught him an hour ago at the weir. I'll scoff him tonight with a drop of wine. Then a gin or two, eh? That's the life!"

Reuben's Hitachi

Reuben, a Romany gypsy, manages to keep his old banger lorry going and earns his money moving scrap and rubbish. I've known him for years. Lovely chap, one of nature's gentlemen.

"Hello Don" he smiled, placing a small chip basket of mushrooms on the counter, "would you have a look at this set I found? It was on the top of a load of rubbish down the trading estate."

The set was a 28in. Hitachi Model C28W510SN (A7 chassis). We found that it worked, after a fashion – it kept reverting to standby. Careful observation revealed a slight spark between the heatsink of the 5V regulator IC952 and an adjacent 2W ceramic resistor, R975 (18Ω). Every time this sparking occurred, the set reverted to standby. The answer, of course, was simply to prise the two components well apart.

We could hardly charge for this. But we did end up with a lot of those mushrooms!

Family matters

The following day we had off.

"Meet Edgar" said Greeneyes, "we're to look after him for an hour while his mother Katie is at the dentist." She gave Edgar a sugary smile.

"This is old grampy" she purred, pointing at me. "He looks grumpy, but he's quite nice really."

Edgar scrutinised me closely. "You're very old" he declared, "with rotten hair."

"You did say half an hour didn't you, dear?" I smiled at Greeneyes.

"Were you a boy once?" asked

Edgar, fixing me with a straight stare.

Greeneyes cut in at this point. "Yes, he was" she replied, "but it was quite a long time ago . . ."

"Were there cars and trees and telephones when you were a boy?" he asked.

There were certainly cars, dozens of makes too. Many of them were grand, hand-made chariots. With running boards. Trees? Not in our central backstreets. Telephones? Only in some of the larger shops. They stood on a little black pole, the earpiece hanging on a little loop when not in use.

But by the time I was eleven or twelve we had a telephone in our own house. It connected my bedroom, at the top of our steep, winding staircase, to the kitchen. And it worked fairly well for a home-made effort.

Telephony

It came about, as most inventions do, of necessity. My bedroom was also my den. I'd lots of bits and pieces, and tinkered with wires, crystals, valves and speakers. I often produced so much electronic noise in there that the only way of calling me to a meal, or to answer the door, was for my mother to trudge to the top of the house.

"Why don't you invent a telephone?" she panted, during her third trip up in half an hour one day.

So I did just that. I realised that a telephone consists basically of a microphone and an earphone. In the Thirties we didn't walk on carpets of money, and when we wanted anything we had to make it ourselves.

First the microphone. I found an old wooden switch-block in my scrap box. This was essentially a wooden tablet, about at inch thick, with a hollowed-out 1in. core in the centre of its underside to accommodate the mains cable. I cut a piece of tin lid to fit into the hole, and secured its centre with a brass bolt, a grip washer and a milled nut which became one of the microphone's two terminals.

I then removed the central carbon rods from some old batteries, smashed them with a hammer, and picked out enough tiny carbon granules, each about twice the size of a pinhead, to three-parts fill the switch-block core. I cut a 'lid' from a piece of thin copper shim and stuck it with rubber solution to the open side of the switch block, before tacking it all round, thus imprisoning the tiny carbon beads. I next drilled a hole through the side of the copper shim and the switch block, and fitted another copper bolt, grip washer and milled nut, which served as the microphone's other terminal.

I reasoned that, by connecting a twin lead to the terminals and a single battery cell in series with one of them, a current would flow via the conductors once the circuit had been completed, and that this current would vary depending on the resistance of the carbon granules, which would in turn depend on the varying compression of the copper-shim diaphragm in response to any air waves present. But this was only a theory. I needed an earphone to prove it.

I took another switch block and drilled through its centre to take a 2in. steel bolt, which I passed through the face of the block and secured with a washer and nut. But the steel bolt was hardened. I needed it to have a loose molecular structure, so I had to soften it. I did this by ensuring that it spent the next couple of nights in the centre of our kitchen coal fire.

When I recovered it, on the second morning, it was ideally 'dead' and softened. I cut off its head, turning it into a threaded rod, and after squaring its ends by filing I secured it into the block with nuts, so that its top ended up just less than flush with the back of the switch block. I then removed it and made it into a bobbin by adding glued-on cardboard end-guides, buried the iron threads with several coats of rubber solution, and wound layer after layer of fine, varnished copper wire from an old loudspeaker transformer primary winding until the bobbin was full. The two ends of the coil were brought to a pair of nut and bolt terminals through the face of the block.

Finally, I made a disc from the thinnest and most springy tin I could find, which happened to be from a National Dried Milk container. This was glued and tacked across the open end of the switch block.

My instincts told me that I now had a one-way telephone – that the varying current from the transmitter would flow through my receiver's solenoid and produce a varying magnetic flux in its core, thus attracting the steel diaphragm in sympathy. But I needed to try it.

Testing, testing

This involved finding every scrap of wire I could and soldering each piece end to end, using a gas soldering iron, some Woolworths' solder strips and a tin of flux, until I had twin pair from our kitchen to my bedroom three floors up.

I remember the evening it was first tested as though it was yesterday. I connected everything up and installed my somewhat unwilling parents so that they were huddled up around the receiver on the kitchen table.

"Are you telling us this is a telephone?" my father said, in his most terse tones, as he shook his fingers impatiently towards my receiver.

Then I ran upstairs to my microphone, asked them for the first time in my life how they were, and finally yelled "I'm coming down to see if you heard!"

When I entered the kitchen their faces told me everything. They looked at me in a kindly new light.

"Oh Donald!" exclaimed my mother.

"It worked, ah, very well" said my father, quietly.

But I had to hear for myself. I asked them to go up to the bedroom and talk to me using the microphone. It seemed to take an age for them to get there. As they entered, I heard them discussing me.

"I'll tell you one thing, Flo" my father said, "he's different all right. Dunno if he's crazy or not. He'll end up either a genius or in the asylum."

They were incredulous about my next project too, the construction of a wire recorder. But that's a story for another day.

Printers

I had an interesting email the other day from Fraser Armstrong, about the troubles I've been having with an Epsom printer (see October issue, page 757). Fraser is a professional business equipment engineer, who services PCs, copiers, fax machines and suchlike for a living. He has come to the conclusion that the inkjet printer must be the biggest money waster ever devised for the user, and the biggest ever money maker for the manufacturers.

"Most of them are programmed to go through endless ink-purging and ink-cleaning cycles, as a result of which much of the expensive ink is spat out" he writes. "If you dismantle your printer you'll find absorbent pads (blotting paper) put there to soak up the ink during the so-called 'cleaning process'. This is where most of the expensive ink goes!"

He mentions that laser printers are cheaper to run in the long term, a fact that's been confirmed by independent tests. I'll be seeking his advice on which one to get. Meanwhile this Epsom inkjet printer of mine is living on borrowed time. All it did was to dither and crackle when I set out to print a few emails before writing this column. Once again I had to resort to longhand.

Don't forget, emails are always welcome. Send them to donald@wheatleypress.com

SATELLITE NOTEBOOK

Reports from Christopher Holland

An IF distribution system fault

We install quite a lot of IF distribution systems in apartment blocks. Very often, because of the size of the apartment block, there are two or three different primary trunk feeds that go to magic switches in different parts of the building. This can involve a lot of cable installation, as four trunk feeds are required to each magic switch, vertical and horizontal for low band (10·7-11·7GHz) and high band (11·7-12·75GHz) respectively, the feed from the LNB being divided by two- or three-way IF splitters which, these days, are often rated to work at up to 2,400MHz. Installations of this type can take several days to complete, as they generally involve connecting a separate IF cable to each flat, totally separate from the existing terrestrial distribution system.

In general we start by fixing the dish and connecting all the trunk cables to the magic switches, making sure that everything is working correctly before connecting the apartments to the system. While connecting an apartment recently, a day or so after the main system had been powered, I noticed that the low-band vertical feed was about 10dB lower than it should have been. When I went back to the magic switch which fed the apartment, I found that the relevant incoming trunk feed was low. I soon discovered that the culprit was the splitter that fed the trunk cables, as the signal levels at the other outputs were at the original levels.

When I removed the cover of the three-way IF splitter I saw that the relevant F connector pin wasn't making contact with the PCB, as the soldered joint had fractured. The pin was close enough however, causing the 10dB or so signal drop. The surprising thing was that the poor connection had taken a few days to show up. Photo 1 shows a typical soldered connection between an F socket pin and the PCB.

Photo 1: Typical soldered connection between an F socket pin and the PCB in a three-way IF splitter.

Digital channel update

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

ITV has been carrying out tests using a spare transponder 54 (10·906GHz V) channel. When added in via a digibox's extra channels menu, the channel is called G54. There were colour bars and changing captions that suggested some kind of quiz – see Photos 2-4. This continued for several weeks then stopped, the caption changing to LNN DTC BARS2, see Photo 5. ITV3, which was due to start via DTT at the beginning of November, may not commence via satellite transmission until the early part of next year. So these colour-bar tests may not be related to ITV3.

The Express Shopping Channel is a joint venture run by Northern & Shell, which is owned by Richard Desmond, owner of the Express Group of papers, and the mail order shopping company N. Brown Group.

HDTV tests

The Euro 1080 high-definition TV transmissions have been mentioned previously in this section. More tests are taking place via the Astra 1 slot (19·2°E). There's an HD demonstration film at 12·441GHz V, see Photos 6-9, using a symbol rate of 27,500 and 3/4 forward error correction. HDTV satellite receivers should become available in Europe fairly soon – the reception shown in Photos 6-10 was via a PC-based satellite receiver.

In mid October the German channel Pro 7 transmitted a joint US/BBC film about African wild life in HD form, see Photo 10. This was at 12·460GHz H. It was interesting, during the transmission, to switch to the usual Pro 7 channel and compare the normal, lower-definition pictures with the HDTV ones.

Reception beyond the footprint

Early C-band (4GHz) satellites commonly had a 'global' footprint. That is, provided the satellite was above the horizon a signal, albeit a weak one, was available – requiring a large dish for satisfactory reception! Later, Intelsat satellites used hemispheric beams alongside the global ones, providing separate coverage of say the Americas or Europe/Africa. The result was more efficient use of the satellite and higher signal strength.

Early Ku-band (11-12GHz) satellites then came along, with much narrower, more focused footprints. But with modern ones it's common to have wide coverage of say all the Americas, or all of Europe plus the northern part of Africa. The use of higher power, along with good transmission aerial design, makes this possible.

Some reception is often possible outside the primary footprint area. Using a large dish, the old Astra 1A satellite was receivable in parts of Southern Africa. Astra 2A has some limited coverage in Western Africa and, if you fancy installing a 7m dish or larger in the Middle East, you might receive Astra 2D, which carries the unencrypted BBC signals. I've heard reports of Hot Bird at 13°E being received in the north eastern part of South America.

Reception of such signals can vary throughout the day. The signal is probably coming from the transmission dish's first sidelobe, at much lower signal strength than from the main forward lobe, and may come from very close to the transmission aerial's null between the main lobe and the first sidelobe. Geostationary satellites do move around slightly, 0·1° being a typical figure, and this can be enough to cause considerable variation in signal strength as the transmission aerial's null point moves into view of your reception site, causing a rapid drop in signal strength, the signal strength rising some hours later as the null point moves away again.

I've seen some of this type of reception here in the Algarve from the North

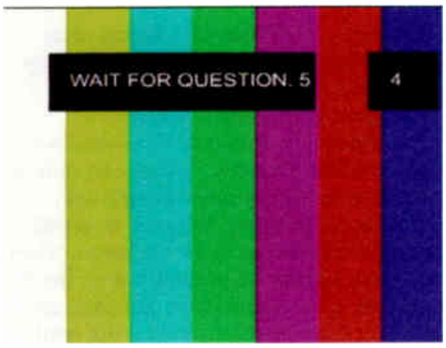


Photo 2: ITV test transmission via a transponder 54 channel.

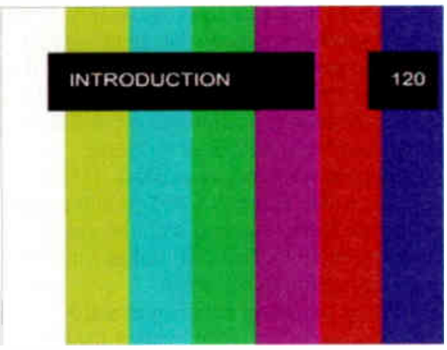


Photo 3: ITV test transmission via a transponder 54 channel.

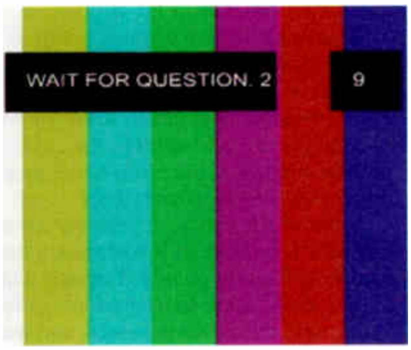


Photo 4: ITV test transmission via a transponder 54 channel.

Photo 5: ITV test transmission via a transponder 54 channel, with LNN DTC BARS2 caption.

Photo 6: A Euro 1080 test transmission via Astra 1 at 12·441GHz V.

Photo 7: A Euro 1080 test transmission via Astra 1 at 12·441GHz V.

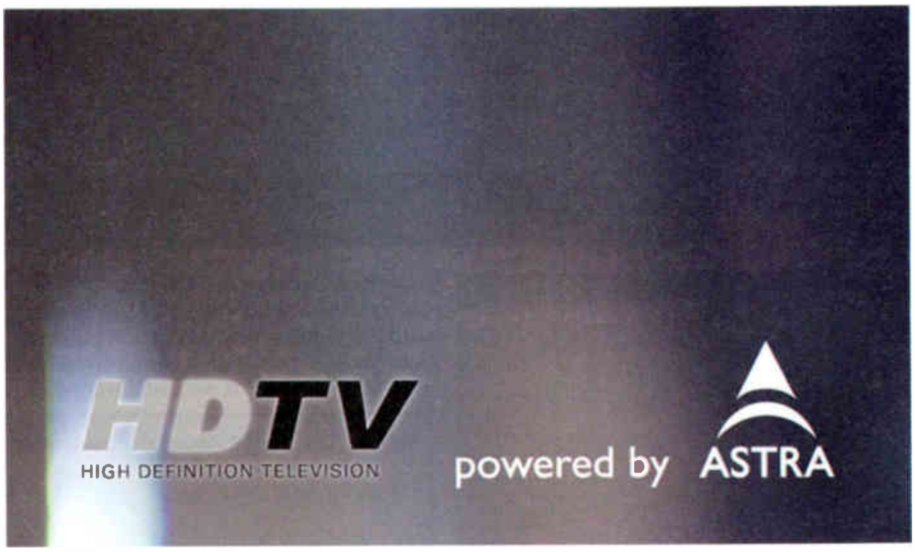


Photo 8: A Euro 1080 test transmission via Astra 1 at 12·441GHz V.

Photo 9: A Euro 1080 test transmission via Astra 1 at 12·441GHz V.

Photo 10: A Pro 7 HDTV transmission, showing an African wild life film, via Astra 1 at 12·460GHz H.

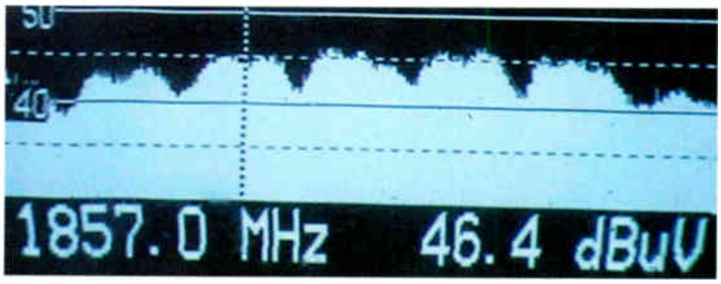


Photo 11: Reception from the North American Rainbow 1 satellite at 61·5°W. Because of encryption, no signals can be viewed.

Photo 12: A plastic depolariser inserted in the feedhorn of an H/V LNB.

American Rainbow 1 satellite at 61·5°W, which transmits between 12·2-12·6GHz with left- and right-hand circular polarisation. Some signal, with a carrier-to-noise ratio of about 5dB, is present during the afternoon – see Photo 11 – fading away rapidly during the evening. Unfortunately no signals can be viewed, as American Digicipher encryption is used.

Interestingly, Rainbow is co-sited with the EchoStar 3 satellite, which transmits in the same frequency range though with opposite polarisation. Virtually no signal is seen from EchoStar in the afternoon, when Rainbow signals are present, but during the morning some signals from EchoStar are present. Circular polarisation is not used very much in Europe in Ku band, though it's commonly used in North America.

Normal horizontal/vertical polarisation LNBs will give some reception of circularly-polarised signals, but a plastic depolariser inserted in the feedhorn of an H/V LNB, see Photo 12, improves the signal no end. Some experimentation is required with the depolariser. The plastic must be fairly thin, just wide enough to slot into the feedhorn tube, and between 2-3cm in length. Position the depolariser at about 45° with respect to the H and V LNB pickup probes – some experimentation with the exact angle relative to the LNB probes is necessary for optimum reception.

When switching between H and V polarisation in the usual manner the depolariser in the feed gives left- or right-hand polarisation. With a depolariser inserted in the feed the incoming corkscrew-motion, circularly-polarised signal is partly slowed down, ending up as a linearly polarised signal at the LNB side of the depolariser.

This modification is much easier to carry out with a prime-focus feedhorn. An offset-type feed will be securely protected with a weatherproof cover. Removal of this to experiment could damage the cover's sealing properties, the result being moisture ingress after replacement of the cover.

Remove the plastic depolariser for normal H/V reception, as it will reduce the incoming linearly-polarised signals a little.

The first Telstar transmissions, in July 1962, were circularly polarised, and the Goonhilly earth station used a depolariser in the feedhorn. Unfortunately it was set for the incorrect circular polarisation on the first day of reception, giving virtually no signal. As the signal pickup unit in the dish had only one probe, it was not possible to switch to another one 90° away. To alter the received polarisation, someone had to climb into the large dish prior to the second day's tests to move the depolariser physically by 90°! After that good signals were finally received. ■

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

Channel and EPG no.	*Sat*	*TP*	*Frequency/pol*
The Estate Agents Channel (tests)	EB	D7S	11·588GHz/H
The Express Shopping Channel (637)	EB	D7S	11·588GHz/H

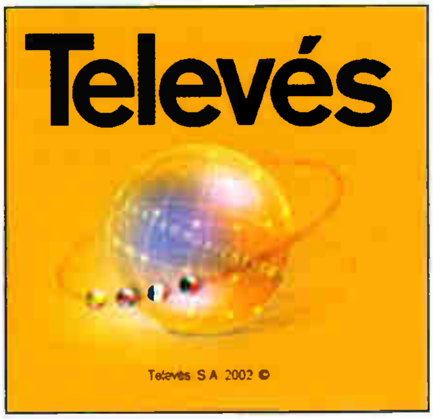
WEB SERVICE

To reserve your web site space telephone
Tel: 01322 611254 Fax: 01322 616339
E-MAILS s.morley@highburybiz.com

Alltrade Aerial & Satellite Ltd

www.alltrade.co.uk

Leading distributor to the trade
Full e-commerce site with over 1500 products with in-stock quantities!! We supply everything associated with Digital/Analogue Terrestrial & DTH/Motorised Satellite reception. All Antennas. All Brackets. All Cables. All Connectors. All Amplifiers. We provide a free MATV/SMATV planning service as well.
Phone 0845 075 0751
Fax 0870 770 9151



Televés

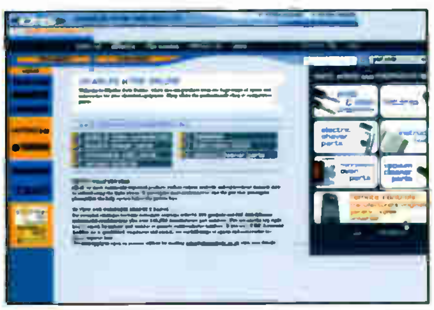
www.televes.com

Televes website was launched as an easier way to keep in contact with our World-wide Network of Subsidiaries and Clients. This site is constantly updated with useful information/news plus you can download info on our range: TV Aerials & accessories, Domestic and Distribution amplifiers, Systems Equipment for DTT and Analogue TV, Meters and much more.

The 'New Look' Storefinder UK

www.storefinder.repairhelper.co.uk

We specialise in promoting electronic repair services throughout the Internet. The Storefinder Site is a UK Search Engine dedicated to the electronic repair trade (i.e. TV, VCR, DVD repair etc). Register with Repairhelper's Storefinder and you get your own optimized pre-built web page and complete listings within the Repairhelper Network of sites as well as high ranking listings within the Major search engine such as Google, MSN and Yahoo!



Charles Hyde & Son Ltd

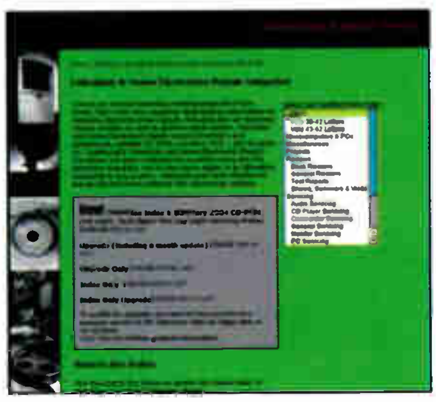
www.charleshyde.co.uk

Search for both original and copy spare parts in our extensive database covering Akai, Alba, Bush, Ferguson, Goldstar, Hitachi, LG, Matsui, Nokia, Saisho, Sanyo, Sony, Sharp, Thomson, Panasonic, Philips, Samsung, Tascam, Teac, Toshiba, Yamaha and many more. In addition huge ranges of Lasers, Lopts, Remote controls and Semiconductors may be accessed.

Swires Research

www.swires.com

Swires Research produce high quality instruments for the television industry, including portable signal level meters and spectrum analysers for digital and analogue RF signal measurements.



SoftCopy

www.softcopy.co.uk

As a PC data base or hard copy, SoftCopy can supply a complete index of Television and Electronics World articles over the past ten years. Photo copies of articles from back issues are also available.

MONITORS

Fault reports from Bob Bradley 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,
Media House,
Azalea Drive, Swanley,
Kent BR8 8HU

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

Compaq TFT7020

The customer complained that her 17in. TFT flat-screen monitor had a bluish tint, especially when she viewed or typed documents, but that it was OK in all other respects. When I opened a Microsoft Word document I found that the problem was present all the time.

After making a few checks I discovered that this was not a fault as such but was caused by an incorrect setting stored in the monitor's memory. It occurs when the default colour temperature is set to 'custom colour', with red, green and blue having equal values. With these settings the colour temperature is in the range 7,000°K to 8,000°K – the higher the colour temperature, the more blue the display appears to be.

To correct the problem you have to go into the monitor's set-up menu, using the On Screen Display assistant, as follows:

(1) Press the Menu button on the front of the display.

(2) By operating the + and – keys on the front control panel, highlight 'Advanced Menu' then press the menu button to select it.

(3) By operating the + and – keys, highlight 'Colour' then press the menu button to select it.

(4) By operating the + and – keys, highlight the required colour-temperature setting, such as 6,500°K for less blue, then press the menu button to select it.

(5) By operating the + and – keys, highlight 'Save and Return' and press the menu button to exit.

After following this procedure to set the colour temperature to 6,500°K I reopened a Word document and found that the previous bluish tint to the page was no longer present. In fact there was a near-white page, as required by the customer. **B.B.**

Compaq 151FS (Model 444)

The LED was alight but there were no other signs of life. A check on the BU2520AF line output transistor showed that it was short-circuit, and when its collector was disconnected the B+ supply came up. This suggested that the B+ regulator FET Q405 (IRFS730, with insulated case) was working, and that the primary winding of the LOPT was not shorted to chassis. There could have been shorted turns however, or the HV block could have been faulty. But when a replacement BU2520AF was fitted the B+ supply was no longer present and there was no sign of any improvement!

Drive for the gate of Q405 comes from a complementary-symmetry driver stage, which consists of a pair of npn/pnp transistors, Q403 and Q404, see Fig. 1. These receive input pulses from a 555 timer chip (U402) which is connected as a monostable multivibrator. U402 is triggered by an output from U801, and there are a couple of common-emitter transistors, Q401 and Q402, between U402 and the driver stage.

The unusual thing here is the way in which a supply is obtained for the driver transistors. Start up isn't a problem, since the collector of Q404 is connected to the B+ supply, which is then at zero, while the collector of Q403 is connected via D402 to a regulated supply (about 10·5V) produced by R416/ZD401. C406 charges via D402. The circuit is a series chopper, with L401 as the inductive reservoir. So when Q405 is switched off its source voltage swings positively then tries to swing negatively, but is clamped at about 0·8V by D403. At this point D402 conducts to replenish the charge across C406.

I found that U402 was producing a pulse output which, as far as I could see, was present at the gate of Q405. But the drive energy available at the gate of Q405 was clearly insufficient. In fact when the line output transistor had failed it had damaged Q405, leaving it with a leaky gate. When there was no load, Q405 appeared to work, but as soon as a load was present its drive was insufficient to keep it going.

A replacement for Q405 completed the repair. The original insulated IRFS730 is rated at 3·7A, 400V, 32W. The non-insulated IRF730 is rated at 5·5A, 400V, 75W. The mounting screw fits perfectly with a nylon insulating collar, so I opted for the higher-rated non-insulated IRF730 plus an insulating kit. **I.F.**

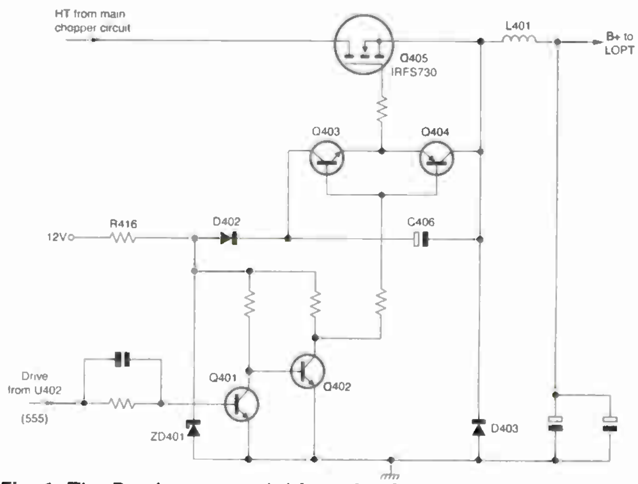


Fig. 1: The B+ chopper and driver circuitry used in the Compaq 151FS. Regulation relies on feedback from the line output transformer to pin 5 of the 555 timer chip.

Answer to Test Case 504

- see page 96 -

Cathode Ray's improvised external power supply was not really a good idea, though it would probably have worked had the TV set's chassis not been earthed via its connection to a UHF aerial output socket in the workshop's signal-distribution network. The network is necessarily earthed for safety reasons.

In fact, like the non-isolated TV sets with which we all had to live many years ago, Ray's 170V supply was 'half-live' to earth: when it was connected to true earth via the TV set's chassis line and the earthed TV-aerial socket, the result was instant tripping of the workshop's mains cut-out. This is of the RCD type, and it's fortunate that it did cut out, never mind Pam's PC project. As this is being written she has only just forgiven Ray, but heaven help him if he does anything as stupid again.

Could Sony have devised some way of setting the CRT's A1/G2 voltage without the need for such a rare item as a standalone 170V power supply? Probably! But the Test Case workshop now has a suitable power supply, nicely cased and mains-isolated. Hand-built by TV Ted and Ray, it's based on a small 230V 1:1 transformer, a bridge rectifier, a reservoir capacitor and a beefy potentiometer. It's strictly a low-current job, protected by a little fuse!

NEXT MONTH IN TELEVISION

DTT reception

Dr Les May suggests that digital terrestrial television is not all it's cracked up to be. He has been able to view DTT for about two years but reception has proved to be far from reliable, despite being in an area where the signal strength should be more than adequate and with no local conditions that could cause problems.

Vestel power supplies

Many modern TV sets are fitted with a chassis of Vestel manufacture. The widely used 11AK19 and 11AK37 chassis and some others use a similar power supply that's based on the MC44608 controller/driver chip. Stephen Williams describes the operation of the basic circuit, including the standby mode, and lists some of the faults that can be encountered.

Vintage repair: the Pye P202BQ

Pete Roberts recently had one of these early UK-made transistor radios, dating from about 1964, in for repair – it was a non-worker. He describes the tests carried out and the remedial action required to restore normal operation.

PLUS ALL THE REGULAR FEATURES

Published on the third Wednesday of each month by Highbury Business, Media House, Azalea Drive, Swanley, Kent, BR8 8HU. **Highbury Business** is a division of **Highbury House Communications PLC**. **Filmsetting** by Impress, Unit 2, Parkway, Southgate Way, Orton Southgate, Peterborough PE2 6YN. **Printed** in England by William Gibbons Ltd., 26 Planetary Road, Willenhall, West Midlands, WV13 3XT. **Distributed** by Seymour Distribution Ltd, 86 Newman St, London, W1T 3EX. **Sole Agents** for Australia and New Zealand, Gordon and Gotch (Asia) Ltd.; South Africa, Central News Agency Ltd.

Service Link

TELEPHONE 01322 611254
FAX 01322 616376

CLASSIFIED TEL: 01322 611254

FOR SALE

inStore
ELECTRICS LIMITED
171 HAREHILLS LANE, LEEDS LS8 3QE
Tel: 0113 240 1114

Tatung LCD 15"................£239
Philips LCD 15"................£299
Philips LCD 17"................£299

Other models available.
CALL FOR FULL PRICE LIST

"The television engineer's wholesaler"

ICC17 LOPTX Kit
Ferguson W7023U etc.
Thomson 24WK23U etc
Pt no. 10608670P1 £24.95

GRUNDIG EHT TRAY
BG1899022644 £18.95

www.IrwinElectronics.co.uk
Telephone 0114 273 9622

RECRUITMENT

***Visual FX* Service Centre**
Require

Workshop and Field Service Engineers – Brown Goods

Field and workshop TV/VCR/DVD and Audio engineers.

These permanent positions are based from our service centre in romford that covers London and the Home Counties.

Experience to repair at component level is essential.

Relevant qualifications and a proven record in service industry essential along with self-motivation and a positive attitude.

Very competitive salary and benefits for the correct applicant.

Please call Jason Megauley on 01705 383110/383111

PROJECTOR SPARES

Spare parts and service information for
VIDIKRON
video projectors from
PROJECTSPARES
Tel: 01444 831769
Fax: 01444 831580
E-mail:
projectspares@btinternet.com

SERVICE DATA

SERVICE MANUALS

Have you ever turned away work for want of a Service Manual? Have you ever brought a Service Manual and never used it more than once? Then why not join ...

THE MANUALS LIBRARY

For details and membership application form write, phone or fax:

HARVEY ELECTRONICS
43 Loop Road, Beachley, Chepstow, Mons, NP16 7HE
Tel/Fax No: 01291 623086
Visa: Mastercard accepted

Fryerns
Service Information — FES — Circuit Diagrams

TV's, VCR's, SATELLITE CAMCORDERS, AUDIO & HI-FI's

Prices are from £5.50 + £2.75 P&P add a further £5.50 per item in the same order
note: some items priced individually

we now supply universal tv/video remotes at competitive prices

Payment by credit card, PO or cheque
Tel:Fax 01206 211570
e-mail: colin@fryerns.fsbusiness.co.uk

2 The Lodge
Easthorpe Green
Marks Tey, Colchester
CO6 1HA

U-VIEW
Television Servicing 9
Now available on CD-Rom only
Special Price **£49***

Contains Schematics, Adjustments, Circuit Descriptions, Parts Lists, Fault-finding Guides.

Over 300 models covered.
Leading manufacturers and supermarket brands included.
Contact us for full model listings.
**Price applies to purchasers of TV7 or TV8 CD, otherwise £59.*
(Please add £2.50 p&p)

U-View Publishing
(Mail Order Only)
73 St.Martins Avenue Doncaster
Yorkshire DN5 8JA Tel:01302 780270

www.u-view-circuits.co.uk

WANTED

BEST CASH PRICES PAID

FOR VALVES KT88, PX4 AND MOST AUDIO/OTHER TYPES.

Tel: 01403 784961

Billington Export Ltd
Sussex RH14 9EZ
Fax 01403 783519
Email: sales@bel-tubes.co.uk
Visitors by appointment

LINEAGE

TELEVISIONS fully serviced. Ready for immediate sale. 4x3 Models. Low prices. All enquiries Tel: 01209-718043. 11am-4pm.

SERVICE DATA

NEED HELP NOW?

Then ring the
★ **ELECTRON TECHNICAL HELPLINE** ★
Genuine help available to all repairers of
T.V. - V.C.R - SAT - AUDIO
(Inc Valves)
Over 30 years experience and vast data base

0906 470 1706
Calls cost 60p per minute

WANTED

WANTED Surplus or Obsolete Electronic Components

Turn your excess stock into instant cash!

SEND OR FAX YOUR LIST IN STRICTEST CONFIDENCE

Will collect anywhere in the UK

Mushroom
COMPONENTS

28 College Street, Kempston, Bedfordshire, MK42 8LU
Tel: 01234 363611 Fax: 01234 326611
E-mail: sales@mushroom.co.uk
Internet: www.mushroom.co.uk