

THE LEADING UK CONSUMER ELECTRONICS TECHNOLOGY MAGAZINE

# TELEVISION

SERVICING · VIDEO · SATELLITE · DEVELOPMENTS

NOVEMBER 1999 £2.80

## Berlin Radio Show report

Servicing GoldStar  
T/LG W series VCRs

Microcontrolled video  
surveillance system

C-band digital  
TV reception

Servicing IBM 6322-  
002 SVGA monitors



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# CONTENTS

November 1999

Vol. 50, No. 1

## The Sony Story

3

## What a Life!

6

A medley of faulty VCRs and TV sets and their curious owners. **Donald Bullock's** servicing commentary.

## Teletopics

8

The analogue TV switch-off, hard-disk recording systems, video-on-demand, business and other news.

## Servicing the IBM Monitor type 6322-002

10



**Ian Rees** provides a servicing guide for these reliable workhorse SVGA monitors.

## Satellite Notebook

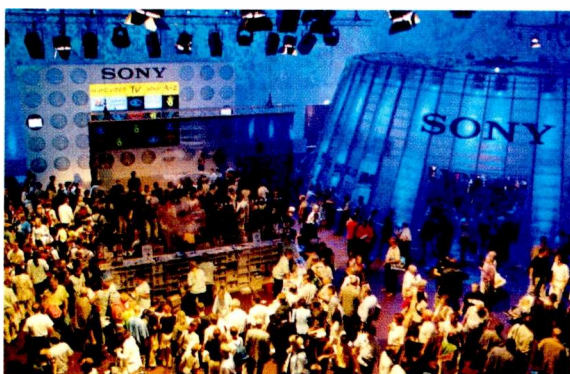
14

Solutions to problems with satellite equipment and installations. Some initial experiences with digital TV.

## IFA '99

16

Highlights of the Berlin Show included the new Multimedia Home Platform, mobile TV, the Free Universe Network, hard-disk storage, DVD recorders,



the Super Audio CD and DVD-Audio formats and MP3, the internet audio system. **George Cole** reports on the technology and products that were on display.

## Satellite Workshop

22

**Jack Armstrong's** column on satellite receiver servicing.

## Test Case 443

23

## C-band Digital TV Reception

24

**Hugh Cocks** on the equipment required for reception of C-band digital satellite TV signals and how to set it up and get started. With plenty of practical know-how.

## VCR Clinic

28

## Service Casebook

30

**John Edwards** describes recent TV servicing experiences.

## Help Wanted

35

Can you help these readers with their spares, service data and other repair problems?

## TV Fault Finding

36

## Simple Video Surveillance System

40



**Denis Mott** presents a microcontroller-chip based security system that enables intruder movements to be recorded. Date and time details are added.

## Servicing GoldStar P, T and LG W series VCRs

42

These reliable, easy-to-service VCRs have simple on-screen displays for setting up and auto-tuning. They are ideal for refurbishment and re-use. **J. LeJeune** passes on practical experience gained from servicing large numbers of them.

## DX and Satellite Reception

48

Terrestrial DX and satellite TV reception. An omnidirectional, wideband aerial system for Band I DXing. **Roger Bunney** reports.

## Letters

52

Spares buying is a vital skill in the repair trade, especially in these difficult times. More on the VCR soak tester and the current situation in the trade. What is an antique VCR?

## Monitors

54

Hints and tips on PC monitor repairs.

## Next Month in Television

55

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# The Sony Story

The recent death of Akio Morita, co-founder of Sony, from pneumonia at the age of 78 has drawn attention to the company – its fascinating history, extraordinary inventiveness, successes and failures. Morita formed Sony with Masaru Ibuka in 1946 as Tokyo Tsushin Kogyo (Tokyo Telecommunications Engineering) – the name Sony was to come later, when Morita realised that a simple, readily-identifiable brand name was essential for marketing purposes, particularly overseas. In the early days, in war-shattered Japan, the company had a simple aim: innovation. Various things were tried, but the first significant step was when the potential of the transistor was appreciated: in 1952 the company applied to Bell Laboratories for a licence to use this new device. It took a year to obtain the licence, and a further six months to obtain the foreign currency required. Bell was not at that stage too enthusiastic about its invention: it considered the transistor to be a low-frequency device that was suitable only for applications such as hearing aids. Sony had other ideas, and by 1955 had developed and started to market transistor radio receivers. In fact Sony undertook considerable research in this field: in 1973 it received a Nobel prize for its work.

Sony didn't take long to develop transistor monochrome TV sets, which it started to sell in 1959. Also in the mid-Fifties the company produced Japan's first audio tape recorder. This was to lead to important developments later in the video field.

The Sony ethos, established by Morita, Ibuka and other senior engineers, was to innovate and develop its own solutions. Hence the Trinitron colour TV

tube, which appeared in 1968. Sony had delayed getting into colour TV because it didn't want to adopt standard shadow-mask tube technology. In its search for something different it experimented for a time with the Chromatron tube, and actually marketed a set that used this tube. It wasn't a success, and in 1966 Sony was unsure what to do next. A Sony engineer came up with the idea of the Trinitron tube: its development, in just two years, was one of Sony's most remarkable achievements. It was initially a small-screen (11in.) tube, and there were those who felt it would never graduate to larger screen sizes. They were wrong.

Sony's Trinitron technology probably did more than anything else to make the company an international one. Its first overseas TV assembly plant was opened in the USA in 1971: only three years later, in 1974, Sony opened a plant at Bridgend to serve the European market.

During the early Sixties Sony also became involved in video recording. The company's 2000 series reel-to-reel system was developed and was on the market by 1967. It was a helical-scan system with some typically original features. To reduce the bandwidth, every other field was recorded then played back twice. Work in this field continued, forming the basis of Sony's subsequent successes in the professional/broadcast video market. A cassette video system, Betamax, came along in the mid-Seventies. It was technically excellent but for various reasons, in particular the ability to provide longer playing time, took second place to JVC's VHS system. Later Sony had considerable success with its 8mm video system, in particular with camcorders.

The Walkman portable audio system,

in which Akio Morita was personally involved, was introduced in 1979 and was an instant success. It certainly, for a younger generation, became their introduction to the Sony world. MARVICA, a solid-state photographic system, was announced in 1982: it used a CCD imager and was able to store fifty still pictures on a small disk. Much more significant however was the launch of the compact disc, developed with Philips, in 1983. It changed the world of audio recording. Sony had for some time previously been working with Philips – Akio Morita was impressed by this company's emphasis on technological research – and the liaison continues up to the present, with the introduction of the SACD system. More recently Sony has had great success in the video games market with the PlayStation. This is an on-going development, with internet access and other features being added.

For a company that started in 1946 with a £300 loan these achievements are remarkable. But in the late Eighties the company decided to become involved in programme software as well as its traditional electronics hardware. CBI Records and Columbia Pictures were bought in 1989. This involved great expense and caused considerable difficulties – the company was not geared up to handle this sort of thing. The idea was to be able to ensure the availability of programme material for whatever technological advances Sony came up with in the electronics hardware field. It didn't work out at all well. Nevertheless Sony's ability to come up with innovative new products continues. And there has never been a time when technology has been able to offer more. The Sony Story continues.

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## SATELLITE FAULT FINDING GUIDE

NEW EDITION No. 5

You could say that what Martin Picketing doesn't know about satellite receivers isn't worth knowing. What he does know has become legendary. Having been at it since the start of consumer satellite TV, he has built up a massive database of an satellite TV receivers. Not only on their faults, common and less common but also on modifications and upgrades. Martin brings in-depth expertise to the subject, having previously been involved with equipment reliability testing and component specification. Originally entitled 'Satellite Repair Manual', the book has become established as a bible for satellite TV repair.



But the subject doesn't stand still. New models, new faults - there is always something to add. So here we have the fifth edition, which has been completely updated and now has 300 pages and a more attractive cover. In addition to receiver fault notes and general information you'll find many useful button sequences for resetting parental lock codes, resetting installation choices to factory defaults and other less well known operations, practical information on LNBs with typical current drains, a list of manufacturers and supplier addresses, other useful information and a beginners section. Digital receivers are now available so the manual includes a chapter to deal with these too.

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KIT1 £6.95 Pace - PRD800, PRD900, PSR800, PSR900 Ferguson	SRD5, SRD16, Grundig STR1, Maspro SRE2508/1, 8508/1, Philips STU802/05M, Manhattan 850, 960 Goodmans	KIT4 £6.95 Amstrad SRD 500	KIT5 £6.95 Amstrad SRX820, 340 etc (export models)
ST700, Toshiba TU-SD200, SAT99		KIT7 £4.95 Churchill D2MAC decoder	KIT8 £5.95 Pace MSS100
KIT2 £6.95 Pace - 38900, 9200, 9210, MRD920, Ferguson SRV1, Grundig GIRD2000, 3000, Philips STU801, Network 900, 9200, Bush IRD150, Nokia SAT1500, Maspro SRE2508, 3508, 4608, Alba		KIT10 £13.11 Pace MSS600, 1000	KIT11 £6.95 Ferguson SRD4
SAT6600, Finlux SR5700, Thompson SRS4		KIT13 £39.71 EchoStar SR8500, 7700, 8700	KIT14 £33.95 Amstrad SRD600
KIT3 £8.95 Amstrad - SR510, 520, 540, SRDR45, SRD550		KIT16 £5.95 Amstrad SRD700, SR850, SRX100, 301, 501, 1002, 2001, SRD2000, SAT250	KIT15 £6.95 Bush IRD155
KIT6 £6.95 Pace D100, 120		KIT18 £10.52 Amstrad SRD2000	KIT16 £6.95 Amstrad SRD650
KIT9 £9.45 Pace MSS200, 300, Apollo		KIT19 £25.95 Maspro ST 5 Grundig 150, 250, 280, 300 Matsui Rd600 Minerva	KIT17 £6.95 Maspro ST-8
KIT12 £16.45 EchoStar SR5500 (early PSU with adjuster)		KIT23 £7.95 Nokia SAT1700 (mainly surface mount)	
KIT15 £7.36 Mimtec (Sorenson PSU type only)			
KIT17 £8.95 BT SV8800			
KIT20 £5.95 Maspro ST 5 Grundig 150, 250, 280, 300 Matsui Rd600 Minerva			
KIT22 £9.95 Philips STU909			

# Economic Devices

32 Temple Street, Wolverhampton, WV2 4AN, UK Tele ++ 44 (0)1902 773122 Fax ++ 44 (0)1902 429052

# What

# a Life!

## A medley of faulty VCRs and TV sets and their curious owners. Donald Bullock's servicing commentary

**A** rather crumpled-looking fellow sauntered in just as we were opening up the other day.

"It's broke, like" he said. I looked at him closely and noticed his small, close-set eyes and narrow brow.

"What's broke, like?" I asked.

"Ain't mine, it's me brother's."

I looked at him afresh. "Yes, but what's broke?" I asked.

"Got it from Dixons" he continued, "his wife's terrible."

Just then Steven came in. I lit my face up and turned to him.

"Gentleman to see you" I said. "I'll go put the kettle on."

When I returned, some time later, Steven was standing at the counter rubbing his temple. His eyes were closed.

"Sorry" I said. "What was it all about?"

"He's gone off to get his video recorder. Says it's broke."

"You mean his brother's recorder?" I asked.

He waved his hands in the air and turned away.

It wasn't long before the chap returned with the VCR. I slipped behind the scenes as Steven managed a slight smile and drew up a job card.

"Name?" he asked.

"Mitsubishi, like."

"No *your* name" Steven said.

The fellow broke into a smile.

"Oh, my name. Harry, like."

Steven wrote Harry Like on the card. "And the trouble?" he asked, looking straight at Harry while tapping the recorder to concentrate attention on it.

"Tangles, like."

### Idler Problem

It was a Mitsubishi HS651V. Steven passed it to Paul who tried it out. When record was selected the

take-up spool remained still for about three seconds then caught up. When eject was selected the tape tangled within the machine because of a tape loop.

"Had this before" Paul said, "there'll be a broken spring in the play/rewind/fast forward idler/clutch assembly. It's a small spring whose tail locates in a slit in the centre pin section. In the play mode it slips, but when the supply reel is taking up the tape it locks via the tail and slit to provide higher torque. I reckon its tail has broken." "Can you fit a new spring?" I asked as he continued to dismantle the machine.

"No, you have to fit a new idler assembly" he replied.

His diagnosis was spot on, and it didn't take him long to get the machine working properly again.

"Chap called Harry Like brought it in" I said, "you might check his loose screws when he comes back for it."

### Interlude

Greeneyes copped in. "They've a lovely white trouser suit in Marks" she announced.

"Fruit and sparks?" I asked, turning my ear towards her.

"There's no need to start being funny" she said, then walked to the other end of the workshop where she started whispering to Paul.

"He's getting good at pretending to be deaf when he doesn't want to hear. And it's only a hundred and fifty pounds."

I spun round. "A hundred and fifty pounds!" I bawled, "here, have one of my old suits and cut it down."

### Wooo-eee

"Excuse me" bawled a voice.

It was Mrs Scurf. She was carry-

ing a Panasonic VCR, Model NVJ35.

"Belongs to my husband, dear. He's all right but 'e keeps going wooo-eee, wooo-eee, wooo-eee."

"And what about the recorder?" asked Steven, producing one of his charming smiles.

Mrs Scurf laughed loudly and slapped her thigh. "That's a good 'un. Ooh ah, ha, ha. Yeah, that's a good 'un all right."

We all smiled politely. This one was also passed to Paul, who tried it out and delivered another of his verdicts.

"Poor capstan servo lock" he declared, "it'll be C1122 in the power supply gone low in value. Should be 330µF." When checked it produced a reading of 90µF.

### An Ivory Cabinet

Mrs Grunge called in with her son Oscar. He was carrying a large ivory cabinet that housed a Sony TV set, Model KV1612UB2.

"Tell Mr Bullock the trouble" she said. Oscar breathed in.

"Tell him, Oscar" Mrs Grunge said before Oscar had had a chance to say anything.

He pointed up to the light and, when his mother followed his gaze, came through with a description.

"It makes a pumping sound and the picture is narrow, like the side view of a fried egg, which rises and falls in the bottom third of the screen."

"Crikey" we said in unison.

As we didn't have a service manual we telephoned Jim, the Sony expert. He directed our attention to the power supply board and read out the voltages we should find at the output plug. The one that was wrong was the HT (B+) voltage, which was 90V instead of 150V. The obvious place to look



for the cause was in the error sensing stage. Checks here revealed that R630 in the transistor's base bias network was open-circuit while R604 had risen in value to over 22M $\Omega$ . Once replacements had been fitted the set produced a normal picture.

### A JVC VCR

Steven pulled up a JVC VCR, Model HRD500EK. According to the job card the complaint was "intermittent erasure and recording of sound". He connected it to a monitor and tried a tape. There was indeed intermittent sound. A scope check showed that the bias voltage was being generated, at the correct amplitude. It was present right up to the erase head. So the head was suspect. But when Steven began to unsolder it he found a break in the central conductor. Resoldering it cured the trouble.

Then Paul called him to the phone and, as he had to jam his finger into his ear to hear what was being said, I turned the monitor's volume control to zero and wandered off to make some tea.

When I returned Steven was examining the innards of the VCR, surrounded by meters, test tapes and the oscilloscope. He was looking hot and bothered.

"Can't understand it" he gasped. "Seems I couldn't have repaired the fault. Now there's no sound at all. But these instruments tell me there's nothing wrong. I've checked just about everything."

"Er . . . have you checked to see if the monitor's volume control is turned up?" I suggested.

He checked and the sound rang out.

"Sorry" I said.

### Abe's TX85

The phone rang. It was Brother Terry.

"Weather's going to be foul up your way in about twenty minutes" he said.

"How can you be so sure?" I asked.

"Old Abe is heading your way with something wrapped in his horse blanket" he replied.

Abe lives in a shanty by the river. For entertainment he keeps two portable TV sets, a car battery and a screwdriver. The latter is used to mess about with the sets, which he then brings to us to put right. He doesn't bother with wash-

ing, and seems to have no sense of smell. Otherwise he's harmless enough.

When he arrived he was humming. To encourage him to unpack his set outside, we came out with a job card and a pen.

"Morning Mr Bullock, sir" Abe said. "I never as much as looked at 'im, honest. No, 'e just went dead all by hisself."

It was a Ferguson 14J9 colour portable, which is fitted with the TX85 chassis and TA185 battery converter. Steven took it in and put it on his bench. When he switched it on he found that there was 340V across the mains bridge rectifier's reservoir capacitor C69 (47 $\mu$ F), but otherwise the set remained dead.

He switched off to make some cold checks. The two 82k $\Omega$  start-up resistors R89 and R91 were both OK, also the 390k $\Omega$  resistor R60 which is in parallel with them. So he unsoldered the cathode of the HT rectifier D12, which produces the 95V supply for the line output stage, and wired a 60W bulb between its cathode and chassis. When he switched on again the bulb didn't light up. To be sure that the cause of the fault was in the power supply and not elsewhere, he disconnected the rectifiers that produce the 12V and 13V supplies, D13 and D14 respectively. No difference. So something was wrong in the chopper circuit.

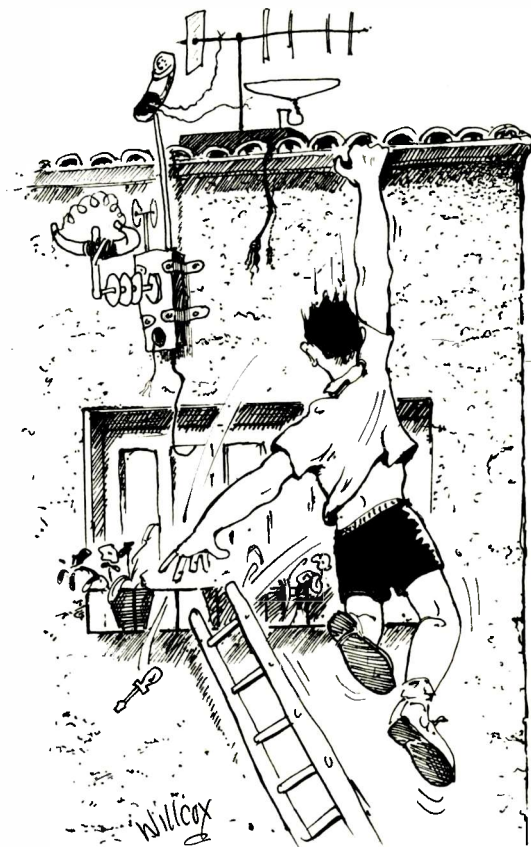
He returned to the chopper control chip IC4, which is a TEA2018A, and did what he should have done at an earlier stage: he checked the voltage at its supply pin 6. Once the voltage here rises above 5.8V, the chip should start to produce drive pulses for the chopper transistor TR6. In normal operation the voltage at pin 6 should be about 11V. The voltage was missing, though the start-up resistors were all right. Why no voltage?

There were two possibilities, the chip itself or C71 (330 $\mu$ F), which is the reservoir capacitor for the chip's supply. The capacitor proved to be OK, so Steven fitted a new TEA2018A. The voltage then appeared and the set worked well enough.

### The Suit

Then Greeneyes copped in. She looked stunning in a white trouser suit and a pair of green shoes.

"You're so good to me" she



**Bas asked for technical details . . . I daresay he has it working by now**

breathed, giving me a hug.

"So it seems" I said, wondering how many bottles of whiskey I could have got for a hundred and fifty quid.

### FM Transmitter

I had a letter the other day from a regular *Television* reader Bas Carter, who nowadays lives in Malaga, Southern Spain. He read my recent piece about the FM transmitter I knocked up – the one that sends BBC radio programmes around our house and plot in Spain. You might recall that I receive BBC Radio 1, 2, 3 and 4 by satellite and feed the signals to the transmitter. This enables us to hear the programmes wherever we are in the house or garden. It's comforting to be able to enjoy such well-produced British programmes while we soak up the sun, the wine and the tranquillity of Spanish life.

Bas asked for technical details, and when he received them he phoned me to say that he too was building one. I daresay he has it working by now.

# TELETOPICS

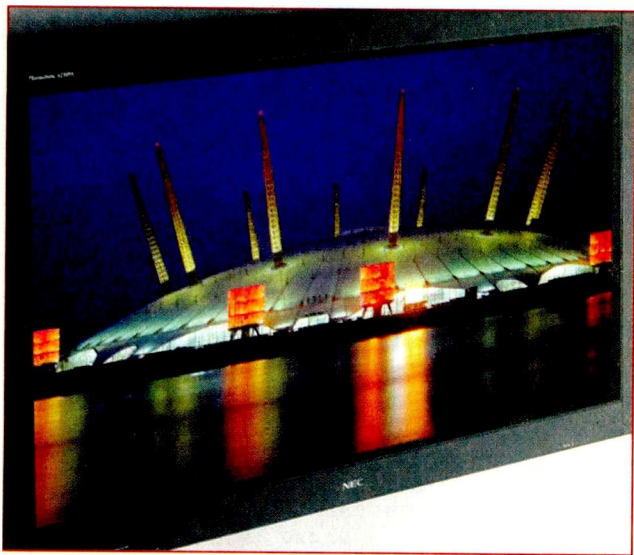
## The Analogue TV Switch-off

Speaking at a recent Royal Television Society conference in Cambridge, Culture Secretary Chris Smith announced that the close-down of analogue TV transmissions in the UK could start as early as the year 2006 and be completed by the year 2010. But he emphasised that for this to happen a number of conditions would have to be met. These are as follows: digital TV transmissions must be available to 99.4 per cent of the population (as with current analogue transmissions); digital receiv-

ing and recording equipment should be affordable for everyone including pensioners and those with low incomes; existing free-to-air channels must continue to be available free in digital form; 70 per cent of homes should be equipped for digital TV before a firm switch-off timetable is announced; and 95 per cent of viewers should have access to digital receiving equipment before the switch-off is completed. He expressed the hope that significant progress towards these goals will

have taken place by the time of the first review in 2001.

A Viewers Panel, which will include consumer and pensioner groups, is to be set up to advise the government during the run-up to the transition from analogue to digital TV. The government also wants it to be easy for viewers to be able to switch between different pay-TV services. Mr Smith has asked the ITC, Ofcom and the OFT to advise on options for ensuring that the digital TV market does not develop in a way that inhibits competition.



NEC has won an order for the supply of plasma TV screens and LCD projectors to the Millennium Dome. Up to 300 42in. plasma displays and 100 projectors are expected to be required. Plasma screens were chosen because of their thinness – under 100mm – and wide viewing angle.

## Video-on-demand

NTL has signed an agreement with DIVA UK Ltd. to launch video-on-demand services on its cable TV networks in mid-2000. DIVA UK Ltd. is a wholly-owned subsidiary of DIVA Systems Corporation, which was formed in June 1995 with headquarters in Redwood City, California. DIVA launched its first commercial cable-TV VOD service in the autumn of 1997: currently six cable networks in the USA use the system. NTL says that its VOD service will provide better picture quality than an ADSL-based system as the data rate is about 4Mbits/sec, twice that available with ADSL. The DIVA system has pause, fast-forward and rewind features.

NTL's service will be provided via broadband networks with no need for hardware upgrades or specialist installation. There will be access to some 350 films initially, at a charge of £3 a time.

Telewest is to hold VOD trials in over 20,000 homes early next year, using technology from SeaChange and nCUBE.

General Instrument has demonstrated an interactive digital terminal that offers VOD, internet access, e-commerce and 3D interactive TV racing games: the demonstration used a DV15000+ DVB-compliant set-top box with Microsoft TV software based on the Windows CE and WebTV technologies.

## Hard-disk Recording Systems

A system called XTV (Extended Television), which adds a hard-disk drive inside a set-top box, has been unveiled by Pace and NDS. Unlike other hard-disk video recorder systems, XTV can be controlled by both the user and the broadcaster. The latter can transmit Metadata (descriptive data) which the set-top box can use for storing specific programmes and advertisements. Thus XTV can be used for targeting advertisements at specific groups of viewers. The data can be used by

smart software within the box to pick out and store programmes the viewer is likely to want to watch: it learns by comparing the transmitted data with viewer use. The hard disc has a storage capacity of 15Gbytes, sufficient for up to eight hours of programme material.

NDS and Pace are also developing a central security server for home use. This consists of a digital set-top box with an IEEE 1394 (FireWire) interface to connect it with other domestic appliances.

The companies say that other network standards, such as Ethernet and Bluetooth, could also be used.

Interactive TV software developer OpenTV, whose software is used by the SkyDigital service, has announced plans with French broadcaster TPS to provide integrated digital set-top box/hard-disk drive units. The aim is to provide viewers with a "virtual video store".

For more on this subject see our IFA '99 report on page 16.



## Video Scene

Philips Semiconductors has unveiled Nexperia, a digital video platform (DVP) for equipment that combines various systems such as digital TV, internet capability and DVD operation. It's a hardware/software architecture that will be the basis of the company's video systems. The Nexperia specification includes a MIPS-licensed Risc core, an on-chip memory bus and Integrated Systems' pSOS operating system. There is the option to use dedicated hardware blocks such as an MPEG-2 decoder, Philips Trimedia processor or a combination of the two. This enables a range of digital TV standards to be handled by equipment intended for different price ranges. There is future-proofing since new features can be easily added. This can be done as software initially, then permanently as hardware.

Matsushita and Microsoft have developed a digital video protocol driver for editing and processing images transferred from a DV camcorder to a PC. The DV Protocol Driver sends and receives data or AV/PC commands to control the camcorder via an IEEE 1394 interface. The new driver has been incorporated in the latest edition of Windows 98, which was launched in Japan in September.

Optical storage technology being developed in Japan could enable up to forty two-hour films to be stored in digital form on a 12in. disc – the discs have a potential storage capacity of 200Gbytes. Development work is being carried out by government researchers in conjunction with Sharp. The discs could be available commercially in two-three years. They would however have to compete with rapid advances in hard-disk storage sys-

tems and multi-layer DVD discs.

NEC has developed a single-chip Dolby Digital encoder for use in consumer electronics devices such as DVD and D-VHS recorders. The uPD61003 consists of a 26-bit digital signal processor with approximately 1Mbyte of on-board memory.

Sony has launched two Walkman-sized camcorders. Models DCR-PC2 and DCR-PC3, that incorporate a Carl Zeiss Vario-Sonnar lens. This gives near-professional quality images. The two camcorders are also the first super-compact models to feature Sony's Nightshot technology, which enables recordings to be made in total darkness. Prices are expected to be in the region of £1,100 for the PC2 and £1,300 for the PC3.

Grundig has launched the Arganto range of four IDTV sets with 16:9 format tubes. Model MW70-500 is a 28in. Nicam set, Model MW70-505 a 28in. Dolby Pro-Logic set, Model MW82-500 a 32in. Digital Stereo set and Model MW82-505 a 32in. Dolby Pro-Logic set. Sony has launched two IDTV sets, Models KV28DS60(S) and KV32DS60(S) – the first numbers indicate screen size in inches. Both models incorporate a digital terrestrial tuner and have 100Hz scanning, an EPG and 16:9 FD Trinitron Wega tubes.

According to a recent report from analyst Strategy Analytics over 11 per cent of US homes will own a DVD player by the end of the year, rising to 58 per cent over the next three years. Ownership in Europe is much lower: only four per cent of households are expected to have a DVD player by the end of the year.



Black Star has introduced the PVG1000 video pattern generator as a low-cost option for testing monitors, covering a wide range of resolutions – up to 2,048 x 2,048 pixels. The PVG 1000 can generate 100 video patterns and timing formats for most systems, including MDA, PGA, VGA, SVGA, VESA and XGA. Users can also create systems of their own, so that new formats and non-standard systems are covered. The timing range is 10-150kHz horizontal and 10Hz-1kHz vertical. Dot clock range is 8-110MHz (135MHz and 170MHz optional).

Hundreds of pre-defined patterns are available, including circles, gratings, dots, text and test cards. Use of the pattern editing system makes it possible to create and store customised patterns, which can be text-annotated to make test procedures easy to follow.

Analogue and digital D-type and BNC connectors are provided. To aid fault-finding, vertical, horizontal and composite sync signals are available separately at the rear panel. Colour levels (red, green and blue) can be individually adjusted from 0-100 per cent. The gamma factor can also be separately adjusted.

Operation is via the front-panel keyboard or a PC using the RS232 interface provided. Storage of video systems can be in a PC or the instrument's non-volatile memory. Data can be sent between PVG instruments so that new units can be rapidly programmed with customised pattern and timing formats.

The PVG1000 costs £1,699 plus VAT. For further details contact Black Star Instruments, 2 Glebe Road, Huntingdon, Cambs PE18 7DX. Phone 01480 412 451, fax 01480 450 409, e-mail blackstar@ttinst.co.uk

## Business News

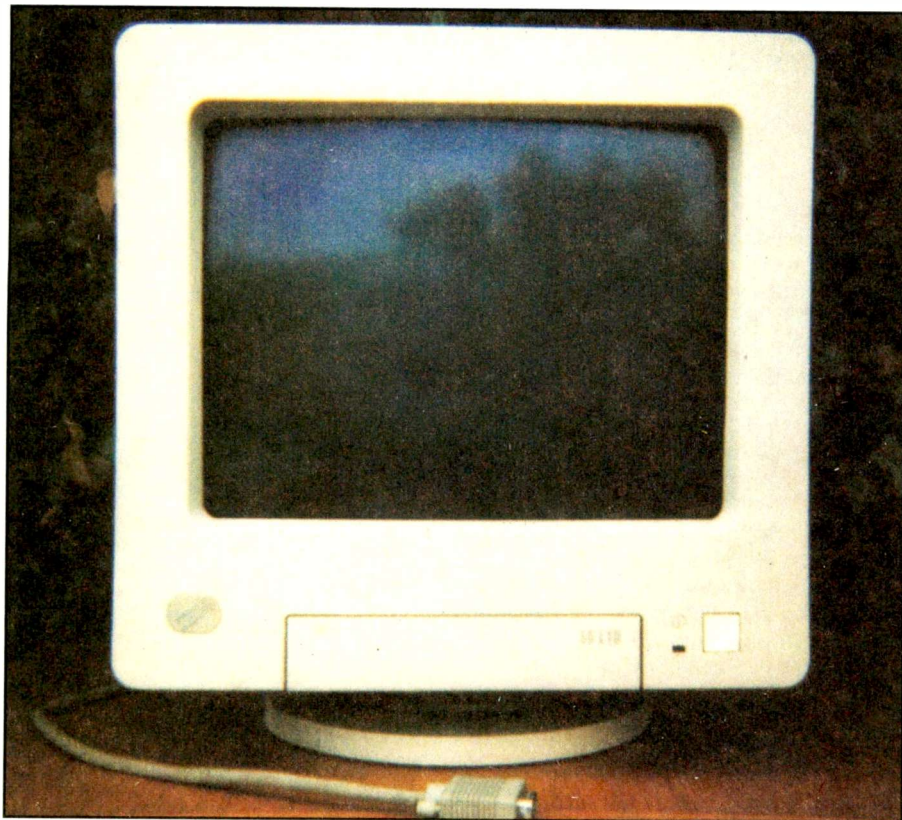
General Instrument, a major US developer and manufacturer of set-top boxes, has been taken over by Motorola in a \$11bn deal. Motorola has developed its own set-top box technology, but GI has a large market share and key technologies. According to a US market research company (Allied Business Intelligence) the number of set-top boxes in use worldwide is expected to reach 252m by the end of 2004. Motorola obviously sees this as a vital market.

NEC and Mitsubishi Electric have decided to combine their computer monitor development, manufacturing and marketing operations because of intense competition in this field. The new venture will be up and running in January. According to NEC it will be the world's third largest supplier

after Samsung and Philips. During the past year computer monitor prices have dropped by almost fifty per cent for 15in. models as new capacity has been brought into operation in Taiwan and Korea.

Toshiba has announced that it's likely to remain in the red for the second year running. The company blames low semiconductor prices and restructuring costs.

Eurosat, suppliers of Manhattan brand satellite receivers, has relocated from Unit 1 to Unit 5, Oxgate Centre, Oxgate Lane, London NW2 7JA. A substantial increase in export business has necessitated the move. The phone/fax numbers remain as before – 0208 452 6699 and 0208 452 8788 respectively.



Ian Rees provides a servicing guide for these reliable workhorse SVGA monitors that often outlive the units with which they were originally supplied

# The IBM Monitor

## Type 6322-002

These IBM Valuepoint SVGA monitors, which were manufactured in the early Nineties, are well-made workhorses. Many have appeared in the second-hand market. They are able to give good service, with a minimum of repair effort, long after the base units with which they were sold have been discarded.

### Danger

Repairs should not be carried out on any monitor unless you have an isolated mains supply and a good knowledge of working with equipment in which live mains and/or very high voltages are present. When the PCB is exposed, there are areas where live high AC and DC mains voltages are present. I always cut out a stout cardboard mask which I tape over the PCB to screen off live track while troubleshooting.

### Measurements

Voltage readings obtained from the ICs, power supply diodes and key components in working equipment form a useful basis for fault-finding when defective equipment comes along.

The voltages specified in these notes are direct readings taken from a working chassis. All are DC and were measured with a high-impedance digital voltmeter. They are relative to either the isolated chassis 'earth' or to the power supply live side 'earth' – a convenient point for the latter is the terminal for the LOPT feedback (single loop)

Brightness control	2V2	1	20	4V9	Ch 1 current out
Ch 1 signal input	3V2	2	19	0V5	Ch 1 voltage out
Ch 1 gain	5V3	3	18	5V6	Ch 1 feedback
Chassis	0V	4	17	4V9	Ch 2 current out
Ch 2 signal input	3V2	5	16	0V5	Ch 2 voltage out
Contrast control	4V7	6	15	5V5	Ch 2 feedback
Supply V	7V9	7	14	4V9	Ch 3 current out
Ch 3 signal input	3V2	8	13	0V5	Ch 3 voltage out
Hor blanking/off	0V3	9	12	5V6	Ch 3 feedback
Clamp/frame blanking	0V5	10	11	5V7	Ch 3 gain

**TDA4881 SVGA video controller Z701. Location CRT PCB**

Input 1	3V1	1	14	5V2	Supply V
Output 1	0V6	2	13	3V5	Input 6
Input 2	0V6	3	12	0V	Output 6
Output 2	4V5	4	11	0V	Input 5
Input 3	0V	5	10	5V2	Output 5
Output 3	5V2	6	9	4V3	Input 4
Chassis	0V	7	8	0V6	Output 4

**74HCT14N hex inverter Z702. Location CRT PCB**

3V	1	8	5V
2V5	2	7	12V1
0V1	3	6	2V
2V6	4	5	0V

**UC28434AN chip Z400**  
Location D2/Y230, X150

2V3	1	Input +
2V3	2	Input -
13V7	3	Supply V
6V4	4	VO-B
0V	5	Chassis
44V5	6	Flyback V
6V2	7	VO-A
0V2	8	Guard output
6V4	9	Feedback in

**TDA8351 vertical output chip Z300**  
Location D3/Y215, X245

8V9	1	6	NC
8V	2	5	2V4
NC	3	4	0V

Pin 1-2 voltages relative to -ve chassis, pin 5-6 voltages relative to the rear sync terminal – see text

**TCDT1101A optocoupler Z101**  
Location D6/Y70, X100



wire close to the chassis-mounted mains socket. Take care when checking around the optocoupler Z101: it straddles the live and isolated sides of the power supply.

A standard set of fully-saturated colour bars was being displayed while the measurements, except the RGB outputs, were being made. The contrast, brightness and geometry were adjusted to provide a normal display.

**Component locations**

The initial notes I compiled usually involved making a time-consuming sketch of the chassis etc. to pinpoint components for future reference. But IBM in its wisdom printed a location grid on the component side of the PCB. It runs from A to F right-to-left along the front edge and from 1 to 7 down the length of the PCB, front-to-back, viewed from the rear.

I've come across some of these monitors without the markings. My personal way of noting component locations is simply to use an X-Y grid measured in millimetres from the rear left corner of the PCB (component side). This method will also locate components on the solder side with the PCB turned over.

Component locations in these notes are shown with the IBM grid position first and my X-Y grid second, i.e. E1 = Y300, X85. If your PCB has the printed grid, E1 will

find the component. If not, measure 300mm up and 85mm across from the bottom left-hand edge of the component side of the PCB.

**Access**

Unlike earlier IBM monitors, this one is easy to get into. Two T25 Torx screws secure the case shell under the front bottom edge of the screen. Remove them then hinge the bottom edge of the shell backwards and up slightly. Once it's in this position a rap with the palm of the hand at the top centre of the shell will unlatch it.

With the cover removed, access to the component side of the PCB is gained by turning the monitor on its side and pushing the two case latches inwards: they are at the front underside, near where the case fixing screws were before you removed them.

Gently ease the bottom out backwards. Don't lose the light pipe for the green pilot LED. It can become detached when the chassis is moved back.

The amount of access is limited by various leads that are attached to the CRT and the casing. Unplugging the earth lead from the mains socket and extending it with crocodile clips on a fly lead will help.

Be careful not to damage the delicate ribbon cable that attaches the front control panel to the chassis. This cable can be detached, without affecting the monitor's operation, if no adjustments to the display are necessary. To do this, pull back the outer sleeve clamp on the chassis socket and pull out the ribbon. To aid reconnection the ribbon is marked "this side up".

To get at the underside of the PCB, remove the seven 5.5mm hex-headed screws on its top side and release the six plastic latches on the plastic frame.

When refitting the PCB, note that its front edge locates under two tabs

Ch 1 output	2V1	1	8	12V1	Supply V
Ch 1 -ve input	2V7	2	7	3V2	Ch 2 output
Ch 1 +ve input	2V6	3	6	2V7	Ch 2 -ve input
Chassis	0V	4	5	2V6	Ch 2 +ve input

**LM358M op-amp chip Z304. Location A3/Y255, X195**

Supply V	12V	1	20	5V2	PLL 2
Line pulse input	0V	2	19	4V2	Line osc capacitor
Line drive output	0V9	3	18	2V5	Line osc resistor
Chassis	0V	4	17	5V5	PLL 1
Frame out 1-	2V3	5	16	2V6	Frame osc capacitor
Frame out 2+	2V3	6	15	2V7	Frame osc resistor
NC	0V	7	14	5V	EW adjust input
Clamp/blank out	0V7	8	13	4V9	Height adjust input
Line sync/video in	4V3	9	12	3V6	Amp control capacitor
Frame sync in	4V3	10	11	1V5	EW output

**TDA4852 HV/VA control chip Z302. Location A2/Y260, X205**

Output 1	0V2	1	8	12V	Supply V
Input 1 invert	7V9	2	7	3V1	Output 2
Input 1 non-invert	2V1	3	6	2V6	Input 2 invert
Chassis	0V	4	5	2V6	Input 2 non-invert

**LM393M dual-comparator chip Z401  
Location C4/Y150, X150**

in the frame. Failure to locate them will mean that all the fixings have to be undone and the PCB refitted to make the chassis fit in the case!

**General Servicing Notes**

The chassis has free-running time-bases and no power saving. This means that servicing is straightforward even when you don't have a signal source.

If the monitor is dead, check for dry-joints at the chassis-mounted mains socket and the green, 0.68Ω wirewound surge resistor R93 (E3 or Y230, X50) which can expire without reason. A gaggle of diodes and resistors near and on the secondary side of the chopper transformer cause a hot spot that should be investigated. Check the ESR of C200, C201, C202 and C204, also C208 and C209. If C208 dries up,

4V9	1	56	4V9
0V	2	55	2V5
0V	3	54	*
4V9	4	53	4V9
4V3	5	52	0V
0V	6	51	4V9
4V9	7	50	4V9
4V9	8	49	4V9
4V9	9	48	4V9
0V	10	47	4V9
0V	11	46	4V9
0V	12	45	4V9
0V	13	44	4V9
4V9	14	43	4V9
2V8	15	42	4V9
0V	16	41	4V9
4V9	17	40	4V9
4V9	18	39	4V9
4V9	19	38	4V3
0V2	20	37	3V5
4V9	21	36	4V8
0V2	22	35	4V9
2V5	23	34	2V6
1V4	24	33	3V7
4V9	25	32	4V9
4V9	26	31	2V6
4V9	27	30	0V
4V9	28	29	4V1

\* Do not measure. See text

**Main microcontroller  
XC86208B  
Location E1/Y300, X85**

**Table 1: CRT voltage readings**

Pin	V DC	Function	Pin	V DC	Function
1	507V	Focus	8	48.7V	Red cathode
4	0V	Chassis	9	0V	Heater earth
5	-44.7V	Control grid	10	6.5V	Heater
6	44.3V	Green cathode	11	44.8V	Blue cathode
7	280V	First anode			

Pins 2, 3 and 12 have no connections. The focus setting range is 436-558V, the first anode setting range 0-332V.

Input 1	3V1	1	14	5V2	Supply V
Output 1	0V6	2	13	3V5	Input 6
Input 2	0V6	3	12	0V	Output 6
Output 2	4V5	4	11	0V	Input 5
Input 3	0V	5	10	5V2	Output 5
Output 3	5V2	6	9	4V3	Input 4
Chassis	0V	7	8	0V6	Output 4

**74HCT14N hex inverter Z702. Location CRT PCB**

Emitter 2	1V7	1	16	1V3	Collector 1
Collector 2	17V2	2	15	0V	Emitter 1
Demag sense in	0V3	3	14	0V	Ground
Min Us threshold	2V2	4	13	1V	In current protection
Supply V	17V2	5	12	6V1	Slow start
Ref current	2V5	6	11	2V8	Sync signal input
Feedback input	2V4	7	10	2V3	Osc capacitor
Error amp	6V4	8	9	2V4	PWM

Voltages are relative to rear sync terminal (see text)

**TDA8380 chopper controller chip Z100. Location E7/Y60, X75**

the tube's DC heater supply will drop and it will look as if it's flat. A check between pins 9 and 10 at the CRT's base should produce a reading of 6.5V DC. No heater voltage is usually because the 1A Wickman fuse F201 has blown or the 1.5Ω wirewound resistor R209 (C5 or Y125, X125) is dry-jointed.

A lot of heat is generated inside the screened box on the CRT's base PCB. Poor colour should lead you to capacitors C735, C775 and C755: uprate them to 4.7μF, 100V, 105°C.

Other than a signal lead problem, intermittent loss of colours etc. will be because of dry-joints at the tube base or the RGB output transistors.

Unfortunately loss of adjustment at the front panel usually means loss of print inside the bubble of the button assembly. A replacement button film assembly is expensive – if you can get one. On occasions I've peeled

**Table 2: RGB output transistor voltages**

Display	Q730 Green	Q750 Blue	Q770 Red
Colour bars	44.8V	45.9V	48V
Red raster	58.6V	59V	37V
Green raster	37.8V	59.1V	58.9V
Blue raster	58.6V	41.2V	58.8V

These voltages were measured from the respective transistor collector tab to -ve chassis. The transistors, type BFQ235, are on the CRT PCB. Their base voltages (5-6V) and emitter voltages (4.9V) did not change under the above signal conditions.

apart an assembly and used silver-impregnated paint to touch in the print. This is tricky and not always successful, because the act of peeling will wreck whatever good print is left! Once set, the display is unlikely to move. So I keep an old bubble switch and set up customers' monitors with confidence that the display will not shift in use. Sometimes a bubble will invert or remain closed, the function running to maximum or minimum. This will lock out any other function adjustment.

**Voltage Checks**

The accompanying diagrams show the voltages to be expected at the various IC pins – all relative to -ve chassis unless otherwise indicated. Do not attempt to measure the voltage at pin 54 of the main microcontroller chip (XC86208B): this will produce complete disruption of the line drive after which the monitor will go into a very nasty and spectacular shutdown. I was lucky that the

circuit wasn't destroyed when I did this by mistake. Table 1 lists CRT (M34KNZ564X51) voltages and Table 2 RGB output transistor voltages under various conditions. The following diode cathode voltages, all relative to -ve chassis, are useful:

**CR200:** 7.8V. Location is D5 or Y120, X85. The tab is the cathode. CR200 feeds the 1AT Wickman fuse F201 at location D5 or Y160, X90.

**CR201:** 89.4V. Location D5 or Y150, X95.

**CR203:** 16.8V. Location D5 or Y110, X90.

**CR204:** 13.8V. Location D5 or Y155, X94. Anode is fed from the 1AT Wickman fuse F200 at location D5 or Y130, X120.

**CR407:** 1V. Location C5 or Y130, X155.

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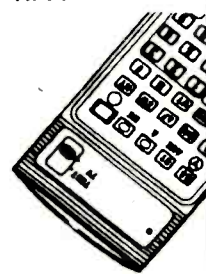
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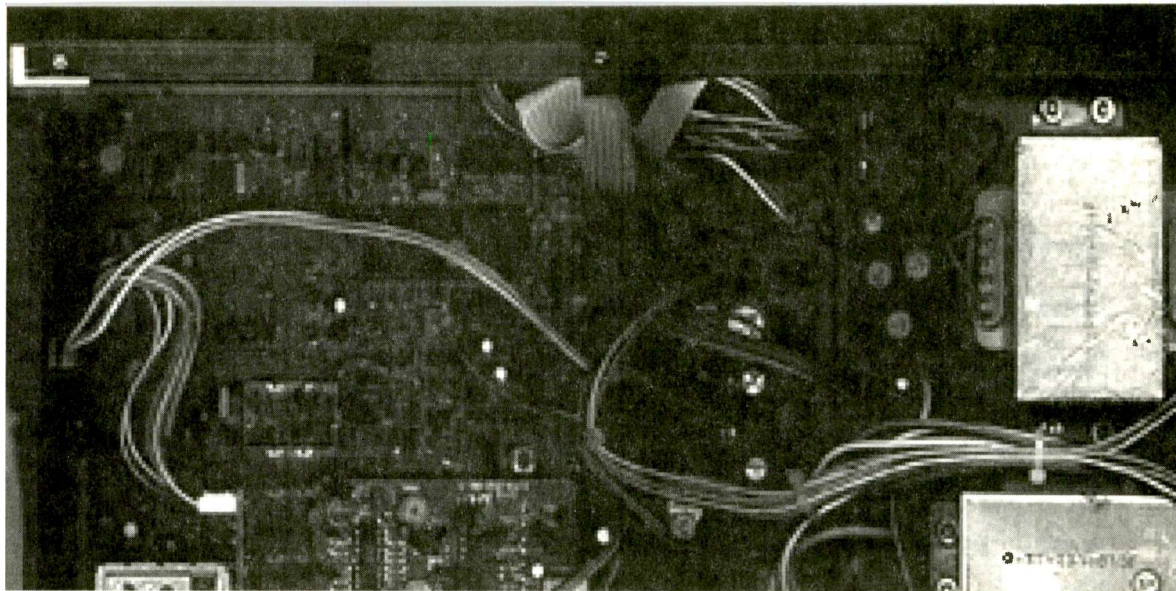


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# Satellite Notebook

*Reports from  
Huch Cocks  
Chris Watton  
Pete Haylor and  
John Hepworth*

## Feedhorn Covers

We've had very little rain here in Spain in recent months. During this time lots of offset LNB feedhorn plastic covers have started to degrade if not disappear altogether. When the first rains appear, business should be good: we'll be replacing LNBs that have filled with water via their feedhorns.

A customer complained recently that his pictures were "coming and going". There was no particular time pattern associated with the signal degradation, though it tended to be worse at night. The dish was mounted quite high up, but I could see that just the plastic rim of the feed cover was present and that wasps were entering and exiting via the hole where the cover should have been. Fortunately the customer had some insect spray. The nest, which was quite small, was soon cleared out.

We always keep a sheet of Teflon in the van. A piece of this, secured with a cable tie, makes a good replacement feed cover that doesn't crack up in strong sunlight. I have learnt by experience to keep an eye out for returning wasps when I'm installing a new cover after clearing out a nest. It helps in this situation to have someone with an insect spray to keep a lookout. It's very easy to miss an incoming wasp while you are fitting the new cover. **H.C.**

## Orion IRD2001/Bush IRD155

This satellite receiver was tripping, with a tick-tock from the chopper transformer T501. The ticking stopped once the chopper transistor's drive coupling capacitor C509

(1 $\mu$ F, 50V) and the two LT reservoir capacitors on the primary side of the chopper circuit, C508 (10 $\mu$ F, 50V) and C512 (33 $\mu$ F, 25V), had been replaced. But when the standby button was pressed the lights flashed and the receiver went back to standby. This was cured by replacing the mains rectifier's reservoir capacitor C503 (47 $\mu$ F, 400V). It had lost its 'goodness'. **C.W.**

## Digital Problems

I thought my problems would be over when digital satellite systems started to be installed. But calls came as soon as they began to be fitted. The following are some of the problems I've had to date.

The biggest one is trying to convince the customer that the cost of an installation doesn't include wiring the phone line from the front of the house to the back, taking possibly an extra hour of a fitter's time. It's all right for Sky to say do it all for £40.00, but they are the only people who make money from the subscription – the fitter certainly doesn't! As I work for myself and do jobs for a number of shops, I find that the jobs I get seem to be the nasty ones – either sceptical customers, jobs that require T and K and a mast, or jobs that require a phone line or long cable run, for all of which the customer is disinclined to pay extra.

The first job that came along was to replace an analogue with a digital installation, the dish being at the bottom of the garden with a cable run of over twenty metres. The dish was realigned to 28.2°E and I then looked for a signal at the receiver end. There wasn't one! I

eventually found five cuts in the cable where the wife had cut the hedge . . .

Job two was where a fitter had installed an 80cm dish to feed four flats, using a magic switch and dual LNB. When he connected the receivers only one worked. I had a new receiver with me. It worked but the others refused to do so, even with a reset. They had been switched on before all the cables had been connected (see below).

I've noticed large variations in signal strength with the digi dish. The worst read below half and the best about 98 per cent of full scale. But both worked.

Battery life with the yellow 'banana' digital meter is very poor. My old spectrum analyser still gives better results. I've tested the banana meter after setting the dish the old way and have found that I cannot improve on the setting.

I've discovered from experience that you must connect all the cables before you switch on. Otherwise you will lock up the system and a reset will be required.

Another problem is the supply of receivers and dishes. Most of the time one or other is in short supply!

I've installed a 'multi-arm' with two LNBs, for 19.2°E and 28.2°E, with the dish at 19.2°E and the second LNB for 28.2°E: the arm has to be bent up quite high to get a good reading on the meter, but a good signal, comparable with the digi dish, is obtained.

Actual faults have been varied – no stock faults have appeared yet. One that might become a regular is when an extra point has been installed. If the cable develops a short-circuit, even momentarily, the



9V supply to the TV link remote head is removed and will come back on only after going into the menu to switch it off then on again! So beware when disconnecting or connecting this cable, or if it goes via a two- or four-way amplifier.

One system worked all right for several weeks then the TV link failed about every two days. No shorts were found. The cause of the fault was finally traced to a piece of coaxial cable from the amplifier to the bedroom: there was a chalky coating under the braiding, which had tarnished. The cure was to clean the braid and fit a screw-fixing coaxial plug.

Several receivers have locked up for no apparent reason, possibly because of mains supply disturbances. Switching off then on will provide a reset. **P.H.**

### A Removal Job

I installed a digital system that the customer had removed from his old address. When I tried to get a signal nothing could be found using either the spectrum analyser or the

'banana' meter. Who said that the signal was 99 per cent wherever the dish was pointed?!

The LNB was marked, as if it had been dropped. Not having a replacement to fit to the digital dish I had to install a Grundig LNB – after removing the plastic case then mounting it upside-down on the remaining plastic mount. This produced a good signal and was therefore left until I could obtain the correct LNB – or so I thought.

Sky sent an engineer to replace the defective LNB under guarantee. When he arrived, he told the customer that the LNB I'd removed was not faulty. He "tested it with his meter", but I don't know how as he didn't attach it to a dish or anything. He also said that Sky wouldn't supply the LNB and they hadn't refitted the dish, thereby invalidating the guarantee.

The customer phoned me to get his old LNB refitted, quoting that Sky had said it was OK. I refitted it and, as expected, the same fault was present. So I told the customer to contact Sky again and complain.

But who pays me for my wasted time?

I did phone Sky to try to sort the matter out, but after going round in circles for ages and not getting through to anyone who would commit himself I gave up.

I have tried to buy the new-style LNBs, but no one seems to have any. **P.H.**

### Pace PRD800

"Picture interference" was the complaint with this receiver. I expected it to be something like diagonal dashed lines. Instead there was very severe multiple ringing – like a duff SAWF but much worse. The symptom reduced a bit when heat from a hairdryer was applied near the Nicky chip U9. So I checked the values of the electrolytic capacitors in this area. None were 100 per cent, but C98 was virtually open-circuit.

Perfect results were obtained once a block of seven capacitors around U9 had been replaced, but to be on the safe side I also fitted a power supply kit. **J.H.**

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5071 = 100	13119 = 095	1290-2-395	5725 = 210	4443 = 120	786 = 005
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5732 = 050	4102 = 065	5010 = 220	7072 = 100	7072 = 100	841 = 010
5790 = 130	4140 = 050	5020 = 350	7404 = 300	7250 = 225	854 = 005
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6326 = 050	4190 = 050	<b>STK</b>	73605 = 195	8196 = 075	872 = 010
6327 = 050	4100 = 080	011 = 300			885 = 015
6332 = 225	4200 = 080	015 = 250	<b>STR</b>		893 = 010
6341 = 120	4422 = 060	078 = 700	370 = 195	<b>TEA</b>	913 = 025
6342 = 095	4446 = 050	080 = 360	371 = 225	1002 = 150	917 = 020
6387 = 170	4508 = 070	433 = 190	380 = 235	1009 = 050	921 = 005
6581 = 100	5512 = 025	435 = 200	381 = 245	1014 = 075	934 = 010
6552 = 040	5522 = 040	436 = 200	456 = 265	2037A = 175	965 = 023
6610 = 045	6324 = 010	437 = 225	1096 = 145	5500 = 200	966 = 010
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	<b>M</b>	563 = 285	3130 = 275	1042 = 150	1123 = 010
	191B1 = 225	583 = 265	20005 = 295	1043 = 050	1156 = 075
<b>BA</b>	296B1 = 485	1040 = 315	20015 = 300	1158H = 030	1300 = 009
526 = 010	490BB1 = 465	1045 = 195	30115 = 165	1167C = 070	1301 = 210
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5102A = 060	708B1 = 200	3042 = 250		1182H = 200	173 = 035
5102L = 065	709B1 = 250	3082 = 295	<b>STRD</b>	1188 = 196	176 = 030
5402A = 065	5214 = 050	4017 = 200	1706 = 250	1228H = 050	337 = 050
5404 = 085	5218 = 040	4211/V = 515	6001 = 250	1238 = 100	434 = 020
5408 = 075	51182L = 075	4352 = 205	6108 = 305	1278 = 400	531 = 100
6109 = 065	51521L = 090	4362 = 200		1288V = 110	548 = 020
6124 = 105	54515P = 190	4372 = 205	<b>TDA</b>	1352C = 120	560 = 010
6208 = 060	54544L = 100	4392 = 350	1022 = 170	1362C = 050	595 = 025
6218 = 025	54564P = 080	4432 = 245	1035 = 450	1363C = 070	596 = 020
6219 = 075	54886P = 210	4773 = 500	1054M = 120	1365C = 200	598 = 200
6235 = 050	54848P = 180	4803 = 350	1220A = 215	1366C = 110	621 = 010
6239 = 085	58665P = 120	4813 = 310	1412 = 060	1379C = 150	643 = 005
6248 = 080		4833 = 460	1514A = 230	1382 = 085	644 = 005
	<b>MB</b>	5335 = 135	1518Q = 110	1391 = 050	690 = 020
<b>HA</b>	3730 = 050	5337 = 260	1589 = 175	1504C = 150	695 = 055
1125 = 055	3731 = 080	5361 = 225	1905 = 080	1536C = 315	793 = 015
1138 = 055	3756 = 115				

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**The theme of this year's Internationale Funkausstellung, Berlin, was digital evolution. George Cole reports on the technology and products that were on display**

# IFA '99

**T**he Internationale Funkausstellung (IFA) is also known as the International Audio and Video Fair or, more simply, the Berlin Show. IFA, which is now 75 years old, is held every two years, giving broadcasters and consumer electronics manufacturers an opportunity to show their latest wares and developments. This year's show attracted 872 exhibitors and the overall display area was 160,000 square metres. The theme was "Digital Evolution". There was certainly plenty of digital technology to be seen.

## The Multimedia Home Platform

One of the most significant developments is MHP (Multimedia Home Platform), a new standard that's being promoted by the Digital Video Broadcasting (DVB) Project. The result could be digital set-top boxes that can run services provided by a number of broadcasters and other sources. MHP is already being supported by over 250 companies.

At present there's a plethora of incompatible set-top box operating

systems, including OpenTV, Mediahighway, Windows CE and MHEG-5. Because of this consumers are 'locked in' to services offered by particular set-top box providers. There have been some moves towards system interoperability. For example in France Canal Satellite Numerique, the digital service run by Canal+, has a simulcrypt agreement with rival operator ABSat, enabling Canal+ viewers to receive some of the latter's channels, while in the UK BSkyB is working with SCM Microsystems on the development of a 'side-car' that will enable SkyDigital subscribers to receive ONdigital services.

The MHP standard is based on Java technology, which was developed by Sun Microsystems. The Java programming language creates material that will work with computers which use a variety of operating systems. More and more web pages carry Java-created features. For set-top boxes the idea is to develop software layers, or plug-ins, that emulate material written for proprietary set-top box operating systems. The 'Java Engine' software will

enable set-top boxes to use services provided by a variety of broadcasters and other service providers.

The MHP Application Program Interface (API) will be known as DVB-J (for Java). To date the standard has been 80-90 per cent agreed, and Version 1.0 should be ready by the end of the year. Visitors to IFA '99 were given the opportunity to see MHP in action – though not, for obvious reasons, in its final form.

A number of organisations and companies were involved in MHP demonstrations at IFA '99, including the BBC, Philips, Canal+, Grundig, Sony, Nokia, Panasonic and the German research institute IRT. MHP is more than just an 'open' standard: it brings together telecoms, the internet, interactive TV and the PC. An MHP box could be connected to various devices, such as a printer, VCR, DVD player, local storage device and home PC to create an Inhome Digital Network (IHDN).

Philips provided some very interesting MHP demonstrations with a modified set-top box which had some



extra memory installed (it had 4Mbytes of flash and 8Mbytes of RAM). There was an interactive version of the BBC's Top of the Pops programme. Viewers could see a video picture in one corner of the screen and have lyrics and other information scrolling along the bottom. An interactive menu at the side enabled the viewer to call up on screen biographical details of the artist and other relevant information. The on-screen text was sharp: it used the Teresias font developed by the RNIB for clearer on-screen displays. It was also possible to call up pop-chart information, participate in live forums and vote for favourite songs.

For interactive or internet use a telephone connection is required to provide the return channel. It's likely that manufacturers will produce a range of MHP boxes, some providing interactive operation and others simply digital TV.

Philips also showed a golf programme it had developed as an MHP application. The company said that the programme took only three weeks to create using Java. Viewers watching it could see an on-screen course diagram, receive live updates, view player biographies and read score tables. It was very impressive.

MHP looks to be a winning technology, but a couple of problems could cause difficulties. First, additional set-top box memory is required. Some existing digital decoders have neither sufficient memory nor sufficient processing power to run Java – some have as little as 1Mbyte of flash and 1Mbyte of RAM. They would thus need to be replaced to achieve MHP compatibility. Such technical problems can be overcome: much harder would be to persuade broadcasters to adopt an open standard that would enable rivals to use their set-top boxes.

### DVB.air

A mobile system called DVB.air, which is based on the DVB-T (T for Terrestrial) standard, was demonstrated by Nokia. It offers the user digital TV, interactive services and internet access while on the move.

The DVB.air project has been formed by Nokia, ZDF and Deutsche Telekom. A combined flat-screen display and DVB-T tuner known as a MultiScreen gives access. So far ten prototype MediaScreens have been built by Nokia, several of which were

present at IFA '99. ZDF has created a multimedia data service, digitext, which is converted into HTML (the programming language for internet content). The broadcast signals were taken from a DVB-T pilot project that's being run by Deutsche Telekom in Berlin. The MediaScreen also used a GSM digital phone channel provided by the D1 network.

A modified version of the Netscape Navigator web browser is used by the MediaScreen for data access, with an operating system called Linux. The latter is a Unix-based system that's become very popular with PC users, partly because it is available free over the internet.

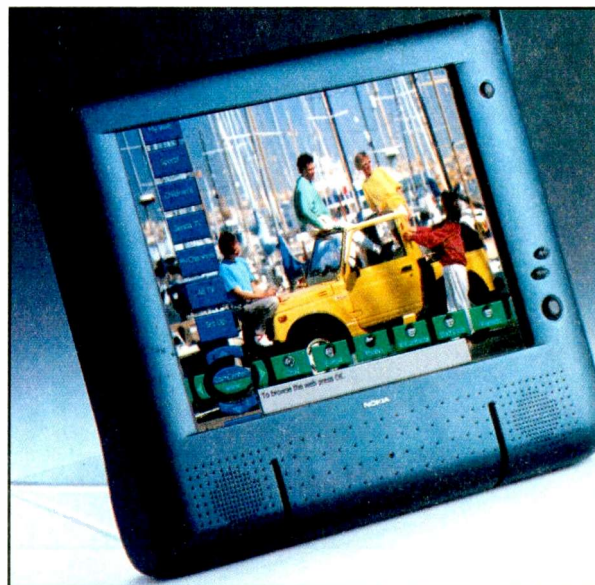
The MediaScreen demonstration showed how users can watch digital TV pictures and, by means of the GSM link, call up specific digitext pages or log into the internet. The latter would be useful only for text-based information however, as the GSM link has a data speed of just 9,600bits/sec compared with about 20Mbits/sec for the DTT signal.

Another project, involving Nokia, Volkswagen and the University of Braunschweig, uses MediaScreen technology. Flat display panels have been installed in a number of vehicles, and a network of DTT test transmitters has been built between Hamburg and Bremen. Tests carried out last spring showed that the DTT signal is robust and that reception is maintained even when the vehicles were driven at high speeds, under bridges and next to tall buildings. Nokia took groups of people around the grounds at IFA '99 to demonstrate the system in action. We were told that it would work at speeds up to a maximum of 180km/hour.

The mobile data and video system could be used to entertain children during long car journeys and provide drivers with useful information such as navigation data, maps and hotel and restaurant guides. There is also information and entertainment potential for public transport systems. Helmut Stein, senior vice-president of Nokia Multimedia Terminals, says that the technology is ready though services and a national network of DTT transmitters need to be established.

### FUN

There are some 200 free-to-air digital TV and radio channels in Germany, which explains why digital pay-TV has been slow to take off there. A consortium of

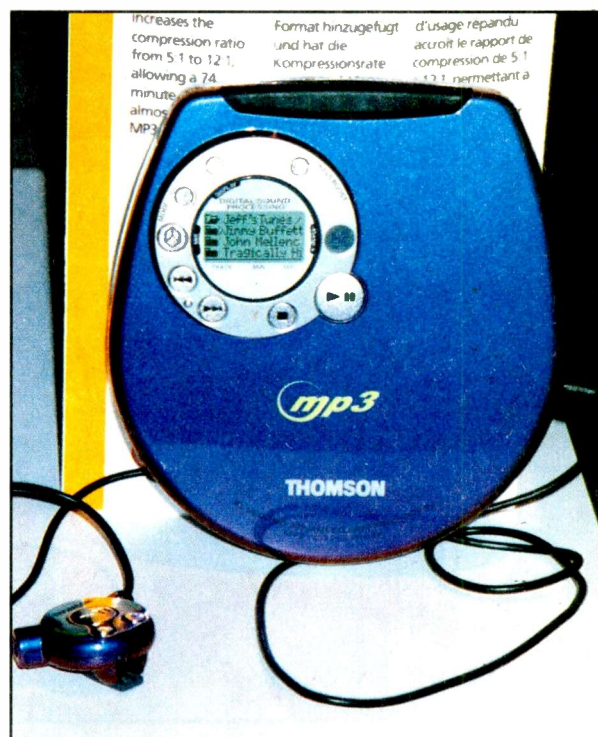


**A prototype Nokia MediaScreen for DVB.air, the mobile system. It has a flat-screen display and incorporates a DVB-T tuner.**

organisations that includes ADF, Echostar, OpenTV and Panasonic has formed FUN, the Free Universe Network, which has established a standard for receiving free digital channels.

Panasonic demonstrated its FUN set-top box, Model S3, which is due to be launched in Germany next year and can also be used for receiving pay-TV channels. It also enables data to be exchanged between a computer, printer, TV set, digital video recorder and a hi-fi system. The S3 has 2Mbytes of flash memory and 4Mbytes of SDRAM. Connections include an LNB input, an RS232 interface, scart with RGB capability, scart with S-video and composite

**A prototype Thomson MP3 audio player.**







**The Grundig Planatron II TV with 42in. 16:9 plasma display is just 4in. deep, with all the electronics contained within the screen section.**

video, an S video output, phono audio sockets and an optical digital audio output.

### Dolby Sound

The Dolby Digital 5.1 audio format could be heard on a number of stands that had MPEG-2 decoders which conformed with the DVB standard. The European digital TV standard originally had MPEG-2 as the audio system, with formats such as Dolby Digital as optional extras. In July however the DVB Project announced that Dolby Digital is now a recognised format that can be used exclusively for broadcasting.

The German broadcaster ProSieben carried out the first European Dolby Digital transmissions (via the Astra network) at IFA '99 and announced plans to transmit prime-time films in this format in the near future.

Several manufacturers, including Lemon, Radix and Panasonic

Germany, have developed Dolby Digital equipment for the European digital TV market. Lemon's Volksbox Dolby Digital set-top unit was on show while Panasonic launched its first Dolby Digital satellite receiver, the S3 (the same box that conforms to the FUN standard). Sony and Canal + are also developing Dolby Digital decoders, but there were no products on display.

According to Dolby Laboratories' software licensing manager David Fraser it's relatively simple to develop a set-top box that extracts the AC-3 (Dolby Digital) data from the bitstream. Broadcasters need a spare 384kbits/sec capacity to carry the additional Dolby Digital data. Forty million households worldwide have Dolby Surround systems: in Europe the average household penetration is eight per cent, twice this in the UK.

Thomson and Philips both showed DTT receivers with wireless Dolby Pro-Logic rear speakers. Thomson was due to launch three DTT models in the UK in October, including a 32in. set with wireless Dolby Pro-Logic. The Philips Model 32DW6834 is a 32in. DTT set with an integrated ONdigital decoder, five built-in speakers and FM wireless rear speakers for surround sound. Philips also showed Model 25PV720, a TV-VCR combi that includes Dolby's Virtual Surround system.

### Flat-screen TV

There were plenty of flat-screen displays on show, including Thomson's Wysius, a 106cm, 16:9 screen that's only 9.6cm thick. It can also be used with a PC, and can display a number of computer graphic formats including VGA, SVGA, XGA and SXGA.

Sharp showed a 20in. LCD monitor, Model LC20VM2E, that's just 4.9cm deep and weighs 7kg. It's being targeted at the business presentation market initially however, though the company says that it is looking at the possibility of developing versions for the consumer market. The biggest problem is the high cost of LCD technology. The Sanyo Model C15LC1 is a 15in. LCD TV set with an XGA (1,024 x 768 pixels) display.

Grundig was demonstrating its Planatron II model. This has a 42in., 16:9 plasma display that's just 14cm deep. It weighs 60kg and has inputs for VGA, RGB, scart, S-video and composite video. The price in Germany is the equivalent of about £10,000.

### Hard-disk Storage

The Philips 'personal TV receiver/recorder' was tucked away in the trade-only section. It uses the TiVo hard-disk recording system that's already been launched in the USA - Philips has an equity stake in TiVo. There are two versions of the Philips TiVo device, Models HRD112 and HRD312. The former can store up to 14 hours of MPEG-2 video while the latter can store up to 30 hours. Hard-disk recorders have various video inputs including composite video, RF and S-video.

The TiVo system can be programmed to record favourite programmes automatically (the device can 'learn' your viewing habits). Pause, rewind, slow motion or instant replay are all available to users while watching live or recorded programmes. There's even a system for bypassing specific commercials. TiVo recorders have a PowerPC processor, MPEG-2 codec (encoder/decoder) and a built-in 33.6 modem. TiVo is so far available only in the USA, but with manufacturers such as Pace demonstrating hard-disk recorders at various trade shows the devices are likely to reach the UK market next year.

### DVD Recorders

No fewer than three incompatible rewritable DVD systems were on display, and there are fears of a format war akin to the VCR one in the early Eighties when the VHS, Betamax and V2000 systems were being promoted. The companies that support DVD know that if it's to replace the VHS format as the standard domestic video system recorders will have to be made

**Hitachi's prototype DVD-RAM digital cam-corder.**





available, and despite the differences all use the same basic phase-change recording system. The following is a brief description of this.

The disc is coated with a mixture of rare-earth metals such as indium, terbium and antimony (silver is often added). In its natural state the recording layer has a polycrystalline structure. When data is being stored, a relatively high-power laser heats the recording layer to 500-700°C. As a result the atoms change to a liquid state. If the area is cooled quickly enough, it's converted to an amorphous state. If the layer is heated to below its melting point but above the crystallisation temperature (about 200°C) for long enough it reverts to the crystalline state. Because the crystalline and amorphous states have different refractive indexes, they can be detected optically – the amorphous state is less reflective than the crystalline state. The two can therefore be used to represent the zeros and ones of a digital signal. As with video tape, discs that use the phase-change process can be re-used about 1,000 times.

The DVD Forum, a consortium of companies that sets DVD standards, officially endorses a system known as DVD-RW which was developed by Pioneer. The discs can store up to two and a quarter hours of high-quality video (about 500 lines resolution) or up to six hours of VHS-quality video. But at a press conference announcing the format there was some uncertainty about its compatibility with existing DVD-Video players.

There are two recording modes with the DVD-RW format. The video mode is used for record-once operation. According to Pioneer this is compatible with DVD-Video machines. But the re-recordable mode, known as Real Time Recording (RTR), is not compatible with existing DVD-Video equipment. Pioneer says that the operating software would need to be modified, though whether this could be done by inserting a disc or replacing the firmware inside a player remains unclear. Pioneer adds that the reflectivity of the DVD-RW disc is similar to that of existing dual-layer discs, which could cause problems with some DVD players.

Version 1.0 of DVD-RW is due to be set this month (November). The DVD Forum will then make a decision on it. Some members of the Forum are known to be having second thoughts about DVD-RW because of the potential compatibility problems.

Hitachi has opted to use another official DVD format, DVD-RAM, for

its consumer video recorder. DVD-RAM was designed for PC applications, but Hitachi believes that it's also suitable as a consumer format. DVD-RAM offers up to two hours of MPEG-1 video on a single-sided 4.7Gbyte disc, but up to an hour of MPEG-2 video can be stored by increasing the data rate from 1.5Mbits/sec to about 6Mbits/sec. This is a short recording time in comparison with other DVD recording formats but Hitachi's corporate chief engineer for digital media, Dr Akira Shibata, believes that the development of blue laser technology will result in DVD-RAM being able to provide longer playing times and high-definition images.

Another issue is compatibility. DVD-RAM uses a caddy system to protect the discs, which means that they can be used with today's DVD-Video players only when they are removed from the caddy. But an exposed DVD-RAM disc can no longer be used in the re-recordable mode. Hitachi plans to launch a consumer DVD-RAM recorder in 2001 and has also developed a DVD-RAM camcorder.

Although Philips and Sony are members of the DVD Forum they have joined forces with Ricoh, Yamaha, Hewlett Packard and Mitsubishi Chemical to develop another re-recordable format which is, rather confusingly, known as DVD+RW. It stores up to two-four hours of video on a 4.7Gbyte disc. Double-sided discs with a 9.4Gbyte capacity are also part of the format specification, see Table 1.

The specification is within the parameters of the DVD-Video and DVD-ROM formats, which means that DVD+RW offers two-way compatibility with them. In other words a DVD+RW player can read DVD-Video discs and a DVD-Video player can read DVD+RW discs. Philips demonstrated this by filming visitors and recording the images on a DVD+RW disc. Visitors were then

asked to select playback from a bank of DVD players from Sony, Philips, Samsung and Pioneer. Sure enough, the recording played back normally.

DVD+RW also offers CAV (Constant Angular Velocity) recording for PC applications, and uses a system known as lossless linking to maintain compatibility with DVD-Video players and DVD-ROM drives. This enables video to be recorded with a variable bit rate. DVD+RW recording is carried out at a constant bit rate, which has to be paused and then continued at frequent intervals. This would create a linking loss and incompatibility. The problem is overcome by using a buffer memory.

Philips also demonstrated other DVD+RW features, including a visual TOC that provides users with an on-screen menu of all the recording's key frames for easy access. Another process, Easy Editing, enables users to select scenes they want to watch. This information is stored in the TOC. The user has the option of playing the edited version or the complete disc.

Philips plans to launch the first DVD+RW machine next summer, and says its price will be similar to that of the first high-end DVD-Video players. The company says that it is discussing with content holders such as Hollywood studios the question of copy protection, and that this issue is close to being resolved.

On the face of it DVD+RW looks like being the ideal consumer video disc recording system. But politics rather than technology could see its rejection by other DVD manufacturers. The problem for other companies developing re-recordable DVD systems is that, so far, none of them offers the same level of compatibility or similar recording times to DVD+RW.

### DVD-Video

There were also plenty of DVD-Video players on show. The Hitachi

**Table 1: Basic DVD+RW Specification**

Recording system:	Phase change
Data capacity:	4.7GB/9.4GB single-/double-sided disc
Laser wavelength:	650nm
Disc reflectivity:	18-30%
Track pitch:	0.74 microns
Minimum pit length:	0.4 microns
Modulation level:	>0.6
Data modulation:	8-16
Error correction:	Reed-Solomon-PC
Channel bit rate:	26.16MHz
Scanning velocity:	1x-2.4x

DVP250E includes the company's Disc Navigation system. This is an interactive scene-selection system that makes it easier for users to find a specific scene. The Pioneer PDV-LC10 portable DVD player is claimed to have the world's smallest DVD drive and weighs just 690g; other features include a 7in. 16:9 LC display and a nickel-metal-hydride battery that provides up to 135 minutes of continuous playback time. Pioneer also showed the DV626D, which is compatible with CD-R and CD-RW discs. The Philips DVD960 also has this compatibility.

Thomson showed widescreen TV sets with built-in DVD players. Screen sizes were 24, 28 and 32in. The Sanyo DC-DV2000 is a mini hi-fi system with a built-in DVD player. Pioneer's NS-DV1, claimed to be the world's first DVD receiver, combines a tuner and amplifier with a DVD player. Thomson's DTH3700 is a five-disc DVD changer. The Sharp DVL70S is a portable DVD player that weighs 600g; its features include a 7in. active-matrix LCD monitor and Dolby Virtual Surround sound.

### VCRs

A number of companies were showing Data VHS (D-VHS) machines. The JVC Model HMDR10000 incorporates an MPEG-2 encoder/decoder, which enables recordings to be made from a variety of analogue and digital sources. Up to 21 hours of VHS-quality video can be stored on a tape: JVC plans to launch, in Japan, a VCR and tape that offers a 24-hour capacity.

The interesting point is that D-VHS was originally designed as a bit-stream recording format that would simply store raw digital video, i.e. there would be no on-board video encoding or decoding, but is now being marketed as a standalone domestic recording format.

The Philips VR20D was on show. This, the company's first European D-VHS machine, should be available towards the end of the year. Other companies with D-VHS machines included Thomson and Hitachi.

Philips is the latest company to offer a tape-management system with its VHS machines. It uses a TV set's on-screen display system to show a list of the recordings on a tape.

### Camcorders

There were plenty of digital video camcorders at '99, but two models stood out because they use discs instead of tape to store the data. Hitachi had a mock-up DVD-RAM

camcorder that could store up to an hour of MPEG-2 video on a double-sided 8cm disc. Its chip complement includes an MPEG-2 encoder/decoder, an IF chip, 4Mbytes of flash memory and 12Mbytes of Work RAM. The latter is a buffer memory that provides video storage: its use means that recordings are unaffected when the camcorder is jolted. Hitachi commented that the DVD-RAM camcorder has been made possible by the advent of LSI MPEG codec chips. It expects the DVD-RAM camcorder's power consumption to be similar to that of a MiniDV camcorder, with the same picture quality.

Sony showed a prototype MiniDisc camcorder. It's not the first time that the MiniDisc has been used as a video format - Sharp developed a MiniDisc video camera several years ago - but this camcorder uses a new type of MD Data disc with a larger capacity (650Mbytes compared to 140Mbytes with earlier versions). The camcorder has an MPEG-2 codec and can store up to twenty minutes of video on a disc. It can also play audio MiniDiscs. Sony has no firm launch plans for the camcorder.

### Super CD

Sony had a major European launch for the Super Audio CD format it has developed with Philips (see *Television* September 1999). SACD is designed as a high-end audio format that offers greatly improved sound quality in comparison with the current CD format. It uses a recording system called Direct Stream Digital, which records the original 1-bit resolution digital signal directly on the disc, bypassing the sampling and quantisation processes used with PCM digital formats. SACD stores up to 74 minutes of sound on a 4-7Gbyte disc and offers either two-channel or six-channel modes.

Sony plans to release two models initially, the SCD1 and SCD777ES. The following day Philips demonstrated a prototype SACD player: its sound quality was excellent. Philips also demonstrated the hybrid disc. This is a dual-layer disc that has an SADC recording layer and a conventional audio CD layer, enabling the discs to be played by ordinary CD mechanisms. Philips said that the hybrid discs have been tested in hundreds of CD mechanisms. There had been only four faults, not because of the discs but because the players didn't conform to the Red Book CD standard. Philips disputed suggestions that the discs

couldn't be played by ordinary CD machines, and said it was unfortunate that a format war had broken out between the SADC and DVD-Audio systems. The company nevertheless plans to launch a player that can read audio CD, SADC and DVD-Audio discs.

### DVD-Audio

Panasonic held a large press conference to announce its plans for DVD-Audio, the official DVD audio format supported by over forty companies (including Sony and Philips). DVD-Audio uses the same PCM format as the audio CD, but with a wider range of sampling frequencies (up to 196kHz) and several quantisation levels (16, 20 and 24 bits). The format also offers two-channel stereo and five- and six-channel audio. A DVD-Audio disc can store audio (high quality or multi-channel) plus optional content such as still pictures, text information, visual menus, hidden web links and video, the latter being a sub-set of DVD-Video. Current DVD-Video players cannot read DVD-Audio discs though they can play any video present on a disc.

Whereas SACD offers standalone audio players, Panasonic has opted for 'universal' DVD players that can read DVD-Audio and DVD-Video discs. Two universal players are to be launched by Panasonic, Models DVDA7 and DVDA10. Both will have integrated Dolby Digital and DTS (Digital Theater System - US spelling!) decoders. Panasonic thinks that universal players will account for 50 per cent of DVD player sales in 2002 and 75 per cent the following year.

One thing that's still not clear is how DVD-Audio copy protection systems will work. It seems that users will be able to make one digital copy of a title with reduced sound quality.

### CD-R

Fifteen consumer electronics and recording media companies, including Philips, Pioneer, Denon, Maxell and TDK, took part in a joint presentation for the CD-R format. There are now some 800 million CD players in use worldwide, and 120 million new players are bought each year (50 million as new purchases, 70 million as replacements). Add the CD playback capability of PC CD-ROM drives and there are over one billion CD players worldwide.

The CD-R/RW Orange Book format has been extended to include 80-minute blank CD-R discs - most CD-R discs provide a recording time



of up to 74 minutes, the official maximum playback time set by the Red Book CD standard, though longer-running discs are not unknown these days.

Pioneer, Teac and Marantz announced new CD-R machines. Philips has a wide range of CD-R equipment, including the latest version of its dual-deck machine. This enables users to put a blank CD-R disc in one tray, an audio CD in the other and then make a recording at double-speed. The new version, Model CDR775, has an audio buffer that stores up to three seconds of music prior to recording: if the user makes an error, there's time to correct it before any data is actually recorded on the disc. The audio buffer also provides synchronised starting from both analogue and digital sources. In addition the CDR775 has a text function that enables users to add to the recording information such as the artist's name or the track title.

### Digital Radio

Digital radio receivers were displayed on a number of stands,

but the system had a lower presence this time round, mainly because of the emphasis on digital TV, recordable DVDs and the new super CD formats. The Fraunhofer Institute for Integrated Circuits showed how DAB can be used for transmitting multimedia content over the air. DAB should have a somewhat higher profile at IFA 2001: by then more DAB services will have been launched and lower-cost receivers should be widely available.

### MP3

A pointer to things to come was the large number of MP3 prototypes and recorders shown at IFA '99. MP3 stands for MPEG-1 layer 3. It's an audio compression system that was originally developed for MPEG-1 video formats such as CDI and Video-CD. MP3 compresses a PCM audio file to a twelfth of its original size and has become the most popular music format on the internet.


A number of companies have developed MP3 recorders the size of a personal stereo: they can be linked to a PC for downloading

MP3 files and can also be used to convert PCM music files to the MP3 format. Most MP3 recorders use a 32Mbyte flash memory card that can hold half an hour of near-CD quality music or an hour of lower-quality sound.

Samsung, the first major consumer electronics company to launch an MP3 player, showed the Yepp. Grundig unveiled the MPaxx, and said that users will be able to play prerecorded memory cards that cannot be recorded over. LG had two MP Free models, the MF-PD330 and AHA-FD770 – the latter includes a cassette deck and tuner. Schneider's MPMAN, also on show, was launched in the UK earlier this year. Philips announced plans to launch an MP3 player early next year. Thomson, which owns some of the original MP3 patents, had lots of MP3 prototypes in its trade-only area, including an MP3 micro hi-fi system, a car radio and a combined MP3/MD/Audio CD player. We can expect to see a lot more activity in the solid-state audio recording market over the next year or so.

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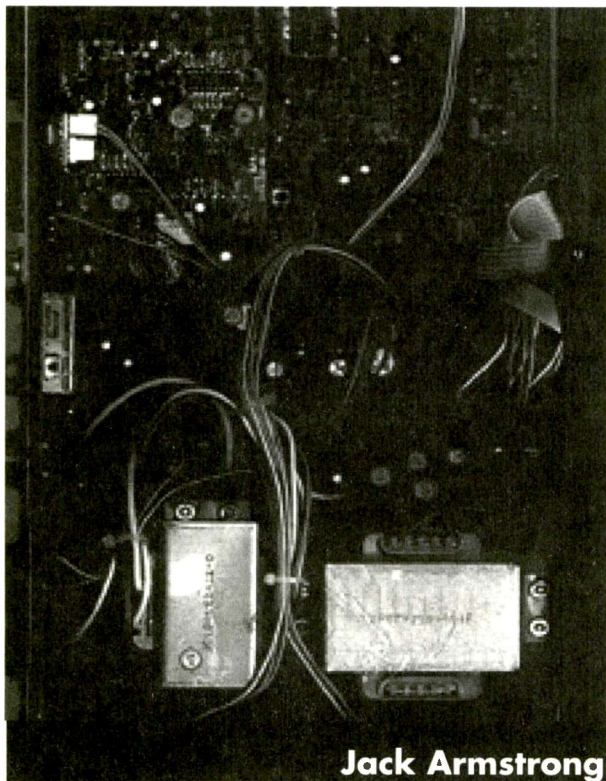
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# Satellite WORKSHOP



Jack Armstrong

## Pace MSS1000

I occasionally get receivers to repair from a shop some twenty miles away. They use a local chap to collect and deliver, so I try to carry out the repair while Dave waits. In return he goes into the kitchen and makes me a cup of tea.

He brought me a Pace MSS1000 with a label that said "PSU ticks". I'm wary about ticking power supplies. It's usually a sign that there will be a very loud noise next time someone connects mains power to the receiver. I like to make sure I'm not that person. So my first move is to replace all the electrolytic capacitors on the primary side of the power supply.

Once this had been done the receiver worked perfectly. But for good measure I replaced all the electrolytic capacitors on the secondary side of the power supply as well. Some of these are ultra-low ESR types, so for safety's sake I opened a Relkit 10. We watched Sky News while finishing our cups of tea (it's a sad life). Then Dave went on his way.

A week later he was back. "Still ticking" he announced.

"But it was working perfectly – you saw it yourself!"

"Yep, but the customer didn't. He collected it from the shop and an hour later he brought it back. It's still ticking."

I removed the cover. As there was no sign of a problem I plugged the receiver in. The power supply could be heard ticking slowly. Blast!

I dismantled the whole unit and inspected it. There were no obvious short-circuits, but the 2A fast fuse that protects the 5V line on the secondary side of the power supply had melted. I was doubtful about fitting a replacement without knowing the cause of the original fuse's failure, but decided to take the risk. The receiver worked perfectly.

I was puzzled, and decided to refit the Dolby audio board to see if the additional load would melt the fuse. It didn't. So I reassembled everything and reconnected the mains supply. There was a faint ticking sound from within . . .

I suspected the Dolby board. Call it intuition maybe, but I'd never had this symptom before. That fuse usually melts only when there's a serious fault that results in the power supply outputs going extremely high. I tried a spare Dolby board and the receiver was fine. I replaced the original board and it was fine. But the instant I screwed the board to the rear panel the fuse melted. A clue at last!

I removed the black plastic insulating cover from the rear of the Dolby board and looked at it closely. A factory-fitted ceramic disc capacitor had been soldered to the back of the Dolby board. The insulating sleeve on one of its leads was a fraction too short. It appeared that each time I tightened the screws in the rear panel the lead touched the leg of a surface-mounted transistor. That's another hour's work I won't get paid for.

## The Sky Digibox

So far I've had very little to do with these digital satellite receivers. I went on the Sky training course

and took a test. This wasn't very helpful however as I do so little installation work. Pace very kindly gave me a repair course, but as most Sky digital receivers are still under guarantee I've not had any for repair. Until yesterday.

A local installer brought me a digibox to inspect – it was not one that had been made by Pace. He had installed it for a customer who'd used it for a month then reported an intermittent fault. The box had been duly returned to the manufacturer, whose service department had returned it untouched. A scribbled note said that there was "water damage" and that repair would cost £380!

There was certainly corrosion inside the receiver. The amount was tiny, and could have been introduced from a polish spray or a single raindrop. The puzzling thing was that the receiver had been taken straight from its box and installed inside a cabinet. So how had moisture got inside? It was near the centre of the board, and had certainly not come down any cable. I began to think that it could have been caused by careless use of a cleaning spray or a worker's sneeze in the factory. The modem and power supply boards and other parts, such as the tuner module, were undamaged.

All it needed was a mother-board, which probably costs less than £200 to manufacture. I can't understand how a price of £380 for repair could have been suggested. Quite apart from that, surely in a case like this the company should have given the customer the benefit of the doubt and either repaired it at no cost or kept the cost to a minimum.

Anyway, it's interesting to know the cost of repair for a 'free' digibox. I think I'll prepare the ground and place a weekly newspaper advertisement announcing "digital repairs from £295".

## Grundig GSRI etc

The problem with one of these receivers was no vertically-polarised channels. The LNB supply voltage remained high because



of a poor soldered joint at the LM317 regulator IC108. This regulator can cause problems with Grundig GSR/GRD, Matsui and Minerva models. The cure is to fit a replacement and put thermal compound on the back – otherwise it overheats and gives intermittent polarisation problems.

### Pace MSS300

The bald-headed owner (join the club!) of this receiver announced that it was “dead”. He was correct. The fuse had melted, but not quickly enough to prevent failure of the BUT11A chopper transistor Q5 and the 10Ω, 2W surge-limiter resistor R49. I replaced these items, also C59, C60 and C61 which produced no readings at all when checked with my ESR meter. The 47μF, 400V mains bridge rectifier’s reservoir capacitor C54 produced a reading of 5Ω. It’s capacitance still measured 45μF, but I wasn’t taking any chances. In went a replacement. I’m used to getting readings of 2-3Ω with this capacitor: anything higher is a sign of imminent failure.

Now that this receiver lit up I could look for the cause of the other reported fault, “intermittent scrambling”. It was in fact difficult to see whether the receiver was

unscrambling or not, because the picture was obscured by a mass of dashed lines that swirled around the screen. As the receiver had been well cooked – the board looked very dark – I fitted all 27 capacitors in Relkit 9. This was tedious but worthwhile: the picture was then free of interference and there was no sign of “intermittent scrambling”.

I checked and found that the contrast was set at 3. So, as a precaution, I changed the setting to 4. All Pace receivers have the contrast control circuitry prior to the decoder. Thus the contrast setting affects the decoder’s video input level. Unfortunately it’s a tad fussy about this!

### Philips receivers

My friend Henrik Kristensen in Denmark has passed on a tip with regard to the Philips STU904/31R receiver. If the picture has moved to the left, leaving a black stripe down the right-hand side of the screen, the following items should be checked/changed: the 2,200μF, 16V capacitor in the power supply, and the 24C04 EEPROM in the processor section.

I’ve found that corruption of an EEPROM’s contents is very common in Philips receivers, but don’t

Jack Armstrong is willing to try to sort out readers’ satellite TV receiver problems via e-mail. You can reach him via the Internet at:

**jacksat@netcentral.co.uk**

One model per message – state make/model and fault symptoms. If you have no e-mail facilities you can write to him c/o Television, Room L302, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Please enclose two first-class stamps.

know why it occurs. The cause could be noise from the power supply because of a defective electrolytic capacitor. You can get a similar problem with the UK Model STU824. In this case the cause has always, in my experience, been a bad solder joint at the infra-red sensor.

### Pace MSS200

This receiver produced a 17V LNB supply regardless of the polarisation selected. In addition it showed a menu option for “LNB 2” and there were various other strange menu features that shouldn’t have been present. A factory reset cleared the fault.

## Test Case 443

The Test Case workshop has always been deeply involved with rental TV. Over the years our company’s sets have been obtained from various manufacturers. They have mostly been cheap but cheerful models, and in recent times Daewoo has been the source of many of them. This company’s TV products are certainly more reliable than its VCRs. When a Daewoo TV set goes wrong, the cause is often a dry-joint that’s easily found.

One of these sets had a problem that was certainly not caused by a dry-joint. Even so, its stay on the bench was too protracted, mainly because the engineer who was in charge of the repair was not familiar with the chassis. We don’t want to upset him, so we’ll refer to him as Mr X! Two of our mainstay technicians were away on this particular day, one on holiday and the other on a training course.

The set’s symptom was straightforward enough and wasn’t even intermittent. There was no picture, though the sound was present: the EHT was heard to crackle up when the set was switched on. It was a Daewoo Model T514, which is fitted with the CP365 chassis, and was some three-four years old. Mr X got the service manual from the filing cabinet and made a good start by measuring the voltages at the pins of the CRT. But apart from the cathode voltages the manual has nothing to say about the voltages to be expected here. Several hundred volts were present at the first anode, and several thousand volts at the focus pin. With the workshop lights out, the tube’s heaters were seen to be glowing. So it seemed that the tube was being cut off by the

voltages at its cathodes. Mr X concentrated on this.

The emitters of the RGB output transistors are connected to bias potentiometers which receive a 12V supply via R541. Mr X soon established that this voltage was present and correct. The RGB signals themselves should, according to the circuit diagram, be at about 2.2V when they arrive at the CRT’s base panel. In this set they were all somewhat lower. So the next checks took Mr X back via plug P501 to the TDA8362 chip I501 on the main PCB. It’s one of those wonder chips that does almost everything, receiving an IF input from the SAW filter and processing the signals right through to baseband RGB and audio outputs while also generating the field and line drive waveforms.

Our man confirmed that the chip’s 8V supply at pin 10 was present and correct. Using an oscilloscope, he discovered that there were no RGB outputs at pins 18, 19 and 20. There was a composite video output at pin 7 for the AV switching chip I710. When a video signal was connected to the scart plug and the AV mode was selected there was still no display. So far he was doing very well! He concluded that the TDA8362 chip was faulty, and replaced it with one obtained from the stores. This involved a hundred and four desoldering and soldering operations, all to no avail because the chip was OK: when the replacement had been installed the fault symptom was still present. So what was the real cause of the trouble? For the solution, turn to page 55.



**Hugh Cocks** on the equipment required for reception of C-band digital satellite TV signals and how to set it up and get started. A further article will provide details of the stronger signals available and information on receiver operation

# C-band digital TV reception

If you were interested in satellite TV reception in the early Eighties you would have started with Russian C-band transmissions from the Gorizont satellite, using a small (in C-band terms) dish of 90cm or more. Gorizont provided the strongest signals from the sky, other C-band signals being much weaker. I ended up building a 6m dish and watching lots of signals from around the world. Nothing was scrambled, and the choice was wide. Late at night some Soviet feed channels even used to transmit very 'unofficial' tapes of the BBC Top of the Pops and other material!

In Europe Ku band then started to become active, while C band was going nowhere. During the past ten years or so I've barely looked at C-band signals. But with the advent of digital transmissions and advances in LNB noise-figure technology I thought it time to take another look at band C, albeit with a smaller dish.

As C-band (3.6-4.2GHz) satellite footprints are generally wider than Ku-band ones, you get signals from more far-flung places. On the minus side, signal strengths are generally lower. So experience in searching for obscure digital signals is best gained in Ku band initially. Now and again in Band C you come across signals that aren't listed anywhere. The number of signals in Band C is far fewer than in Band Ku, but the ones you come across there can be of greater interest to the satellite DXer.

## Dish Requirements

For Band C digital TV reception the minimum dish size should be 1.5m. If you have space for a larger one, so much the better! Reception of some of the strongest signals might just be possible using a 1.2m dish.

Prime-focus dishes are the order of the day in Band C: an offset C-band dish/feed assembly is a rare bird indeed. As C-band signals have a wavelength of some 8cm, about three times those in Band Ku, overall dish

surface accuracy does not need to be as great. You can even use one made of mesh with a fairly large diameter hole, about 5-7mm. Don't expect spectacular results in Ku band with such a dish however: results are often very poor, with even two Ku-band pick-up lobes, because from the Ku-band point of view such a dish is out of tolerance.

Whereas reception of a C-band analogue transmission is possible using a small dish, IF bandwidth reduction and FM demodulator threshold extension, the result being fairly 'scratchy' pictures, this approach doesn't work with a digital signal. When the digital signal is at a just usable level a few parts of the picture will turn into squares and there will be intermittent sound. Increase the signal a fraction and you get perfect results: reduce it and you are left with nothing except a helpful message from the digital box telling you that there is no signal. Such is technological progress!

## The LNB

Traditionally a noise temperature rather than a noise figure is quoted for C-band LNBs. Modern ones run at about 17°K, which is equivalent to a noise figure of less than 0.3dB, and cost less than £40. I shudder to recall that in 1982 we stumped up about £300 for an imported US unit with a noise temperature of 120°K – that's about 1.5dB. And it would normally be only a low-noise amplifier (LNA): an IF downconverter had to be connected to the enormous N socket at the back of the unit. At that time you could obtain from US manufacturers Ku-band LNBs with a noise figure of 3.5dB for about £1,000 plus – to special order, and with a very long delivery time!

C-band LNBs are not of the voltage-switched polarisation type with a built-in feedhorn. They require a bolted-on feedhorn/polariser unit. The IF output is from 950MHz upwards, the local oscillator frequency being

*Our heading photograph shows Iain Menzies with a friend's domestic C-band dish during a visit to N. America.*



above that of the incoming signal (the reverse of Ku-band practice) at 5.15GHz – so 4.2GHz, at the top of Band C, produces an IF of 950MHz. All modern C-band LNBS have low local-oscillator phase noise, which is essential for error-free digital reception, and have “digital-ready” or a similar claim in the instruction leaflet.

Modern analogue satellite receivers have a C-band LNB option in their set-up menu. As the incoming IF signal spectrum is reversed, the result would be a negative picture. The C-band LNB menu should include an automatic video inversion option to correct this. Digital satellite receivers should also have provision for automatic signal inversion via the LNB selection menu to cater for band-C operation. I've had experience, when this has not been the case, of some channels being listed in the electronic programme guide though the stored frequency is totally incorrect! You can experiment with this, once some experience has been gained, by entering search as a 'Ku-band' signal and seeing the results.

### The Feedhorn/depolariser

A good satellite supplier should be able to sell you a C-band feedhorn to go with the LNB. It's a larger version of the Ku-band scalar ring assembly required with a prime-focus Ku-band dish. The C-band unit will have a built-in servo-motor type polariser. Basically this rotates a small pickup probe in the C-band feed: the other end of the probe sits in a small section of waveguide, sending the signal to the LNB.

All Intelsat, Gorizont and Telecom satellites with C-band capacity use left- or right-hand circular signal polarisation (LHCP/RHCP). The newer PanAmSat satellites use linear (horizontal/vertical) polarisation, the North American practice in Band C.

To receive circularly-polarised signals a depolariser has to be inserted in the feed. It consists of a quarter-wavelength slab of Teflon material, about 8-10mm wide, that sits in the feedhorn – you should be able to buy it with the feedhorn. Insert it end-on into the feedhorn. The pickup probe is set to 45° either side of the slab for LHCP or RHCP.

The Teflon slab slows down the incoming, rotating signal so that it arrives at the C-band feedhorn's pickup probe as a linear signal. This is best tested with an analogue signal, for peaking/nulling as the probe is rotated for LHCP/RHCP. I've noticed that with the Teflon slab inserted the polariser probe setting is slightly frequency dependent, so that for example the optimum RHCP setting is slightly different at 3.7GHz compared with 4.2GHz.

Some compromise has to be accepted if linearly-polarised signals are to be received with the slab left in the feed. Initially PanAmSat craft will be of lesser interest in the UK since they are very low on the east/west horizons at 58°W and 68°E respectively – apart from 43°W, more of which later. Any PanAmSat reception testing should be done initially with no depolariser in the feed.

C- and Ku-band feedhorns are available commercially as a combined unit. I've no experience of such devices, which tend to be expensive. If you intend to install a large dish from scratch, this may be a good approach.

### Simple Feedhorn Assembly

A 'simple' C-band feedhorn may also be available from your satellite equipment supplier. It simply bolts on to the LNB flange, and for polarisation selection you rotate the whole feed assembly. For LHCP/RHCP selection the Teflon depolariser can be manually moved through 90°.

In addition to being considerably cheaper than a servo-



Photo 1: Hero Miami at 3.847GHz from NSS 806.



Photo 2: Chinese TV (CCTV) at 4.03GHz from PanAmSat 3R.

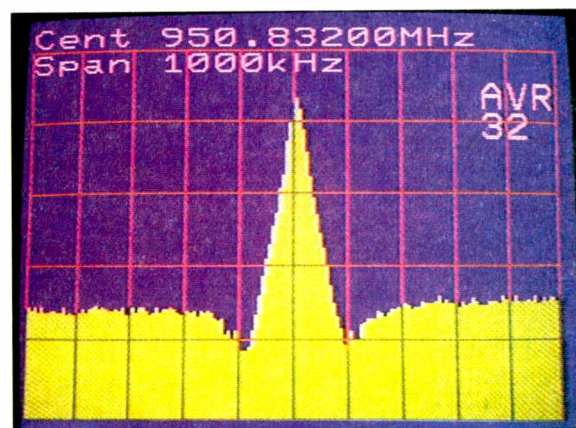


Photo 3: Beacon at approximately 4.2GHz from PanAmSat 3R.



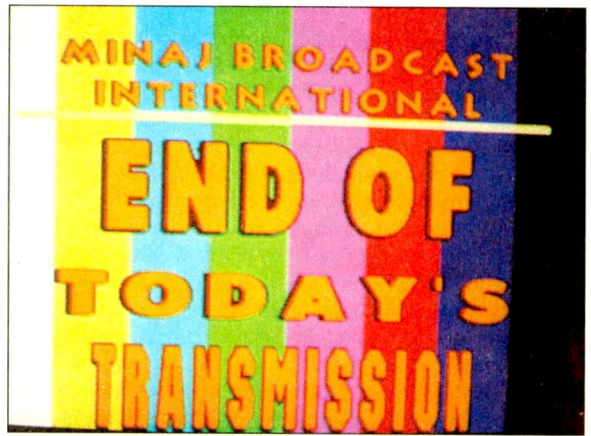
Photo 4: Minaj Broadcasting International, Nigeria, from PanAmSat 3R at 4.187GHz.



Photo 5: (left)  
An MBI news-  
reader  
(PanAmSat 3R).



Photo 6: (right)  
MBI close down  
(PanAmSat 3R).



motor feedhorn, the simple type introduces much less signal loss because the signal doesn't have to pass via a rotating probe between the feedhorn and the LNB: this can introduce a loss of 1dB, hopefully less. While 1dB doesn't sound much, in practice C-band dish gain is hard won. Going from say a 2m dish to a 3m one provides a theoretical increase of 3dB at most, and this is realised only when the larger dish has reasonable surface accuracy, which becomes much harder to achieve as dish size is increased. You might in practice gain 2.5dB at most by going from a 2m to a 3m dish. Thus a 'good' 2m installation with a very low-loss feed might be almost as effective as a 3m one with poor surface accuracy and a lossy feed. Size ain't everything!

### Polarisation Control and Receiver Connection

Unfortunately digital receivers don't provide servo-motor polariser drive, so the motor will have to be connected to an analogue satellite receiver that has a suitable output. This is no disadvantage however, as it helps to be able to 'see' an analogue signal when aligning the dish with a satellite. The IF input can be split between digital and analogue receivers and possibly a spectrum analyser, see Fig. 1.

In general C-band LNBS provide a slightly higher IF output level than their Ku-band counterparts, so splitter signal losses don't present a problem. If the splitter has DC power passing facilities for both receivers, it's best to power the LNB from just one receiver. Most modern analogue and digital receivers will switch off the LNB power via the installation menu. The LNB requires a supply of at least 15V DC, so select the receiver's 18V 'horizontal' option – the signal output may be slightly low with a 13V 'vertical' output.

Test the servo-motor polariser thoroughly before you install it at the dish. There have been dramatic improvements with modern ones, but I still have memories of early Ku-band polarisers, of Far Eastern origin, whose motor quality was truly dreadful. A few horizontal and vertical selections were all that they would take before they would go literally into a spin, giving simultaneous horizontal and vertical reception.

The addition of a small amount of decoupling to the 5V motor supply can help to reduce motor jitter, say 470µF across the positive and negative terminals and a 1Ω resistor in series with the 5V supply from the receiver, soldered next to it. In extreme cases a capacitor of 100pF or less between the servo pulse input and motor earth helps. As a general precaution, keep the servo control cable away from the dish motor actuator cable.

### Dish Alignment

If you are installing a larger dish from scratch and want

to align the polar mount (this would require an article in itself!) with the geostationary satellite arc, it's much better to do this using a Ku-band LNB. C-band satellite signals are in general quite weak, while the older satellites can be in an inclined orbit, which means that they go above and below where they should be during the day. Russian satellites are notorious in this respect: if you try using one of these as a signal reference you'll have a very long job indeed! Satellites such as the Telecom, PanAmSat and Intelsat ones that transmit in both bands are normally very stable – because of their beamwidth, Ku-band dishes won't tolerate an inclined orbit.

Since dish beamwidth is much sharper with Ku-band than C-band operation, if the dish tracks across the arc well at the Ku-band frequencies its C-band tracking will be excellent. Any polar-mount tracking errors generally occur at the end of the arc. If the dish tracks well with most of the satellites, but say PanAmSat at 43°W and Turksat at 42°E require dish elevation for maximum Ku-band signals, decrease the polar mount elevation a little and reduce the dish declination. If the opposite effect is experienced – the dish seems to be too high at the edge of the arc – increase the mount's elevation and the dish declination. Aligning polar mounts becomes much easier with practice. But how often does one install a polar mount these days?!

For reception from the maximum number of satellites, make sure that the dish can see as much of the eastern and western sky as possible. But because the dish beamwidth is much wider at Band-C frequencies, more noise will be picked up from the ground when C-band satellites are close to the horizon. This limits reception to satellites that are 5-10° above the horizon, though in practice reception is possible quite close to "scraping the horizon". In this respect the larger the dish the better, as along with increased gain the beamwidth is less. Ground noise is also picked up by sidelobes in a dish's response. This is in general more of a problem with C-band than with Ku-band reception, where the beamwidth is so much sharper. I've seen Ku-band reception with a small dish at an elevation of about 2° to the horizon: you'd need a very large C-band dish to be able to do the same thing.

### Testing the System

Line up the dish with an analogue signal initially. A 'hot' digital C-band satellite that has one analogue signal is positioned at 40.5°W: formerly called Intelsat 806, it's now known as NSS 806. New Skies Satellites took over operation of some of the Intelsat craft at the end of 1998. The signal to aim for is Argentina Televisora Color at 4.167GHz (983MHz IF) with LHCP. It's a 625-line transmission with Spanish audio at 6.4MHz and Radio Nacional Argentina in mono at



7MHz. The pictures usually have an ATC logo at the top, right-hand corner. Make sure that the depolariser nulls the TV signal when set to RHCP. Perfect signal cancellation can be hard to achieve, but a signal should be barely detectable with the opposite polarisation selected.

### Signal Strength

How strong the signal should be is always a difficult question in Band C. Many of the signals are not as stable as those in Ku band, and they can vary quite dramatically from day to day. As a plus point however weather plays no part in signal strength reduction as it does in Band Ku.

First of all adjust the dish for maximum signal (naturally!), then if possible adjust the feedhorn slightly into/out of the dish, again for maximum signal. The dish's focal point (maximum signal) should be just inside the feedhorn's tube.

If you are lucky the scalar rings will be adjustable relative to the front of the feedhorn 'Flat' dishes, i.e. with a high focal point to diameter ratio ( $f/d$  ratio), require 10mm or so of feed tube to stick out in front of the scalar rings. With a low  $f/d$  ratio dish a little more tube should protrude. The ring position is often marked on the side of the waveguide. Adjustment here can often provide a little more signal – the position of the feed tube relative to the scalar rings adjusts the feed's beamwidth, enabling it to look at the edges of the dish efficiently. If the pick-up angle is too narrow, signals coming from the edge of the dish are rejected. If the feedhorn sees over the edge of the dish the LNB will detect ground noise and reduce the signal strength.

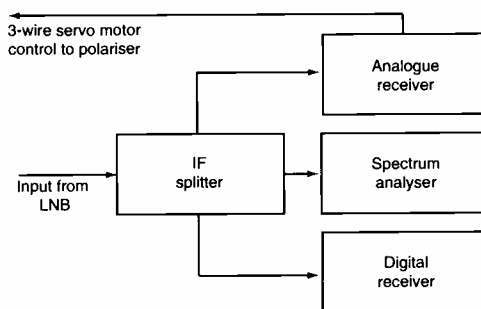
Some adjustment of the position of the depolariser slab inside the mouth of the feedhorn may be beneficial – and experimenting with different material may also help! Teflon has a high dielectric constant, a requirement in order to be able to slow down the circularly polarised signal so that it becomes a linear one when it reaches the pickup at the end of the feedhorn.

When a reasonably sensitive receiver with wide/narrow bandwidth selection and possibly carrier-to-noise threshold extension is used, a 1.5-1.8m dish should provide quite a good picture with the ATC signal, though the test pattern transmitted at up to about 11.00 UK time may have flaring, saturated colours (an effect I'm glad to see the back of with the advent of digital transmission!).

The non-IRD, non-positioner Pace Model MSS228/LT, with threshold extension, produces good C-band pictures. Receivers from some manufacturers can give quite sparkly pictures, especially when they are intended for reception of the strong Astra/Eutelsat signals. It's a shame that this receiver wasn't available during analogue's heyday a few years ago!

### Making a Start

Next hook up the digital receiver and adjust the polariser for RHCP (nulling the LHCP analogue TV signal). Enter 3.847GHz with a symbol rate (SR) of 18,800 and forward error correction (FEC) of 3/4. The receiver should come back with a listing in the EPG (electronic programme guide) of channels 31-34. Select ch. 33 and you should see a test pattern that says Hero, Miami (see Photo 1) with a Florida radio station as the accompanying sound (WLVE 94MHz). Ch. 31 is normally scrambled, but ch. 32 is a Spanish-language channel called GEMS TV, which is usually in the clear, while ch. 34



**Fig. 1: A typical C-band receiving set-up. Only one receiver supplies power to the LNB, at 15V nominal.**

has various news feeds. All these channels are transmitted with 525 lines in MPEG-2 form. A receiver such as the Nokia 9600 will produce a 625-line picture that's a little shortened at the bottom: there will be a momentary 'drop-out' every few seconds. This appears to be the strongest digital signal at 40.5°W, and may be possible with a 1.2m dish.

If all is well, key in 4.016GHz RHCP with a symbol rate of 5,712 and 3/4 FEC. You may see RCN TV, ch. 4 Columbia, which could be possible with a 1.5 or 1.8m dish and is again a 525-line transmission.

At 3.803GHz LHCP, with an SR of 27,500 and 3/4 FEC, 625-line transmissions should be present. Various French channels should be seen, together with some radio stations, also 525-line versions of Fashion TV and MCM, the French pop music channel.

If you have internet access – which is now almost essential for up-to-date information on digital satellite occupancy, as the situation changes so quickly – go to <http://www.lyngsat.com>. Information on Intelsat/NSS 806 will be found at

<http://www.lyngsat.com/806.shtml>

The neighbouring satellite PanAmSat 3R at 43°W should produce 625-line Chinese TV (CCTV), see Photo 2, at 4.03GHz with vertical polarisation, SR 19,850 and FEC 3/4. For initial tests, remove the depolariser slab. About six channels should be present at 4.03GHz. Though intended for Africa, the wide footprint stretches into Europe. We don't receive its American beam. For those with access to a spectrum analyser, the satellite has an enormous beacon signal (see Photo 3) at about 4.2GHz with vertical polarisation.

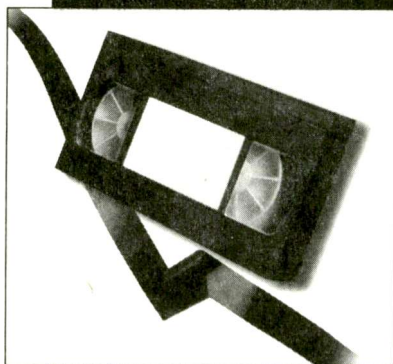
A much weaker signal, from Minaj Broadcast International, Nigeria (photos 4-6), is present at 4.187GHz with vertical polarisation, SR 6,111 and 3/4 FEC. The signal strength is variable, and a dish of over 2.4m may be necessary for reception.

Intermittent feeds from the operator who uses 4.167GHz, with SR 6,617 and 2/3 FEC, are stronger.

Note that Photo 3 was taken using an AOR 5000 receiver and an SDU 5000 spectrum display unit. The receiver's AGC system should have been switched off. Not doing so caused the dip in noise at either side of the bottom of the blip. The signal was resolved with a 30kHz bandwidth setting. Most Intelsat craft have narrow-band beacons – a little weaker than this one! – at about 3.950GHz (IF 1,200MHz). They can be useful for dish alignment.

### Next Month

In this instalment I've outlined equipment requirements and how to make a start. In Part 2 next month further strong signals will be listed and more information on receiver operation will be provided.



# VCR Clinic

Reports from  
**Philip Blundell, AMIEelec**  
**Eugene Trundle**  
**Denis Foley**  
**Adrian Spriddell**  
**Michael Maurice and**  
**P.J. Roberts**

## **Pye DV105/05 (Queen Turbo deck)**

This machine had insufficient take-up tension. Because of this it kept stopping when the customer tried to make it play. I removed the deck, once I'd found the hidden screw that's accessible through a hole in the back panel, and the reel belt. I then found that there was resistance to reel clutch movement. In fact the reel clutch, item 115 in the exploded view in the manual, had come apart. A replacement, part no. 4822 528 20736, restored normal operation. **P.B.**

## **Sony SLVE230**

This and other recent Sony VCRs use the **S mechanism**. There was a very nasty intermittent fault with this machine: occasional failure to eject a tape. The cassette would get stuck about half way through the eject cycle.

I found that this was more likely to occur with a heavy cassette, i.e. a three- or four-hour one. The cause was a cracked sleeve on the loading motor worm: with a heavy load, the motor shaft slipped inside it. A new loading motor assembly, part no. X3947-577-1, restored correct operation. **E.T.**

## **Philips Turbo Deck**

A VCR (Model VR422) fitted with this deck was brought in because it had no fast forward or rewind. Keith Evans's note in the December 1998 issue (page 127) indicated where to look, but this

machine wasn't so easy to repair. In normal operation the reel brakes are controlled by the main slider (item 125). The problem was that the main slider lever (119) wasn't coming into the correct position, in line with the main slider. The main slider lever is triggered into the correct position by the slider lever trigger (123), which is actuated through the chain 108, 110 and the pulse roller 107.

When I removed the small PCB to gain access to these parts I noticed that the fulcrum for the pulse lever (110) was rather 'wobbly'. This is one of the plastic mouldings into the deck chassis, which had cracked. I don't think that the chassis is available as a replacement part, and even if it was I wouldn't like to spend the time required to replace all the parts on it.

I cleaned the deck to take a small amount of superglue and stuck the fulcrum firmly in place. After reassembling the machine everything worked correctly. Only time will tell whether this is a lasting repair. With new machines costing so little, it's not worth spending more than an hour or two on any repair. **D.F.**

## **Akai VS425**

This machine came in for a routine service and because the display was dim. I gave it a quick check over and provided a quotation. Once the service and the modifications had been carried out and a new display tube had been fitted the machine was put on test. There was a line across the first test recording. Still dirt on the drum? I cleaned it again and retested. Same line, different place! After another scrub and retest I just glimpsed the line as it disappeared off the bottom of the screen, only to reappear later at the top then move slowly down during

the next few minutes. The head switching point was wandering, and the replacement SX2777S servo chip that was required cost a good slice of our profit margin. **A.S.**

## **GoldStar GHV1290I**

There was no loading arm movement though the loading cam could be seen going through its motions. I found that the inner section had broken through, allowing the gear rack to free-wheel around the centre of the cam. For good measure I replaced the mode switch as well.

If you get one of these machines that beeps erratically for no good reason, try resoldering the internal connections on the beeper – even though they may appear to be satisfactory. This seems to work for us. **A.S.**

## **Goodmans TX1100**

This machine came in for a service and because "the remote control doesn't always work". We did the service then put the machine on test. Fast forward and reverse were intermittent – sometimes they worked and sometimes they didn't. Then the machine went into the record mode while playing a protected tape. Knowing that the machine is kept in a unit, I decided to replace every electrolytic capacitor in the power supply. This restored normal operation – and the customer later reported that the remote control unit, which she had forgotten to bring in, now worked properly. **A.S.**

## **Ferguson FV31R**

There was very bad wow on sound. Because the supply reel brake did not release fully, the arm toothed rack (item 40 in the exploded view in the manual) was jumping out of sync with the loading motor gear. Moderate heat with a hot-air torch enabled us to reposition the retainer



– it's part of the chassis extrusion – and hold the teeth firmly in mesh. **A.S.**

### **Bush VCR830VP**

The complaint with this VCR was "erratic functions". I found that the machine worked all right until I tried to eject the test tape. The loading arms then retracted two-thirds of the way back and stopped. After this the supply reel rotated in the reverse direction at high speed. It did this again intermittently during the day. I cured the fault by removing the mode switch housing and lightly scrubbing the gold contacts printed on the PCB with silver polish. **A.S.**

### **JVC HRD860**

When I first powered this machine it seemed to be completely dead – I could see no display at all. All the mechanical functions appeared to work however. So I carried out the service that had been requested, then turned my attention to the display problem. After removing the front fascia with its orange filter I could see the fluorescent tube pretending to be an Akai – still just alight but very dim. There was an effective improvement once C28 (120µF) in the power supply had been replaced. **A.S.**

### **Panasonic NVJ45**

This VCR seemed to have dirty heads: while E-E operation was OK, playback was just snowy. But checks in the workshop revealed that there was ripple on most of the supplies. Replacing the 680µF and 390µF electrolytic capacitors in the power supply restored normal playback. **M.M.**

### **Sony SLVE710**

I've now had three of these machines with the same fault, the carriage being out of alignment. Each time the trouble has been cleared by removing the carriage then realigning the gears before refitting it. According to Sony Technical the serial number stamped on the top of the carriage should be checked. If the first five digits are in the range 60203-60531, replace the carriage with an improved type, part no. A-6751-496-H.

There's a modification to prevent the fault occurring with carriages that are not out of alignment: add a spacer, part no. 3-973-667-01, between the side plate and the driving arm. It's as well to get the relevant bulletin from Sony, refer-

ence no. HV01896. You will, however, be more likely to encounter a machine whose carriage has jumped out of alignment, so you probably won't need to carry out the modification. **M.M.**

### **JVC HRD330**

When play was selected the capstan motor would rotate fast for a fraction of a second then the machine would go to stop. The cause of this behaviour was the VC2023B servo IC, which wasn't providing the microcontroller chip with capstan FG pulses. **M.M.**

### **Panasonic NVHD200**

This machine was paying its third visit to my workshop, each time with a different fault. On its first visit the loading motor coupling had split. On the second occasion it was difficult to insert a tape because the take-up end sensor was dry-jointed. This time the customer complained that the machine would intermittently shut down when going from one function to another, with error codes flashing.

When I checked it the machine remained lifeless with its clock flashing irregularly. The clock problem was simply because the power supply connector had not been pushed home fully, robbing the machine of a couple of supplies – in particular the 14V output. But refitting it didn't cure the other fault. The main lever, sometimes referred to as the plate assembly, had cracked in three places and the worm wheel had lost most of its teeth. Once these items had been replaced, along with the mode switch, the machine performed faultlessly. **M.M.**

### **Hitachi VTF860**

Dead after a power cut is becoming a common fault with this and other Hitachi VCRs. Locate the 1µF, 250V capacitor and replace it, using a 105°C type. You can get this from Farnell Electronic Components in Leeds (01132 636 311). **M.M.**

### **Panasonic NVJ45**

This machine came in because it wouldn't accept tapes. When the top had been removed I noticed that the capstan seemed to rotate too fast: the stop mode was soon selected. Panasonic's Infobox bulletin (0276) tells us that this can occur when L2001 is open-circuit, but it was OK. Dry-joints and all the usuals were looked for, but nothing was found. What about the FG sen-

sor on the capstan motor? I quickly swapped it for one from a scrap machine. This restored correct motor speed and deck operation. After a lengthy soak test the machine was returned to its owner. **P.J.R.**

### **Sony SLV425**

This machine was dead without even a glimmer of life. The mains fuse was OK, and there was 320V across the bridge rectifier's reservoir capacitor, but the power supply refused to start. The 270kΩ start-up resistors were all open-circuit – they are chip-type, surface-mounted devices – and the TDA4605 chopper control chip had failed.

Once these items and C5030 (47µF) had been replaced there was life but the mechanical operation was incorrect. A cassette would be accepted but the tape wouldn't lace up, with the solenoid clicking. The mode switch was replaced, but this had no effect.

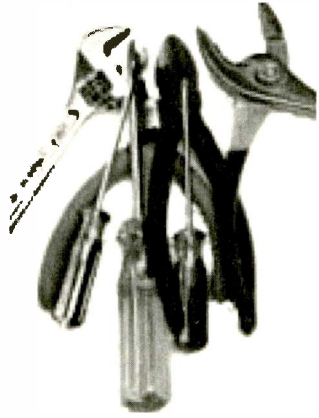
Back in the power supply I noticed that several of the 220µF capacitors were leaking. Once they had all been replaced and a new pinch roller had been fitted the machine worked well. The mode switch is part no. VSS0175A (Panasonic G deck). **P.J.R.**

### **Panasonic NVSD410**

The owner of this machine said that it had been looked at by "someone". It wouldn't accept a tape. The cause of this is usually the loading motor coupling, which tends to split and is then free to rotate on the motor spindle. But we continued to have problems when a replacement coupling and mode switch had been fitted. The unit still had difficulty taking a tape. The cause was traced to the main shaft, which can become twisted.

There was a further problem when this item had been replaced. The machine would accept a tape, lace up, move the tape at high speed, unlace and eject the tape. On closer examination I saw that the capstan motor was rotating too fast, possibly because of loss of FG. A new motor was tried, but in the end the cause turned out to be the processor IC. Once a new IC had been fitted we at last had correct operation. The customer was warned not to let "someone" look at the machine again.

Part nos. are: motor coupling VXP1434; main bar VXP1339; mode switch VSS0365; and processor chip MN67434VRTA. **P.J.R.**



# John Edwards' Casebook

## Philips 21CE7550

The telephone conversation started off nicely. The young lady at the other end told me that her friend recommended me highly because I was really honest, really reliable, really clever and, wait for the punch line, really cheap! "My husband has had a look. He told me to tell you it was the fuse, but he doesn't know what amp to fit. He's quite happy to pay you something to call and check it out."

"That's kind of him" I replied, trying not to sound sarcastic.

When I called I found that the power supply was struggling to produce about 35V HT. So I desoldered the line output transformer's HT pin and tried again. The HT settled at 135V. I then desoldered the line output transistor's collector and checked the primary winding of the transformer with my LOPT tester. This declared it unfit.

"I'm sorry dear" I reported, "it's not the fuse, it's something called the line output transformer."

"Oh right." She paused then continued. "He said if it wasn't the fuse it must be something else."

I couldn't resist it. "Clever man, your husband."

"That's what I keep telling him" she said, proudly. "You'd best do it, he just hasn't got the time."

I touched my forelock, loaded the set into the van, and departed.

## Bush 2114

The picture produced by this set had four black bands equally spaced across the screen. Closer examination revealed that the tube was being blanked in sections. Two capacitors were the cause of this unusual symptom: one of the reservoir capacitors on the secondary side of the chopper power supply, C806 (1,000 $\mu$ F, 16V), and C307 (0.33 $\mu$ F) in the field timebase circuit. The latter is hidden beneath the right-hand side PCB support moulding and took some time to track down.

## ITT TX3446

Fuse Fu01 on the standby/controller PCB had shattered, so it didn't take long to establish that the S2000A chopper transistor was short-circuit. Electrolyte gunge around the bottom of C712 (10 $\mu$ F, 400V) revealed the culprit. A new fuse, transistor and capacitor restored operation, but when the set was switched on from cold there was severe line tearing and intermittently muted sound, both symptoms clearing after a few minutes.

Fortunately I'd come across this fault before and had made a note about it. C209 (10 $\mu$ F) and C231 (0.47 $\mu$ F) in the tuner can had changed value. With new capacitors

fitted there was a good, locked picture from switch on.

When I delivered the set its owner told me he'd got used to waiting for it to settle down, and that if I'd charged extra for fixing it he'd want it put back the way it was and the difference refunded!

I told him I did it as a favour, but for future reference wrote something very different on my invoice copy.

## Grundig CUC6369

This set lived on the tenth floor of a local skyscraper block. The lift obviously knew that I was to call and was in a hurry, so it stopped working when it got to the second floor. By the time I'd climbed the remaining eight floors my toolbox weighed a ton, my legs were aching, and my heart pounded. Leaning against the customer's front door frame I looked to heaven, which didn't seem too far away, and prayed that I wouldn't have to take the set back to the workshop.

The door opened and I was ushered inside, where a very large Grundig set displayed a picture with reduced height and several flyback lines across the top of the screen. "Please let it be dry-joints" I told myself.

While I was busy removing the back, the customer told me not to worry if I had to take it away as she had a spare portable. She didn't realise that I was very worried about the possibility of having to struggle down ten floors with this monster.

Much to my relief, the pins of the field chip were all dry-jointed and a quick session with the soldering iron restored normal scanning. Once outside again I was tempted to press the lift button. The doors slid open, inviting me in. I decided not to risk it and proceeded cheerfully down the stairs.

## Matsui 21V1N (Grundig CUC7350 chassis)

I was surprised to find a Grundig chassis when I removed the back of this Matsui set. Whatever next?! Anyway, glancing at the blackened remains of the mains fuse I expected a power supply rebuild job. But the damage wasn't too bad. Two of the four 1N4007 bridge rectifier diodes, D60013/4, and the IRFBC40 chopper FET T60020 were short-circuit. I replaced the latter with a BUZ90 from stock, and as a precaution replaced the UC3842N chopper control chip IC60030 as well.

Fortunately I had a very careful look at the soldered joints in the power supply before I switched on. Several dry-joints were developing, and the chopper transformer's pins all needed resoldering. The set then came on without making a fuss, and I gave it an appreciative pat.





## Satellite PSU Repair Kits

MAKE & MODEL	CODE	MAKE & MODEL	CODE	MAKE & MODEL	CODE	MAKE & MODEL	CODE
<b>ALBA</b> SAT6600	SATPSU2	<b>FINLUX</b> SR5700	SATPSU12	<b>MATSUI</b> RD600	SATPSU20	<b>PHILIPS</b> STU802/05M, STU804, STU811, STU824	SATPSU1
<b>AMSTARD</b> SAT250, SR950, SRD2000, SRD700, SRD950, SRX1002, SRX2001, SRX301, SRX501, SRX502	SATPSU16	<b>GOODMANS</b> ST700	SATPSU1	<b>MITSUBISHI</b> ST-PB10	SATPSU1	STU801	SATPSU2
SRD510, SRD520 SRD540, SRD545, SRD550 SRD500	SATPSU3 SATPSU4	<b>GRANADA</b> KR1, LR1, LR2, M/N92MR1/A HR 1, JR1	SATPSU1 SATPSU2	<b>NOKIA</b> SAT1500, SAT1600	SATPSU2	STU3301	SATPSU20
<b>BRITISH TELECOM</b> SVS300	SATPSU17	NR2, PR2 M92MR2	SATPSU8 SATPSU9	SAT1700, SAT2200, SAT2202 SU23	SATP-	STU909	SATPSU22
<b>BUSH</b> IRD150	SATPSU12	<b>GRUNDIG</b> STR1	SATPSU1	<b>PACE</b> PRD700, PRD800, PRD900, PSR800, PSR900, MRD950, MRD960	SATPSU1	STU350	SATPSU9
<b>ECHOSTAR</b> SR5500 EARLY PSU WITH ADJ.	SATPSU12	GIRD2000, GIRD3000 GRD150, GRD250, GRD280, GRD300, STR200S	SATPSU2 SATPSU20	MSS500, MSS1000 MRD920, SS9000, SS9010, SS9200, SS9210, SS9220 SU2	SATPSU10 SATP-	<b>SONY</b> SAT301	SATPSU10
<b>FERGUSON</b> SRD 5, SRD15 SRD4 SRV1	SATPSU1 SATPSU11 SATPSU2	<b>HITACHI</b> SR-1050D	SATPSU1	<b>APOLLO</b> , MSS200, MS290, MSS300	SATPSU9	<b>THOMSON</b> SRD11, SRD 14 SRD7/8, SRS3, SRS4	SATPSU1 SATPSU2
		<b>MASPRO</b> SRE250S/1, SRE 350S/1 SRE250S, SRE350S, SRE450S ST5, ST-12	SATPSU1 SATPSU2 SATPSU20	<b>PANASONIC</b> TU-SD200 TU-SD250	SATPSU1 SATPSU9	<b>THORN</b> SAT99, SAT120	SATPSU1
						<b>TOSHIBA</b> SAT39, TU-SD200 TS540	SATPSU1 SATPSU10

CODE	PRICE	CODE	PRICE	CODE	PRICE	CODE	PRICE
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SATPSU2	550p	SATPSU8	1100p	SATPSU11	650p	SATPSU17	850p
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43700000	LOT02	1200p	2434393	LOT405	2250p	TLF 14567 F	LOT39	1850p	43700000	LOT02	1200p
<b>AMSTRAD</b>			2434593	LOT44	1050p	TLF 14568 F	LOT40	1500p	7140021	LOT02	1200p
3714002	LOT02	1200p	2435006	LOT401	1700p	TLF 14584 F	LOT41	1700p	<b>SHARP</b>		
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43700000	LOT02	1200p	2433891H	LOT23	1400p	<b>PHILIPS</b>			<b>SONY</b>		
<b>FERGUSON</b>			<b>MATSUI</b>			3119 108 31260	LOT90	1200p	1-439-332-41	LOT100	1500p
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3714002	LOT02	1200p	7140021	LOT02	1200p	3122 138 36923	LOT57	1100p	1-439-387-21	LOT311	1450p
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2433752	LOT01	1300p	043714002J	LOT02	1200p	4822 140 10306	LOT57	1100p	23236425	LOT288	1400p
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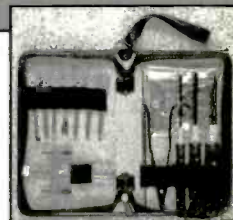
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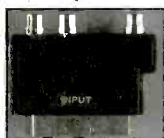
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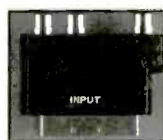
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Samsung TV	RCUNI07
Toshiba TV	RCUNI08
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BU2520DF 225p	BUZ90AF 280p	MJ15024 400p	TIP36C 65p	SAA1293 550p	STR44115 475p	TDA1557Q 300p	TEA5170 200p	
BU2525A 325p	BUZ91A 260p	MJ2501 100p	TIP41A 20p	SAB3035 275p	STR451 800p	TDA1558Q 300p	UC3842N 60p	
BU2525AF 220p	IRF510 70p	MJ2955 55p	TIP41C 22p	STK4131 480p	STR4512 400p	TDA2004 150p	UC3842AN 80p	
BU2525D 240p	IRF520 75p	MJE13007 100p	TIP42C 22p	STK4141 II 420p	STR50103A 260p	TDA2005 150p	UC3843 80p	
BU2527AF 400p	IRF530 75p	MJE13009 100p	TIPL791A 80p	STK4142 530p	STR54041 320p	TDA2030 80p		
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BU508D 75p	IRF620 100p	MJF18006 200p	BA5406 180p	STK4171 900p	STR6020 270p	TDA3653B 80p		
BU508DF 85p	IRF630 75p	MJF18204 350p	BA6209 85p	STK4172 II 680p	STR61001 475p	TDA3653C 85p		
BU508V 110p	IRF640 150p	MJW16206 600p	HA13150A 1150p	STK4191 700p	STR81145 375p	TDA3654 80p		
BUF405A 200p	IRF710 150p	MJW16212 350p	HA13151 875p	STK4332 365p	STRD1706 360p	TDA4565 150p		
BUH1215 450p	IRF720 85p	S2000A3 175p	HA13152 800p	STK5331 300p	STRD1806 360p	TDA4600 200p		
BUH315 200p	IRF730 125p	S2000AF 90p	HA13153A 900p	STK5332 180p	STRD1816 350p	TDA4600 II 160p		
BUH315D 175p	IRF740 90p	S2000N 150p	HA13155 920p	STK5333 650p	STRD4420 550p	TDA4601 120p		
BUH515 200p	IRF820 90p	S2055A 175p	HA13157 950p	STK5337 550p	STRD6108 450p	TDA4605 190p		
BUH515D 250p	IRF830 85p	S2055F 175p	LA4440 200p	STK5481 470p	STRS6707 1000p	TDA4950 100p		
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BUH517D 175p	IRF9610 95p	TIP121 35p	LA4460 120p	STK73410 350p	STRS6709 600p	TDA8171 230p		
BUH715 425p	IRF9620 85p	TIP122 30p	LA4461 120p	STK73410 II 500p	STV9379 400p	TDA8172 200p		
BUT11A 35p	IRFBC30 120p	TIP125 30p	LA4705 400p	STK7348 400p	TA8207K 175p	TDA8350Q 275p		
BUT1AF 35p	IRFBC40 210p	TIP127 35p	LA7830 90p	STK73605 375p	TA8215 300p	TDA8362N3 1200p		
BUT12A 80p	IRFZ44 160p	TIP2955 50p	LA7851 200p	STK73907 700p	TA8221AH 600p	TEA1039 150p		
BUT12AF 90p	MJ11015 250p	TIP29A 22p	LM1207N 450p	STK7406 650p	TA8227 250p	TEA2018A 80p		
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# HELP WANTED

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

**Wanted:** Control door/front flap for the Saisho TV Model CM2880TX. P.J. Roberts, 14 Balaclava Road, Fishponds, Bristol BS16 3LJ.

**Wanted:** Brimar D13-47GH (P31) CRT in good condition, or a working Telequipment oscilloscope type S54AR. D. Dawkins, 25 Clausentum Road, Southampton SO14 6RX. 01703 638 163. E-mail [djd@ecs.soton.ac.uk](mailto:djd@ecs.soton.ac.uk)

**For sale:** Box of assorted valves for old radio and TV receivers. A. Clarke, 2 Alston Crescent, Stanstead, Sudbury, Suffolk CO10 9AN. 01787 280 079.

**Wanted:** Capstan motor bearing and housing for the Sharp VCR Model VC-A36HM (M deck mechanism). The flywheel and associated electronics are not required. E. Parry, Maes Awel, Llanfair, Harlech, Gwynedd LL46 2RS. 01766 780 659. E-mail [erylparry@freeserve.co.uk](mailto:erylparry@freeserve.co.uk)

**Wanted:** Circuit diagram for the Mitsubishi CTV Model CT180B, photocopy OK. J. Austin, 5 Cranwell Road, Greasby, Wirral CH49 3PP. 0151 677 9048.

**For disposal:** Philips PM3240 50MHz delay oscilloscope with manual. In good condition. M.D. Stevenson, 124 Green Lane, Eastwood, Essex SS9 5QJ. 01702 522 929.

**Wanted:** SN76730N IC for a Panasonic colour TV receiver. H. Mode, 24 Steven Court, Egerton Road South, Manchester M21 0XH. 0161 860 0224 (after 6 p.m.).

**Wanted:** Service manual and/or circuit diagram and parts list for the H.H. Scott T516 stereo tuner. I particularly need information on the tuner/trimmer capacitor. Dave Robinson, 93 Courtington Lane, Bloxham, Banbury, Oxon OX15 4HS. 01295 720 548.

**Wanted:** MN15362VPD IC for the Panasonic VCR Model NVG40 (scrap panel would be OK); reel clutch gear assembly for the Amstrad VCR500 series VCRs; a TDA2653 field IC for

the Grundig CUC720/CUC740 chassis (a field panel would be OK). Call Les on phone/fax 0151 426 4152.

**For sale:** Workshop clearout! Because of lack of space, a quantity of ex-rental CTVs, microwave ovens, spares and test gear. Lots of useful equipment going very cheap. Steve Farley, Jolly's Radio Ltd., 128-130 Hawthorn Road, Kingstanding, Birmingham B44 8QA. 0121 382 1312.

**Wanted:** Information/manuals etc. for the following CRT testers/reactivators: Capener Electronic Developments (CED) Model 5A and a T.T.R. unit, there's no model number but it's in a small, grey plastic case. Both date from the Seventies. Stewart Clark, 3 Starrock Cottages, Chipstead, Surrey CR5 3QN. 01737 551 054.

**Wanted:** TAD100 chip or scrap Roberts RIC 1/2 radio receiver for spares, also a turntable rubber drive wheel for the Philips 22GC06055S four-speed record deck. Bruce Adams, Vintage Radio Repairs, 53 Red Leasowes Road, Hasbury, Halesowen, West Midlands B63 4SE. 0121 550 0019 any time.

**Wanted:** Circuit details for the Sinclair multimeter Model DM2 (digital model). Also spares. Ron White, 29 Nunnery Street, Castle Heddingham, Essex CO9 3ND. 01787 460 105 or 01787 463 091.

**For sale:** B&K 467 CRT restorer with instruction book and six bases. £30 plus postage. Paul Byrne 99 Bro Deg, Ruthan, Denbighshire LL15 1XY. 01824 705 810.

**Wanted:** Timer/operations chip type MN15283VPY for the Panasonic VCR Model NVD48HQ - or a timer/operations board part no. VEP07450 or a scrap unit. Bernard Pruden, 83 Hereford Road, Feltham, Middx TW13 5BU. 0181 890 0727.

**Wanted:** Chopper transformer for the Panasonic Model TX25A3 (Euro 1 chassis). D. Jordan, Central Electronics, 6 Queen Street, Stirling FK8 1HN. Phone 01786 451 230, fax

01786 449 830 or e-mail [david.jordan3@virgin.net](mailto:david.jordan3@virgin.net)

**For disposal:** 18in. Toshiba black-stripe PIL tube and coils, type 470KUB22 (ex Decca series 80 chassis). Very good emission and focus. Free to collector (Oxford or Surrey). Nicholas Arnold, 30 Mere Road, Upper Wolvercote, Oxford OX2 8AN. Phone/fax 01865 556 991.

**Wanted:** A Philips N1500 VCR, preferably in working order. Also any old N1500/N1700 tapes. Richard Bell, 91 Kings Road, Melton Mowbray, Leicestershire LE13 1QQ.

**For sale:** Television magazines 1979-1998 inclusive, £50; CQ-TV magazines nos. 100-181 inclusive, £25. Bruce Ward, 12 Pagets Road, Bishops Cleeve, Cheltenham, Glos GL52 4AG. 01242 673 520.

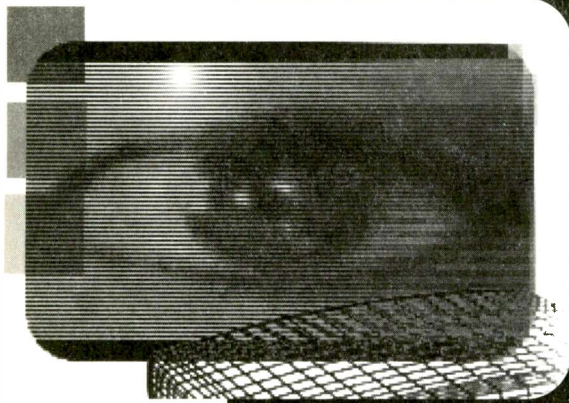
**Wanted:** Service information for the Siemens Nixdorf MCM1702 (NT) monitor. IC1004, labelled 1702D, on PCB PWB2832 is faulty. If it's some kind of EEPROM it may only need reprogramming? Please help. Andy Corr, 18 Cranbrook Avenue, Grange Park, Gosforth, Newcastle upon Tyne NE3 2HQ. 0191 284 6800. E-mail [andy@corno1.freeserve.co.uk](mailto:andy@corno1.freeserve.co.uk)

**For disposal:** Free to collector, two Philips G8/G9 26in. TV sets in large cabinets. Working when last used. Laurie Jones, 56 Southridge Rise, Crowborough, E. Sussex TN6 1LQ. 01892 654 867.

## Obituary - Neville Norbury

It is with deep regret that I have to report the recent death of Neville Norbury following a heart attack. Before he set up his own business in Wilmslow, Neville was known to just about every dealer in the North West as "the Rep from Wizard". He will be fondly remembered as the man who could never refuse a pint!

Neville first had heart problems a few years ago and, though he slowed down a little, he didn't allow it to stop him from enjoying life's pleasures. He lived life to the full and enjoyed every minute of it. M.P.



**Reports from**  
**Philip Blundell, AMIEelec**  
**Colin J. Guy**  
**Edgar M. Beddow**  
**Mike Leach**  
**Bob McClenning**  
**V.W. Cox**  
**Graham M. Coleborn**  
**David A. Chaplin**  
**Jim Kirkman and**  
**Pete Gurney, LCGI**

**Philips 32PW9631/05**  
**(5GFL 2.30E AA chassis)**

This monster went off during a thunderstorm. When power was applied, the standby LED went green for 40 seconds then turned steady red – there was no flashing. The standby power supply was working normally, but the FFS supply didn't start. The set worked once an FFS supply kit, which includes the FFS supply module, had been fitted. Part no. is 4822 310 32214. **P.B.**

**Goodmans 3375 (F11 chassis)**

If one of these sets comes in for repair, ask to see the customer instruction book. You may be lucky and find a circuit diagram folded up inside!

This particular set had smoked then gone dead. A dry-joint at C134 (the circuit diagram says 10nF, but a 12nF capacitor was fitted) had arced, burning a hole in the PCB and destroying the line output transistor TR20. The circuit diagram says that this is a BU508D, but an S2055AF was fitted. Once the print had been repaired and the S2055AF had been replaced there was a good picture. Fortunately there were no EW problems with this one! **P.B.**

# TV

## Fault Finding

**Hitachi CPT2598 (G8Q chassis)**

I've had a number of complaints about these sets reverting to standby intermittently. No one reason has been found: the cause is often dry-joints in various places. In this case however I found that when the fault occurred the crowbar thyristor was being triggered. The cause of the trouble was R718 (51kΩ) which had gone high in value. **C.J.G.**

**Matsui 14R1 (Grundig G1000 chassis)**

This set was brought in because it was dead. I found that there was no 9V supply because fusible resistor R116 had gone open-circuit. Once it had been replaced the 7805 5V regulator IC102 got very hot. Not surprising as there was a short-circuit across the 5V rail. The culprit was a surface-mounted capacitor, C543, which is under the microcontroller chip IC500. **C.J.G.**

**GoldStar CI20E20 (PC53A chassis)**

There was no front-control operation and the screen said "lock on" when an attempt was made to turn the set off with the remote control unit. A replacement 24C08 EEPROM chip restored normal operation. **C.J.G.**

**Amstrad CTV2110 (Onwa chassis)**

This set was dead, though for once the power supply was working and was producing the correct outputs. Further checks revealed that the AN5601 jungle chip IC302 had a short-circuit from its supply pin to chassis. I fitted a replacement and switched the set on again. The result was a shower of sparks from around the base of the LOPT, and the new chip soon expired. A crack in the PCB beneath the LOPT was the cause of the problem. Once this

had been repaired and a new AN5601 chip had been fitted there was a picture but no sound. The arcing had also destroyed R368 (2.2kΩ), D302 and D303. These components are in the sound muting circuit. **C.J.G.**

**Granada C51GP4 (Philips G90 chassis)**

This set was tripping but would work when the HT was turned down to 85V. The protection circuit was in operation because the 33V zener diode D6656, one of three that are connected in series in the HT sensing circuit, was faulty. I replaced all three to be on the safe side. **C.J.G.**

**Akai CT2158 (Sanyo E4-A21 chassis)**

This set reverted to standby five seconds after being switched on. If the channel up button was held in the set would remain on, stepping through the channels and producing a perfect picture with each of them. So I concluded that there was no serious fault. Checks revealed that pin 15 of the microcontroller chip IC701 (protection input) was being held low because Q341 (2SC536, HT sensing) was leaky. **C.J.G.**

**Salora 21M90 (M chassis)**

The width would suddenly decrease by about two inches at each side when this set had been on for about twenty minutes. The EW correction was not affected. When the set was switched off then on again the fault would clear, returning twenty minutes or so later. No amount of freezing or prodding would instigate or cure the fault. The DPU2543 timebase processor chip IC8501 was the culprit. **C.J.G.**

**Sony KVE2532U (AE2 chassis)**

The owner of this set said it would



not switch on. In fact it came on, but with no picture and one of the two red LEDs flashing. When I removed the back I was rewarded with a picture! What had happened is quite common with this chassis: the field output chip was dry-jointed. Once this area and a few other joints that were starting to go had been repaired the set worked very well. **E.M.B.**

### JVC C14ET1 (Onwa chassis)

This set's picture was about 2in. high. Another dealer had replaced just about everything that could have been responsible. I checked all the resistors and capacitors in the field drive and feedback circuits and found nothing amiss. I had a horrible feeling that the scan coils were faulty, and substitution proved this to be the case. A normal DC resistance reading for the field coils is about 13Ω: the faulty ones read 2.5Ω. If the set had been out of warranty it would have been a write-off, as the coils are not available separately from the CRT. **E.M.B.**

### Toshiba 1510TB

The microcontroller and EEPROM chips had been replaced to try to cure a tuning fault. Now neither the tuning mode nor teletext could be selected. The volume functions worked, but the set wouldn't change channels. It was fitted with the newer, single-chip teletext decoder, which means that it is the TB5 version of the chassis. I confess that I'd not at first noticed the sticker – on the back – that confirmed this. A TB type microcontroller chip had been fitted. It couldn't operate the set because it doesn't have separate SDA/SCL lines to control the text decoder. Everything worked correctly once the correct type of chip had been fitted.

It turned out that the component supplier involved (not Toshiba) had the two versions of the chassis down as using the same IC, a mistake that took a lot of man-hours to sort out. **E.M.B.**

### Pioneer AV28

This set is fitted with an ITT Core chassis, which I'd not come across before. The fault was intermittent line output transistor blowing. I checked the HT, using a 60W bulb as a dummy load, and found that it was correct. As the capacitors in the power supply had all been replaced, I felt that the cause of the fault was unlikely to be in this area.

So I replaced the line output transistor, the line output stage tuning capacitors and the EW modulator diodes. At switch on there was a crackle of EHT then another line output transistor bit the dust.

I was beginning to wonder how I would be able to sort this problem out, as there was virtually no time to make any tests. I fitted another transistor then blacked out the workshop and tried again. This test revealed the cause of the trouble: a quick arc could be seen from the scan coil plug. The old ITT CVC32 chassis used to suffer from a similar problem. I removed the plug and socket and hard-wired the leads to the print, providing reinforcement with a drop of hot glue. A long soak test proved that all was now well. **E.M.B.**

### Grundig CUC70 Chassis

I was reluctant to proceed with this set as it was so old, but the CRT was still pretty good. The symptoms were severe ringing on the video and ragged verticals. Blanket replacement of the electrolytics in the IF module cured the ringing. Then, while checking the line driver stage, I found that its supply is smoothed by a 1,000μF capacitor. A replacement cured the ragged verticals. The original capacitor read about 300μF when I checked it with my capacitance meter. After all this I was rewarded with a good picture for a set that must be at least fifteen years old. **E.M.B.**

### Ferguson D68N (ICC9 chassis)

There was very poor, streaky video and the teletext didn't work. A composite video/blanking/sync output was present at pin 6 of the IF amplifier. I followed the video signal path until I came to a BC858B surface-mounted transistor, TX09, which turned out to be leaky. A replacement restored normal pictures and text. **M.L.**

### JVC C14E1 (Onwa chassis)

Here's one for Onwa fans. This set had been to the workshop three times for a power supply rebuild. All the relevant modifications had been carried out, but the power supply would still go into the self-destruct mode after about a week.

On its most recent visit the set remained dead after all the usual parts had been replaced – the chopper transistor, the error sensing and chopper switch-off transistors, the surge limiter resistor etc. – and after about twenty seconds the

chopper transistor became very hot. The culprit turned out to be C910 (0.1μF), which was open-circuit. It's part of the chopper switch-on pulse shaping network. **M.L.**

### Samsung C17230WN (U88MT-1 chassis)

There was no colour in this bulky set's display. Checks around the TDA4661 delay line chip IC502 showed that the 5V supply at pins 1 and 9 was missing. The cause turned out to be the 5V zener diode D503, which was leaky. **M.L.**

### Hitachi C2546TN

The set was stuck in standby. My first step was to resolder the regulators, as this is a common cause of the symptom. They were OK however. I then found that the protection circuit was in operation. This happens when a fault loads the 12V, 8V or 5V supply. In this case the 12V supply was low at 10.2V. The cause of the trouble was the 11V zener diode ZD952, which was leaky. **M.L.**

### Sharp 51AT15H (5BSA chassis)

There were two faults with this set. First there was a blank raster with heavy flyback lines. Sound was present, and the raster flickered when the channels were changed. For this one I got advice from Sharp Technical. Before you plunge into chip changing, try replacing D1002 – it's near the remote control receiver assembly. A 1N4148 worked wonders!

Once I'd got the picture back I discovered that there was no text. Fasttext graphics were present at the bottom of the screen but nothing else. I traced the cause of this fault to the 2SC2412 transistor Q806, which is a surface-mounted device. It feeds a CVBS signal to pin 30 of the microcontroller/text chip IC1001. When checked it was found to be leaky, with the video level lower at its emitter than at its base. **M.L.**

### Nokia 3724UK

This portable was reluctant to start up. The cause was failure of the 11V zener diode V0005 in the start-up supply to the TEA2164G chip. Oddy enough, the set would sometimes start and work well for days. **B.McC.**

### Toshiba 215R8B etc.

We've had loss of field linearity – pictures stretched at the top of the screen and compressed at the bot-

tom – with several sets in this series. The cause is C317. In this model the value is 4.7 $\mu$ F, 50V. A slightly different value will be found in some other models.  
B.McC.

### **GoldStar C21C22F (PC42B chassis)**

There was no start up though the LED indicated on/off. Checks showed that the HT supply was low at only 35V instead of 109V. The cause of the trouble was the 12V regulator IC831. V.W.C.

### **Ferguson A59F (ICC7 chassis)**

If one of the on-screen displays appears without being requested and the controls then don't work at all or behave in a peculiar way, try unplugging the ribbon cable from the front-panel membrane keypad. If this clears the fault, order a new membrane keypad from Charles Hyde or SEME. G.M.C.

### **Panasonic TC2160 (U5 chassis)**

The picture was so dark it was barely visible. What there was consisted of chroma components only, as if the luminance delay line was open-circuit – but it wasn't. There was a luminance input at pin 8 of the colour decoder chip IC601, but it didn't appear at the outputs.

There are several versions of the TDA3562 colour decoder chip. The one fitted was a Telefunken TDA3562A, which is now very hard to find. A Philips TDA3562AP provided a cure in this set. G.M.C.

### **Intel CTV6000**

Intel it said outside. It looked Polish inside, I think. This unknown set came in because it was "all dead". Nothing ventured, nothing gained – so I looked inside and found a very well screened chassis. But the components weren't labelled. The mains fuse at the lower right-hand side had blown. Would I strike lucky? Yes, two of the mains bridge rectifier diodes were short-circuit. I replaced all four, and checked and carefully refitted the little disc capacitor across each one. G.M.C.

### **Bush 1402/Alba CTV840 (Onwa chassis)**

Snow, snow and more snow. There was no sign of a signal on any channel. Stations could be tuned in, but couldn't be stored. For it to work, the MN1220 memory chip

IC601 should have -30V at pin 9. Only -10V was present. The cause of the trouble was the 30V zener diode ZD601 which was leaky. When it had been replaced all the original tuning settings magically reappeared. G.M.C.

### **Ferguson D59F (ICC9 chassis)**

The screen was blank and there was virtually no video output at the scart socket. The video signal from pin 6 of the IF module goes to chip transistor TH01. This transistor was saturated because its base bias was too high: anything over 5V is too much. The fault was cured by replacing the LA7550 IC inside the IF module. G.M.C.

### **Philips 21PT166B (AA5 AB chassis)**

I was told that this set would switch on but after a few minutes the picture would collapse to a vertical line. By the time it was brought to me it refused to switch on at all. I found that the S-correction capacitor C2450 (680nF, 150V) in the line output stage was short-circuit. D.A.C.

### **Saville XPM25 (GoldStar P58A chassis)**

The bottom half of the display was normal, but the top half had collapsed to a bright horizontal line. The cause was the TDA8350Q field/EW output chip IC351. It seemed sensible to replace the 100 $\mu$ F, 25V reservoir capacitor for the 45V boost supply, also the rectifier diode D704 and its reservoir capacitor C708.

Another of these sets had no EW correction. FR359, a 10 $\Omega$ , 0.5W fusible resistor, was found to be open-circuit. D.A.C.

### **Toshiba 212T4B**

This set wouldn't come out of standby for the first twenty minutes or so after being switched on. It would then work normally. The cause was C814 (22 $\mu$ F, 50V) which had gone very low in value. D.A.C.

### **Boots CTV14**

The reported fault was intermittent colour. When I tapped the chroma delay line gently there was fierce arcing and the set went dead. The line output transistor was short-circuit and the 6.8 $\Omega$  surge-limiting resistor had gone open-circuit. A dandy dry-joint at the PCB-mounted mains socket had been the cause. I cleaned and resoldered the socket, then replaced the transistor

and resistor. The colour fault was cleared by replacing the colour decoder chip – I fitted the equivalent TDA3561A in place of the U8060B originally used. D.A.C.

### **Philips 25PT4101 (Anubis B chassis)**

There was complete loss of EW correction with this set. I didn't have a circuit diagram but managed to find that a 47 $\Omega$  safety resistor, R3404, on the module 110 panel was open-circuit. A replacement and a prolonged soak test showed that everything was then OK. D.A.C.

### **Akai CT2142VNT**

There was a drab picture with five flyback lines, also no PAL switching – the picture had alternate lines of curious colours in areas with a red content. Checks around IC301 showed that supply pin 12 was at 7.5V instead of 9.1V. The associated safety resistor R424 measured 12 $\Omega$  instead of 0.68 $\Omega$ ! J.K.

### **Bush 2857NTX**

The width, height and sound surged rapidly at about one second intervals. Very dramatic! It was obvious that a supply was behaving like The Big One at Blackpool Pleasure Beach. Checks showed that C926 (22 $\mu$ F, 160V) was low at 18 $\mu$ F. When an ESR test was carried out on it with the Aussie meter the reading was 35 $\Omega$ , which changed rapidly with heat. J.K.

### **Matsui 1455**

The picture had no luminance content though the chroma content appeared to be normal. Scope checks revealed that the luminance input at the CRT base panel was sitting on a large pulse. This effectively cut off the luminance content. To cut a long story short, Q408 (2SC1815Y) and D417 (1N4148) in the control circuitry were the culprits. It seems that this is a well-known one to Mastercare technicians. J.K.

### **Beko 20306NX**

The power supply was dead with the 2SK1118 chopper MOSFET short-circuit. When I replaced the transistor and, as a precaution, the associated electrolytics the set worked normally. But it came back with the same symptoms four weeks later.

Ringing checks on the chopper transformer produced what seemed to be acceptable results, except that the +B secondary winding wouldn't



ring. I carried out a comparison with a replacement: when the +B winding was shorted out, the waveform produced by the primary winding doubled in amplitude! Shorting any other winding damped the pulses, as you would expect. I can only assume that the change in leakage inductance resulted in an approach to series resonance in the primary winding. The poor old MOSFET, rated at 1kV, would have needed to be a 2kV device to survive. Odd things these switch-mode power supplies. J.K.

**BPL 9002ECR Mk II**

There were electrolytic remains all over the PCB. Six secondary side capacitors had failed, the HT filter capacitor C561 (220µF, 160V) having lost everything – its sleeve was later found embedded in the CRT mounting lugs at the top of the cabinet! When all the visible damage had been cleared up the set came to life and slowly achieved an HT reading 112V, but there was no sound. The AN5265 audio output chip had failed and R582 (3.9Ω, 2W) in its feed measured 16Ω.

Suspecting that there was more to this than met the eye, I phoned Falmouth Hi-Fi (01326 313 412) whose technical wizard told me that Q511, the optocoupler's driver transistor, was prone to overheating in the standby mode. I was advised to fit a 2SA1015 in this position in place of the rather brown 2SA933, and was also told that R552 (91kΩ), R555 (47kΩ) and the optocoupler are known causes of upwards HT drift in standby. J.K.

**Hitachi C2146TN**

The customer said this set was dead. There was certainly little activity when it was switched on, though LED1 on the front panel was alight. Checks on the outputs from the power supply produced correct voltages, so attention was turned to the 5V regulator IC952 and the 8V regulator IC951. Both were poorly jointed and effectively open-circuit.

I've had this fault on several occasions. Bad joints are also common at the 5V standby supply regulator IC950 and the TA8427K field output chip IC601. P.G.

**Ferguson 36K2 (TX89 chassis)**

This set was dead though there was 350V across the mains bridge rectifier's reservoir capacitor. A hunt for start-up resistors took me to R89 and R91, both 82kΩ, which are connected in series. R89 was open-circuit. In the interests of reliability I replaced them both, along with C71 (330µF, 16V), C72 (2.2µF, 50V) and C74 (10µF, 50V). P.G.

**Huanya 37C-2**

This portable produced a picture that was normal but had shifted half way across the screen. Attention was turned to the h/cent DC shift plug, which is by diode D781 in the line output stage. D781 (SM1-02) was found to be largely ash, and the associated 220Ω, 1W resistor R783 had followed it. C780 (2.2µF, 160V) seemed to be the cause of their demise: it had leaked electrolyte all over the PCB. A good clean up plus replacement components restored the picture to its proper position.

I've found that a BY299 works well in position D781. P.G.

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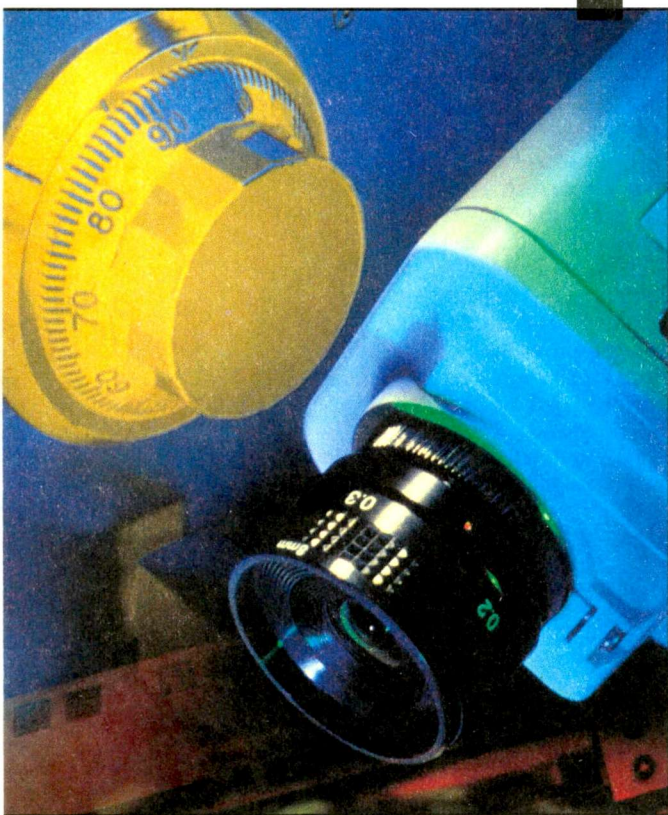
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# Simple

**Denis Mott** presents a microcontroller-chip based surveillance system to enable intruder movements to be recorded. Date and time details are added

## video security system Mk 2



In an article in the April 1997 issue of *Television* (pages 388-9) I described a video surveillance system that uses simple cameras, controlled by PIR (passive infra-red) detector units, to trigger a VCR which switches on to record evidence of the presence of an intruder. Considerable changes have been introduced since then, the most significant being the use of a PIC microcontroller chip, which brings the system into the computer age, and the addition of a date/time generator module. The present article describes this latest version.

The date/time generator module is from the Maplin catalogue – it became available just as the original article was being published. A PIC16C54 microcontroller chip is used for camera selection and VCR control, via relays as before. Also as before, the VCR used is a Sharp VC381. In a letter in the November 1998 issue there was a suggestion for using a mechanical Ferguson VCR:

power was applied, with the machine laced up and set to record. Either idea can be used, but a different relay arrangement would be required to switch the mains supply to the Ferguson machine. A suggestion for a timer-control system with a single record button VCR appeared in the April 1999 issue.

### Circuit Description

The circuit of the microcontroller version is shown in Fig. 1, where IC1 is the PIC16C54 chip. Pins 1 and 2 are connected to the camera DC active outputs. As the voltage from the active camera is 12V, potential dividers (R3/4, R5/6) are used to reduce this.

The video output from each of the two cameras is routed via IC2, a 4053 analogue switch. Selection is controlled by IC1, whose outputs at pins 10 and 11 are connected to pins 10 and 9 of IC2. The video output at pin 15 of IC2 is connected via buffer transistor Q4 to pin 5 of the date/time module MOD1. The buffer is required because IC2's output is at a rather high impedance while MOD1's input impedance is rather low.

The video output at pin 4 of MOD1 is fed directly to the VCR via SK3. No buffer is required as the lead to the VCR should be reasonably short. The module's date and time outputs are displayed at the top left corner of the TV set's screen. Miniature push-buttons are used to set this. The module has provision for battery back-up, which works very well. My only criticism of the module is that the background to its display is grey rather than black.

Relays are again used for VCR control (power and record), but the relay driver transistors Q1-3 are this time under the control of pins 7, 8 and 9 of IC1. Manual/auto switching to allow local control of the VCR is done by

SW1 in conjunction with pin 6 of IC1.

As MOD1 is a bit greedy with its power requirements it is provided with a separate supply derived from the mains transformer T1.

### VCR Modification

For the benefit of those who don't have the previous article, the Sharp VC381 modification details are as follows. Cut the track to the closed power switch contacts (these enable the machine to power up in the timer mode). Connect wires (two) to the normally-open contacts and another one to the unswitched side of the cut track. Solder two wires to the record switch. These five wires are connected to the control unit via SK4. The system should work with any VCR that uses strobe signals to detect switch states.

### Cameras

I continue to recommend the CCD monochrome camera modules available from Maplin (e.g. order code MS37S). Recently however I found that additional gain was required when the video output was to be fed over long distances – say more than 25m. Fig. 2 shows the camera circuit I now use. Any excess video can be attenuated using resistors.

A word of warning. Earlier this year I noticed that the output from one camera was very poor. A check on the lens showed that it had been severely scratched. This was entirely my fault – I had been wiping the dust off with my finger. Fortunately I had another camera module and borrowed the lens. Hey presto, back to normal! Both cameras now have a bit of removable cling film stretched tightly over their fronts. It doesn't degrade the picture at all.

### Software

There are two versions of the soft-



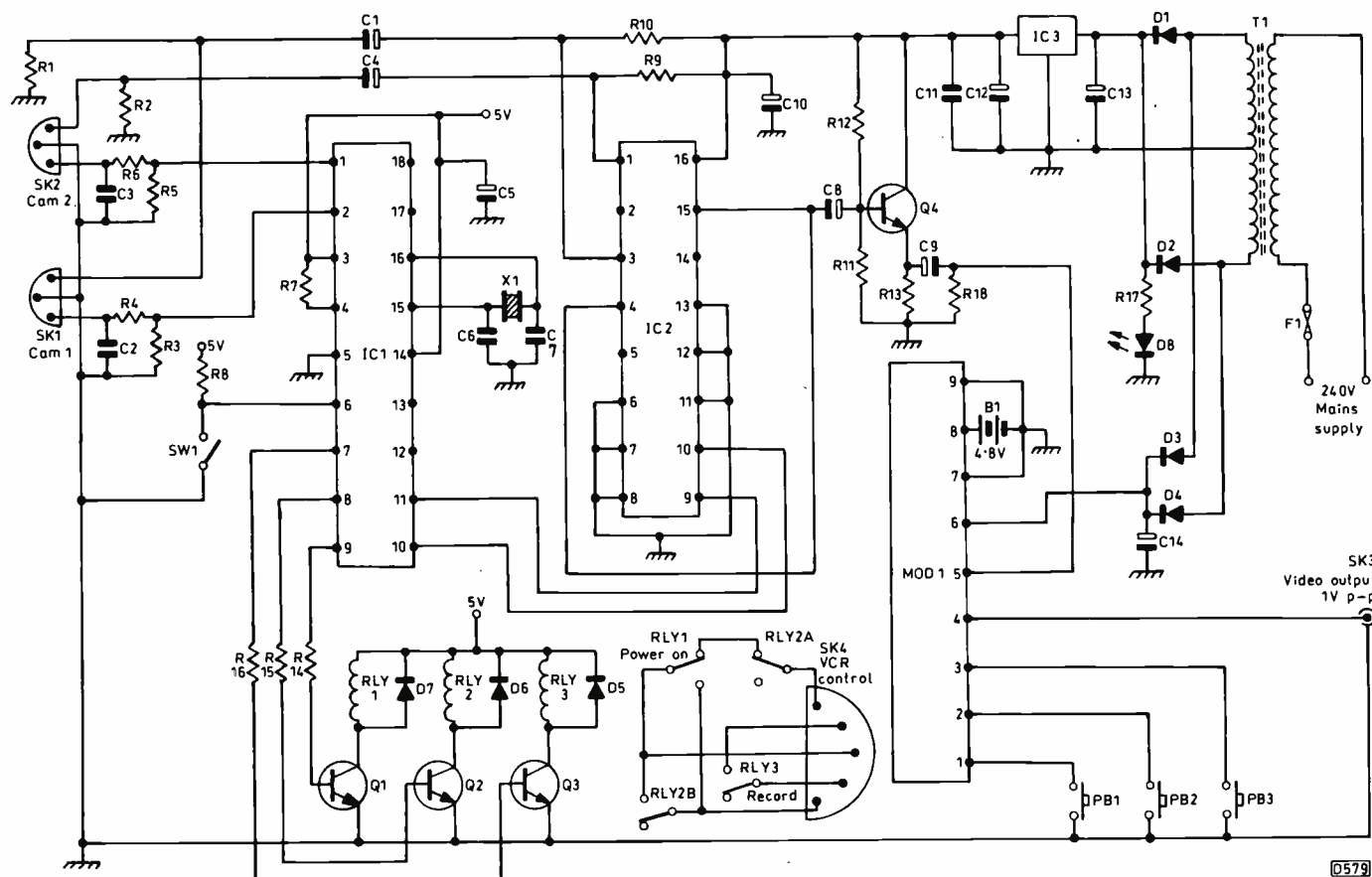


Fig. 1: Control unit circuit diagram.

ware, one for the Sharp VC381 and a dual version that, when booting up, checks the manual/auto switch. If this is in the manual position, the Sharp mode is retained. Otherwise it selects connection to an IR handset – the IR-controlled VCR I use is a Nikkai NV3. Software listings or a pre-programmed PIC chip are available from Denmo Electronics, 91 Sheepridge Road, Huddersfield HD2 1HF (e-mail denis@denmo.freereserve.co.uk).

### Construction

Construction of the control unit and camera circuit is on PCBs. These can also be obtained from Denmo Electronics. The control unit is housed in a Vero box from Maplin (order code NC92A).

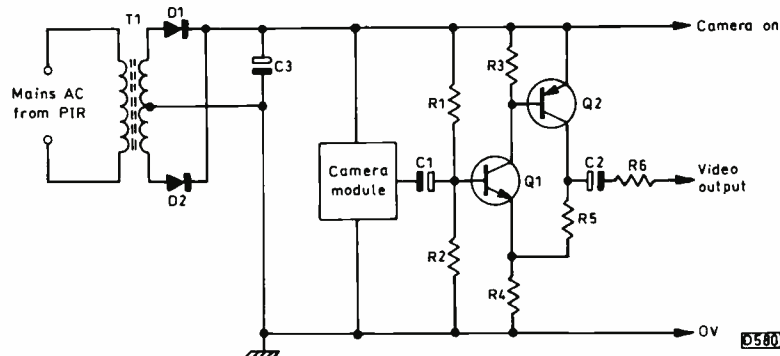


Fig. 2: The camera circuit.

### Parts lists

#### Control unit

R1, 2	75Ω	R11	10kΩ
R3, 5	470Ω	R12	6.8kΩ
R4, 6	820Ω	R13	150Ω
R7	47kΩ	R17	680Ω
R8, 14-16	4.7kΩ	R18	1kΩ
R9, 10	100kΩ		All 0.5W
C1, 4, 8	47μF, 16V	C11	100nF poly-ester (Maplin CX21X)
C2, 3	1nF ceramic disc	C12	47μF, 16V
C5	100μF, 16V	C13	1,000μF, 25V
C6, 7	22pF ceramic disc	C14	2,200μF, 25V
C9, 10	10μF, 16V		

IC1 PIC16C54, IC2 4053, IC3 LM7805

MOD1 date/time module, Maplin order code NV10L

Q1-4 BC548, D1-4 1N4001, D5-7 1N4148, D8 3mm LED

B1 4.8V NiMH battery, Maplin order code BN25C

X1 4MHz crystal, HC49U can, Maplin order code FY82D

SK1, 2 3-pin DIN PCB sockets; SK3 phono/RCA PCB socket;

SK4 5-pin DIN PCB socket

PB1-3 PCB-mounted switches (vertical), Maplin PM46A

RLY1-3 5V relays, Maplin GU35Q

F1 0.5A Wickman fuse

SW1 miniature SPCO toggle switch

T1 6.0-6V 2VA low-profile mains transformer, Farnell order code 149-158

#### Camera circuit

Camera module to suit

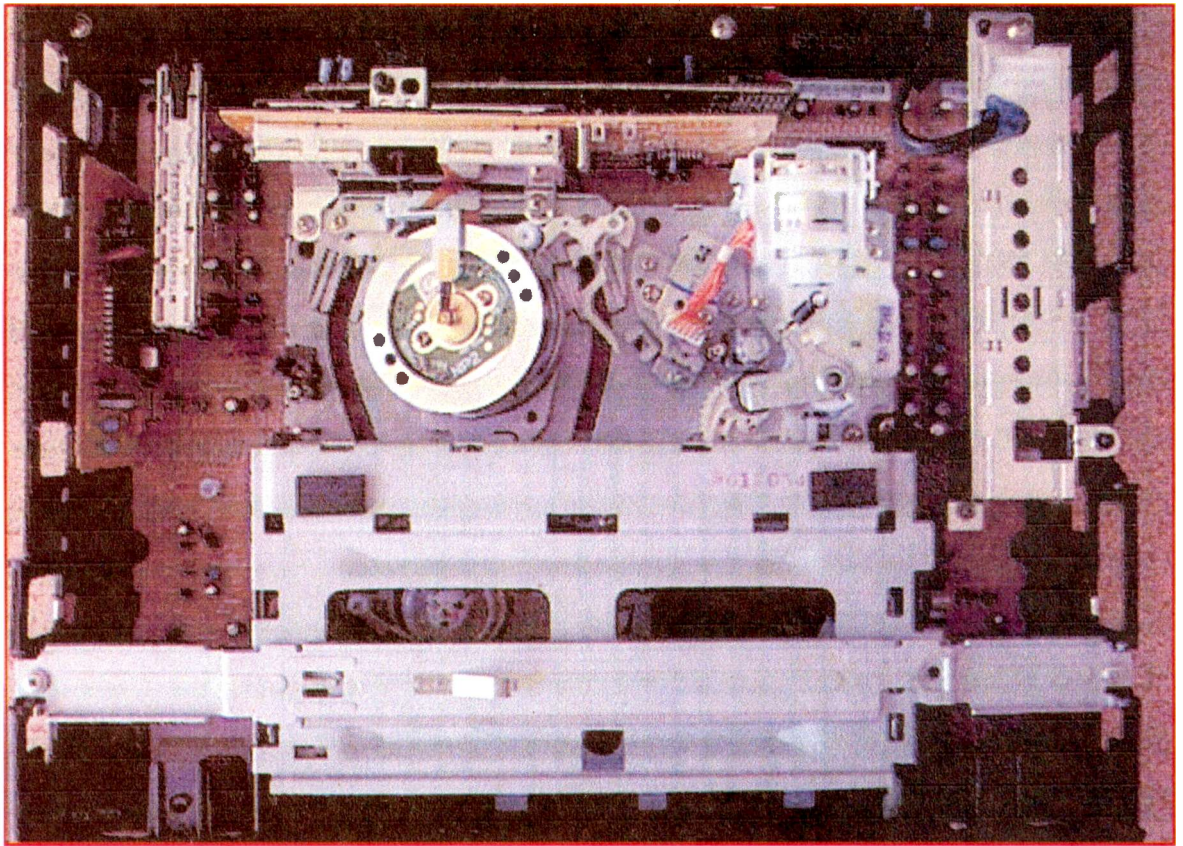
Q1 JC501, Q2 JA101

R1, 2 10kΩ; R3-5 470Ω; R6 33Ω

C1 220μF, 16V; C2 100μF, 16V; C3 1,000μF 25V

D1, 2 1N4001

T1 12V, 100mA sub-miniature mains transformer. Maplin order code WB02C



# Servicing GoldStar P, T and LG W series VCRs

**These reliable and easy to service VCRs have simple on-screen displays for setting up and auto-tuning. They are therefore ideal for refurbishment and re-use. J. LeJeune passes on his experience gained from handling large numbers of them**

**A**s they have much in common, in particular the mechanism and the general electronic design, these three series of VCRs can be dealt with together. Despite being economy models, they are reliable, easy to service and also good looking. Installation is facilitated by an auto-tuning system and, should the associated TV set be without provision for video and audio inputs, easy setting of the RF output channel. On-screen displays with simple menus, called up by the remote-control handset, make setting up easy.

## Description

The P, T and W series use the DV27 deck, which is straightforward and has proved to be reliable and sturdy. There are three motors. The drum and capstan motors are of the brushless, direct-drive type: the latter also drives part of the loading mechanism. The third motor drives the slant-pole arms and in addition raises, lowers and engages the pinch roller.

The centre-sited mechanism is mounted directly on the main PCB and cannot be operated separately. The complete assembly can however be operated out of the cabinet and upside down to expose the copper side of the

main PCB. Four other PCBs complete the basic machine: the control panel; the IF/demodulators; the YC (pre-rec) board; and the input/output panel. These daughter boards plug into the main one. The LG models have an integral chopper power supply, the GoldStar models a modular PSU.

The tuner and modulator are controlled by the micro-controller chip via separate phase-locked loops. Tuning can be automatic or customised. With LG models the RF output channel is set by front-panel keys – there is full UHF-range output. GoldStar models have a trimmer-adjusted output over channels 30-40. All models have a scart connector. Tape motion, record/playback (SP or LP) and standby can be controlled by the remote handset or the front-panel keys.

Note that the metalwork has razor-sharp edges. Take care particularly with the cassette-loading platform and the brace that holds it down, across the upper front edge. The metal cabinet top should also be handled with care.

## Access

Four screws, two on each side, hold the cabinet top in place. Once this has been removed you can set about



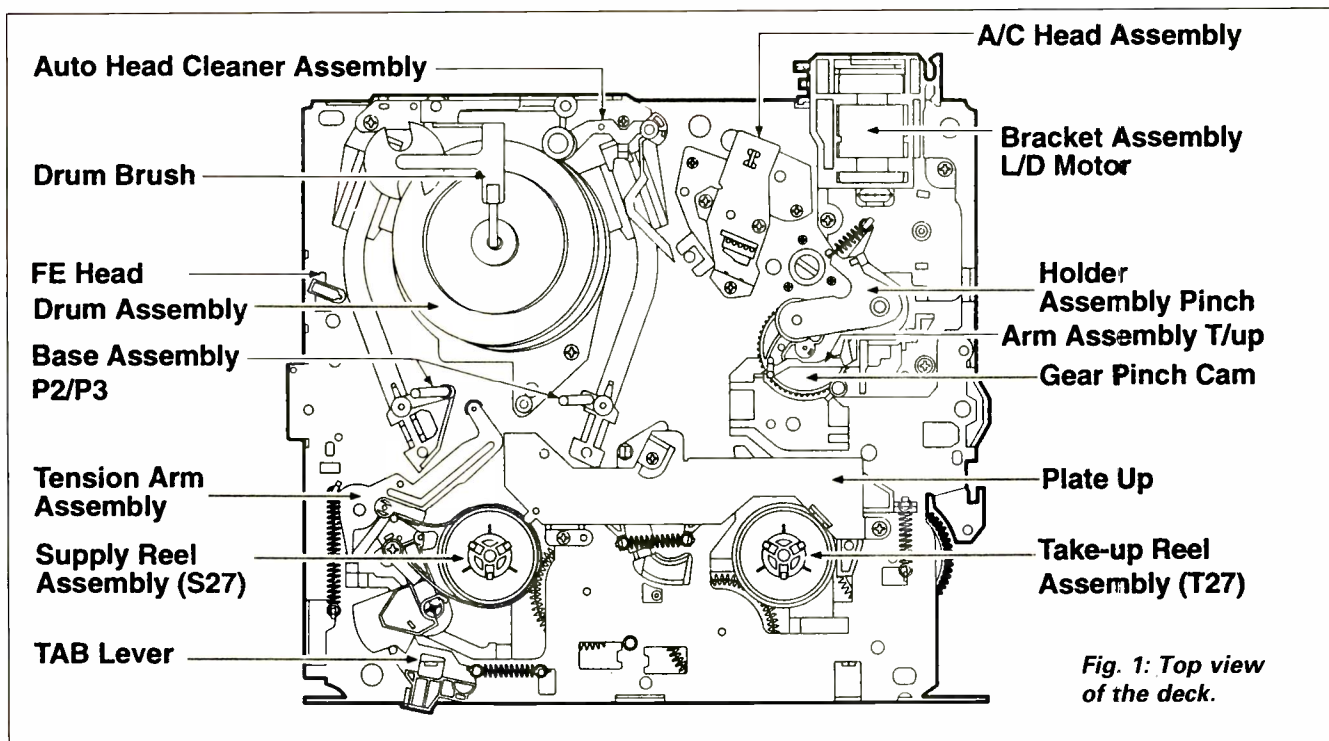


Fig. 1: Top view of the deck.

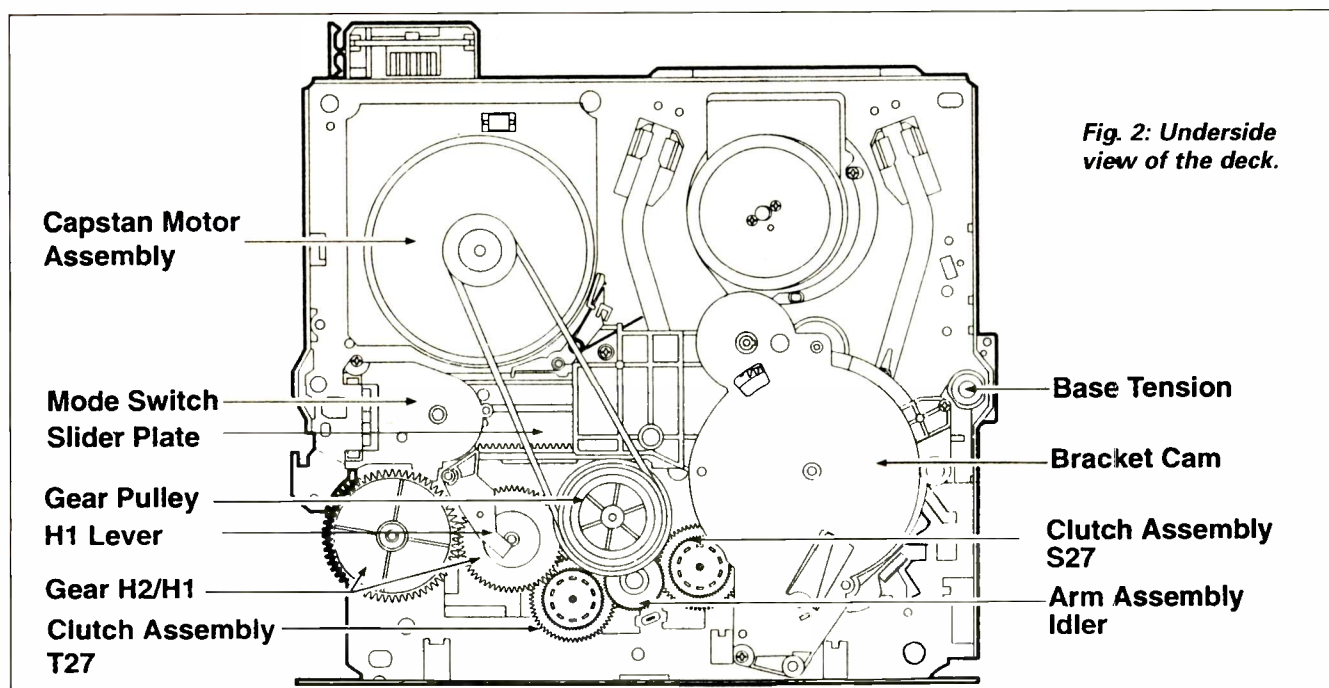


Fig. 2: Underside view of the deck.

dismantling the machine. Unfortunately the plastic chassis has a virtually solid bottom and doesn't allow access to the underside of the main PCB. Don't be fooled by the presence of a detachable metal bottom plate: its removal merely reveals a solid expanse of black ABS plastic. Thus the best course is to remove the entire machine from the chassis for diagnostic and repair work. For head cleaning only the top cover needs to be removed.

GoldStar models have an extra screening plate over the drum, but for all practical purposes the decks in the GoldStar and LG models are identical.

**The Deck**

As noted above, there are three motors. The capstan motor also provides drive for the spools, via a belt. The

small DC motor also operates the mode control switch and drives, via a rack arrangement, the braking mechanisms.

The deck layout is shown in Figs. 1 and 2. Alignment of the datum marks for correct mechanism timing is simple, see Fig. 3. Ensure that the smaller (A) of the two holes in the pinch-cam gear is aligned with the hole in the chassis beneath. Then check that hole B in the PS gear, which meshes with the pinch-cam gear, is aligned with the hole in the raised portion of the chassis above it. Then turn the deck over. The hole in the body of the mode switch, see Fig. 4, should align with a hole in the mode-switch gear. The 'vee' index mark in the slider plate should coincide exactly with the vee between the teeth of the gear beneath it.

There are few problems with the deck but it is, when-

**Power supply circuit semiconductor device list**

BDP01	SIWBA60
DP01	ERA22-20, EG01CW
DP02	1SS131
DP05	1SS131
DP07	2A07, 1N4005
DP08	ERC81-004, 31DQ04
DP10	EU01W
DP12	EU01W
DP13	UF3002, RU4YX
DP17	EU01W
D101-3	1SS131
FEP01	2SK903MR
ICP01	KA7552, FA5311P
ICP02	PS2561-1-V
ICP03	KA431AZ, KIA431
Q101	KTC3199
Q102	KTA1273
Q103	KTA1273
Q104	KTC3199
Q112	KTC3205
Q113	KTD1414
Q114	KTA1273-TP-Y, KTA966A
Q121	KRA103M
Q122	KRA103M
Q123	KTC3205
Q124	KTC3199
Q131	KTC3199
Q132	KSA709C, KTA1268
ZDP02	MTZ5-6B
ZDP03	MTZ22B
ZDP06	MTZ18B
ZD111	MTZ13C
ZD112	MTZ12B

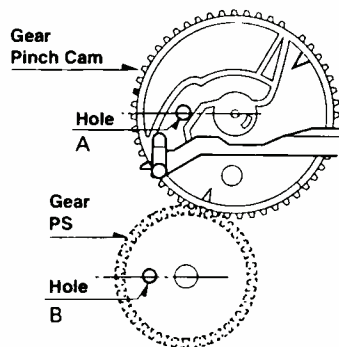


Fig. 3: Top deck timing alignment.

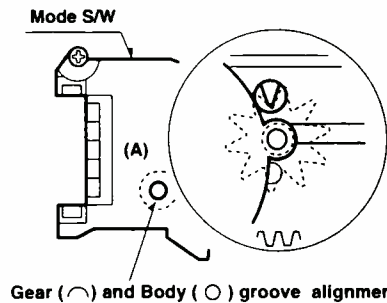


Fig. 4: Underside deck timing alignment.

ever you have one on the bench, worth taking a look for a small, white plastic O ring that should sit at the base of the capstan spindle, in the diecast housing, but has a habit of working its way up the capstan shaft, fouling the tape and the small take-up lever. Just push it well down into the housing.

The loading platform gears, which connect with the main deck, sometimes go out of correct mesh – normally because someone has attempted to push a cassette into the machine with the power off, or because a cassette

jam has occurred. It's not normally necessary to remove the entire deck and retime the mechanism. Remove the platform and set the carriage to the rest position, i.e. ready to accept a cassette. Then spin the loading motor until the small hole A in the cam gear lines up with the hole in the deck (see Fig. 3). Spin the loading motor manually using a small screwdriver or use a couple of AAA cells to apply 3V. All should be well once the loading platform has been repositioned. But this is sometimes not the whole solution. If resetting the loading platform and the cam gear position doesn't restore normal operation the mode switch could be dirty or damaged.

As the mode switch is on the underside of the deck, it will be necessary to remove the deck from the chassis. Switch off the power if you haven't already done so. The main deck is held in place by three screws, one at each back corner and the third at the centre of the front edge, underneath the loading platform. You then have to remove the YC module so that another two screws can be undone and the module can be unplugged. Remember to remove the ribbon cable that's connected to the drum. After this the deck can be lifted clear of the chassis.

The switch is on the end of a sliding lever that operates the brakes etc. A squirt of Servisol is not sufficient to fix mode-switch problems. For your own peace of mind, it's best to strip the switch down and give it a good clean with a cotton bud. Retension the wiping contacts if necessary, and grease them *lightly* using silicone grease. With the deck removed you have a good opportunity to examine it and replace any obviously worn parts.

Most models are fitted with a 'head cleaner'. If so, take a careful look at the drum. Many show signs of light abrasion around the bottom edge. If you don't trust the head cleaner it can easily be removed – it simply clips on to a pin on the drum assembly's diecast moulding.

Be careful not to break the Perspex light guide at the bottom end of the right-hand slant pole guide slot. If this is broken off, the machine will power up then the cassette loading platform will pulse, as if about to load, in a cyclic manner.

If you have to remove the lifting gear for the pinch roller, ensure that the triangular timing mark behind the tooth on the pinch cam gear is aligned with the left-hand side of the bottom end of the cam slot in the lifting gear. A lot of trouble can be avoided if you note gear positions as you dismantle the mechanism.

**The Power Supply**

In the LG models the power supply is along the right-hand side of the machine. It's the usual switched-mode type (see Fig. 5), with a control chip that drives the chopper FET directly. Feedback from the secondary side of the circuit to the primary side for regulation purposes is via an isolating optocoupler. Five secondary windings provide outputs most of which go to switching transistors driven by the microcontroller chip. Some of the switch circuits also operate as regulators. With both LG and GoldStar models, beware of the charge retained by the mains bridge rectifier's reservoir capacitor CP06. It can remain charged for many days, and it's best not to discharge it via your fingers.

A blown mains fuse (FP01) can tell you a lot. If it's blackened, the most likely cause is a short-circuit in the bridge rectifier. If the fuse has not met such a violent end, it's more likely that the chopper transistor FEP01 is short-circuit. Check the 2.7Ω surge-limiter resistor RP01 as well. When FEP01 has failed, it's safe to assume that the control chip ICP01 has also been damaged. Also check RP04, ZDP06, DP02 and CP09.

A dead power supply with the mains fuse intact usually means that RP01 has gone open-circuit or high-resistance. Another possibility is the 47kΩ start-up resistors

**Table 1: Power-on state voltages**

Transistor	Emitter	Base	Collector
Q103	5.2	4.5	5.2
Q112	11.2	11.8	14.8
Q113	12.4	13.5	14.8
Q123	-13.4	-12.7	-13.4
Q124	-21.5	-21.7	-21.4



RP02 and RP03 which are connected to pin 6 of the chip – the normal voltage here should be about 7V.

Fast tripping usually means that the rectifier for the 14V supply, DP13, is leaky.

Failure of transistor Q123 or Q124 is a common cause of no fluorescent display: Q124 can also be responsible for a dimmed display.

When a machine has sluggish load and unload movement, the culprit is usually CP22. Check the voltage, which should be 14V, at the cathode of DP13.

If the machine is stuck in standby, the microcontroller chip IC501 may not be providing a high output at pin 96. This pin should go high when pin 3 is taken high by pressing the operate key on the front panel. Check the reset circuit (especially C565) and ensure that the oscil-

lator crystal X501 is running before you condemn IC501. When pin 96 goes high Q104 and Q103 switch on, passing 5V via F102 to the servos etc.

Here are some check voltages, measured with respect to chassis with an LG Model W221:

- DP08 cathode 5.3V.
- DP10 anode -18.5V, cathode -13.5V.
- DP12 anode -24V.
- DP13 cathode 14V.
- DP17 cathode 34.5V.

There should be 3V across the filament pins of the fluorescent display. Table 1 lists transistor voltages with respect to chassis in the power-on state.

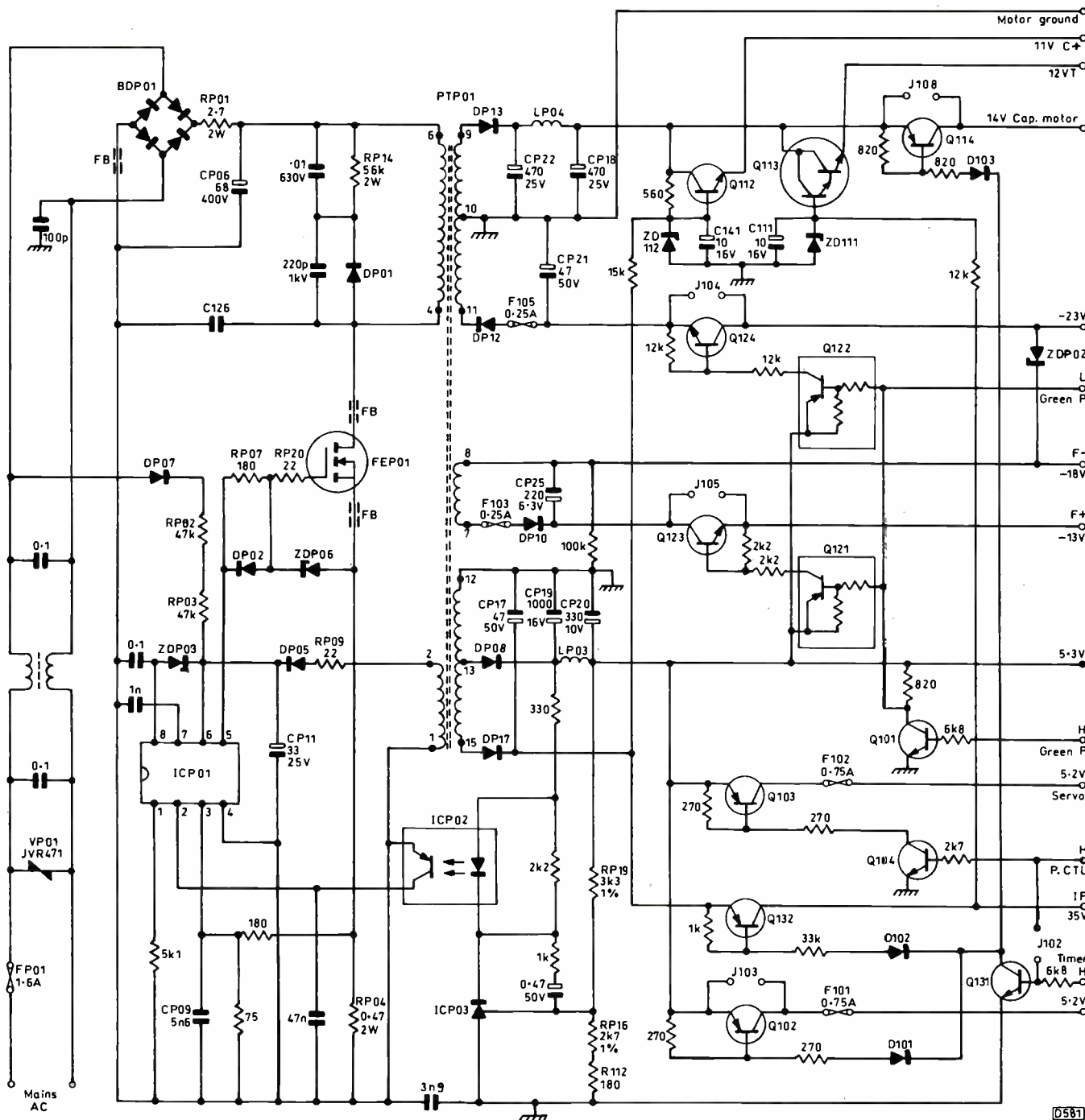


Fig. 5: Basic power supply circuit. See list on opposite page for semiconductor device types. C126 may not be fitted.

On the live side of the supply, there should be 310-315V across the mains bridge rectifier's reservoir capacitor CP06.

The GoldStar models have a modular power supply. Even the mains fuse is inside the can, which is held in place by two screws. Both are accessible from the top side. Remove them and the module simply slips out. The circuit is almost identical to that in the LG W-series models. The module is connected to the motherboard via a 9-blade plug; it's inadvisable to attempt to run the power supply without a load. Watch out for CP19 which tends to dry up. Replace it with a 1,000 $\mu$ F, 10V high ripple-current type.

### Fault Finding Notes

Many years ago I was told by a long-since departed service manager that a lot of diagnostic time can be saved by having a good look around the circuitry before applying power. Many of these machines that have passed through my hands have been maltreated by their owners and have developed open-circuit copper tracks. These are very fine in places and are thus fragile. Dry-joints are a problem, particularly at connectors between the deck and the main PCB – this occurs particularly when the deck fixing screws are for some reason slack. Inability to tune the RF output channel and intermittent video to the scart connector are often caused by dry-joints in the path between the modulator and the rear input/output jack board. With LG branded machines, loss of audio and video at the scart connector can be caused by broken print adjacent to IC202.

A very obscure fault was no operation and shut-down to standby, with the << and >> symbols in the fluorescent display flashing. The cause was eventually traced to C733 which was short-circuit.

If the drum spins first, then the power supply reverts to standby with the << and >> symbols flashing, the most likely cause will be a broken drive belt. In this condition there will naturally be no cassette loading.

Cassette loading problems are common, generally because of mishandling. Sometimes the cassette snags in the loading platform at the left-hand side because the screw that holds the earthing strip between the deck and the top of the platform has been replaced with one that's too long: the correct length is 6mm. A problem with LG machines is when the cassette loads 'lop-sided', going in farther on the left than the right. In this case look for a missing spring, called a 'stopper' spring – it's item 111 in the LG manual.

Should the tape load successfully then, after a few seconds of operation, it stops and is ejected, the cause is one of the end sensors or the associated circuitry. In particular Q501 fails, though on occasion the fault goes all the way to no response from IC501. Q503 in the GoldStar P- and T-series models is another cause of this sort of trouble.

A blue screen that flashes to grey intermittently or pulses blue/grey is almost certainly caused by the 17MHz crystal X503. Replacement will cure the fault.

Fine herringbone patterning on the playback picture occurs when the earthing screw on the head preamplifier assembly is not tightened to the diecast head drum chassis.

Unequal RF outputs from the video heads, viewed at the test point, can also be caused by loose earthing screws.

If a GoldStar machine goes into the playback mode but there's no output from the YC (pre-rec) board, it's possible that the microcontroller chip IC501 is not switching on Q510 and Q506 to provide the record 5V

supply. Note that in this condition the erase circuit still functions!

Noisy signals, worse via the VCR than when fed directly to the TV set, is usually the result of the 5V supply to the UHF boost amplifier circuit being low. L703 is often the culprit, going high-resistance.

No sound with LG models is sometimes simply because IC301 is faulty.

Many of these machines exhibit all the symptoms of a faulty microcontroller chip (IC501): the machine has no response to key presses or commands from the remote-control unit. Before condemning IC501, check that its reset circuit is working. If not, C565 is probably leaky – with one such capacitor I got a reading of 750 $\Omega$ ! Another thing worth a try is to switch off the mains power to the machine, short-circuit the memory back-up capacitor C523, then restore the mains supply, press 'operate' and try again. This procedure is also necessary when the channel set indicator shows 00 instead of a channel number, and is useful if you've made a mess of setting up the machine and would like to start again from scratch. If you are probing around IC501 and it gets into a 'locked' state, again try dumping the charge in C523 and repowering the machine.

### Tuning

Unlike machines of similar price from other manufacturers, in the auto-tune mode these LG and GoldStar models ignore the digital channels in the group. If, at the end of the auto-tuning operation, you end up with a blue screen, check that the tuner's 9V supply is present. F104 can go open-circuit to remove this supply. A replacement will normally restore the supply, there being no cause for its failure. No tuning also occurs when C703 goes short-circuit, with R704 burnt and possibly open-circuit and maybe Q132 short-circuit. C703 is a very small, yellow 100nF capacitor, about the size of a match head. There are several of them in these machines, and in any faulty circuit it's worth checking them at an early stage. One such capacitor is C400, which decouples the 12V supply to pin 10 of the input/output board connector. When it goes short-circuit there's no sound. As the supply comes from the emitter of Q112, this item should also be checked.

Tuning drift can sometimes be cured by removing the sides of the can and replacing them again! Otherwise check the 35V supply from Q132. If it's low, CP17 has probably gone low in value.

If there's rust along the bottom of the tuner/IF can, it is likely that water has entered via the aerial plug. It's surprising how many installations have a continuous length of cable from the connection box at the aerial to the coaxial plug at the rear of the VCR. Water gets into the cable at the aerial, because the connection box fills up when it rains – a poor installation perhaps – then travels along the cable's cellular insulator to the tuner socket. The only cure is tuner replacement.

### In Conclusion

These models have been superseded by more modern ones in which there is greater integration. But the P, T and W series continue to give a good account of themselves, are reliable when treated properly, and are reasonably easy to service once the chassis has been removed from the cabinet. Head life is excellent: cleaning is quick and effective when the normal rules are followed – rarely are more than two attempts needed to restore the picture and sound. The tape path is conventional, is easy to clean and align, and failure of the A/C head or the full erase head is rare.



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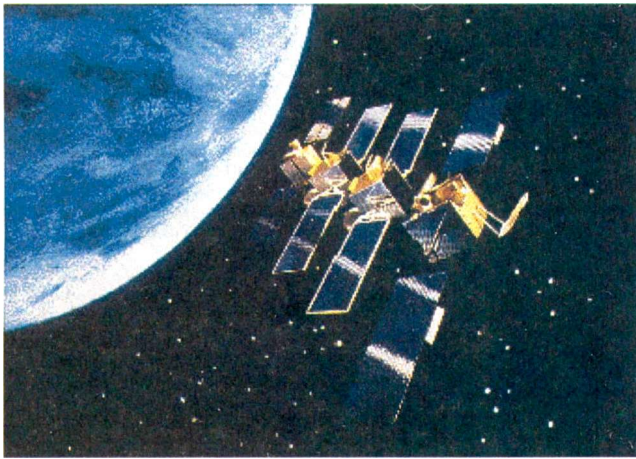
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# DX and Satellite Reception

**Terrestrial DX and satellite TV reception. News from abroad and of satellite launches etc. An omnidirectional, wideband aerial system for Band I DXing. Roger Bunney reports**

**T**here was a fall-off in terrestrial DX-TV reception during August, with increasingly lengthy periods between the Sporadic E openings. I received a number of reports of signal pings being received during the late evening of the 12th and into the 13th, when the Perseids Meteor Shower peaked. Meteor activity was even mentioned in the national press. The SpE log is as follows:

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feed for CNN  
via 36°E.



10/8/99	TVE E2; RTS (Serbia) E3; SYT (Syria) E2 (1308 BST); at 1248 a smeary PM5544 test pattern was received in ch. E3.
11/8/99	RAI IA; Video E2; TVA IA+.
13/8/99	Video E2.
14/8/99	C+ L2; RAI IA; Video E2; TVA IA+.
15/8/99	RAI IA; TVA IA+; Video E2.
16/8/99	Video E2; RAI IA.
20/8/99	TVE E2-4; TVA IA+; Video E2.
21/8/99	TVR (Romania) R2, 3; ETV-1 (Estonia) R2; NRK (Norway) E4; SVT (Sweden) E4; also many unidentified signals.
22/8/99	RAI IA, B; TVA IA+; Video E2; MTV-1 (Hungary) R1; TVP (Poland) R2; ARD (Germany) E2; RTP-1 (Portugal) E3; also many unidentified sig- nals.
31/8/99	RAI IA.

The reports of Syrian TV and the smeary PM5544 test pattern on the 10th came from Cyril Willis (King's Lynn). I am pleased to be able to report that Cyril is now recovering well after recent hospitalisation.

Ian Menzies (Aberdeen) laments the "pretty poor" SpE reception in

northern Scotland so far this year. He notes that, monitoring the 28MHz band, there are reports of much better conditions "down south".

The August issue of *Six News* (No. 62) provides envious reading of 50MHz-band reception by radio amateurs. But whereas radio signals have a bandwidth of a few kHz, TV involves several MHz and the inherent noise problems. Here's a run-down on the reports: eastern European ch. R1 TV received at good strength in New Zealand during March; a ch.0 (Australia, 45.25MHz) carrier was heard in South Africa via a South Pole path; Spanish radio amateur Jose, EH7KW heard New Zealand ch. 1 TV audio (50.75MHz) via long-path propagation on June 15th; in early June a radio amateur DXpedition to Namibia had successful contacts at 50MHz with many central European stations, including operators in Germany, France, Switzerland and the UK; Scott Watson, VK4JSR in South Africa monitored European ch. E2 and R1 video carriers, usually between 2100-2200 GMT (trans-equatorial skip?). There was a European-Australian 50MHz contact on May 30th, and during June 20-27th the 50MHz band was wide open daytime between Europe and S.E. Asia, Africa and the Americas. As the solar peak approaches, there have been greatly improved F2 layer conditions. My thanks to the



UK Six Metre Group for this information. There's a lot about, so it pays to be vigilant.

### Satellite Sightings

It was a busy month for satellite reception. Reuters reported the gunman at large at the Jewish Community Centre School, Los Angeles on August 10th. The live output of a local TV station that carries news-breaking pictures as a story unfolds is often taken by Reuters. On this occasion the output from the local channel 4 NBC affiliate station, which had sent a helicopter up to take bird's-eye pictures, was present on the usual Reuters digital lease via NSS-K at 21.5°W (11.566GHz V, SR 5632, FEC 3/4). There was noticeable fading on the 2.5GHz analogue microwave link between the helicopter and the base receiver.

The output from Turksat 1C at 42°E revealed the extent of the disaster when the earthquake shook northern Turkey on August 22nd. For several days coverage was maintained by TV stations from their regional studios. ABC News Istanbul ran news packages via Eutelsat II F3 at 36°E (11.621GHz H, SR 5632, FEC 3/4), but much of the output was flagged up as 'encrypted'. A German SNG crew, WDR Fly Away 1, ran footage via Eutelsat W3 at 7°E (11.105GHz H, SR 6116, FEC 3/4). Feeds from Turkish OB units and the German TV channel SAT-1, including material from the Turkish news agency I hazimit, were carried via Eutelsat W2 at 10°E – these one-off links were all digital. There were at least three outputs at the top end of Ku band via II F3, including APTV. Unlike the early days of the Balkan war, there is shut down once a feed has been uplinked – the equipment isn't left running with a helpful test pattern for us to find. According to an internet satellite newsletter the PID values for many OB/SNG uplinks are V-308 and A-256: useful information for those who insert PIDs.

An early-morning turnout by SISLink on August 24th reported on the collision between the Norwegian Dream and the Ever Decent off the North Kent coast. The feed to UK breakfast TV, flagged as Auto 9 News, was via Eutelsat II F3 (11.580GHz H, SR 5632, FEC 3/4). That evening two SISLink trucks were at Dover Harbour (SIS-2UKI-27) feeding BBC news, one in the clear and the other encrypted (11.079GHz H).

During the last week of August there was full coverage of the Sevilla 99 European athletics finals late into each evening via Eutelsat W3 at 7°E. These were unencrypted, analogue transmissions, a sort of one-off occasion, with audio effects plus commentary at 6.6MHz and effects only at 7.2MHz.

August 11th was the time of the eclipse. The GMTV UKI-149 unit arrived at Falmouth on the eve and used the St. Mawes ferry MV May Queen as a background for its news inserts. These were in clear analogue form via NSS-K (21.5°W) at 11.530GHz H. By the following day the media had arrived. CNN produced an early-morning programme insert via Eutelsat II F3 using SISLink's UKI-253 Goonhilly. This was a clear digital transmission at 11.684GHz H.

It's now common to find PAS-3R/6 at 43°W being used by Spanish OB TV feeds rather than Hispasat at 30°W. On the evening of the 26th Retelevision was uplinking beach 'hand tennis' back to Madrid from 1800 hours in clear PAL at 12.698GHz H. This is a casual game played by young ladies.

Roy Carman suggests a check on Sirius at 5°E where a varied digital menu can often be found. I discovered a digital package at 12.113GHz V (SR 27500, FEC 3/4) with four channels: 13th Street and Studio Universal were both encrypted, RLO-TV was "temporarily off the air" while under a flagged feed a glorious Snell and Wilcox test pattern appeared. Further up the band, at 12.376GHz H, TVN-Chile appeared – real DX but encrypted. Alas no exotic captions/test patterns however. Sirius is a curious satellite: there's always something 'different' to be found here. So if you are passing, take a look.

I've received several queries in recent months asking where the SISLink Racing Service feeds are now carried. Back in the analogue days 21.5°E was a favourite. I've had no luck locating the Service, though Sirius has been suggested, possibly at around 12.646GHz H or 12.400GHz H, SR6111, FEC 3/4, PIDs V-308 and A-256. News of any sightings would be appreciated.

Intelsat 801 at 31.5°W is the bird for French football enthusiasts. Regional kick-offs are carried every Saturday night, usually about six different matches. This is digital (the usual 5111 and 3/4) between about 10.960-11.025GHz from 7



p.m. UK time. There's some confusion about the Setanta Irish sports programme each Sunday afternoon via Telecom 3C (3°E) at 12.600-GHz V: one report says part clear, part VideoCrypt, another says the whole programme has been seen in the clear.

It was certainly an active period for satellite viewing.

### Terrestrial News

UK: Pressure is being out on the

Seen on the North Atlantic circuit via NSS-K.

## Aerial Techniques

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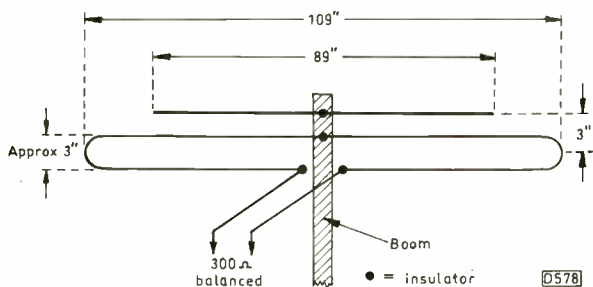
**The omnidirectional, wideband crossed dipole aerial system described in the text, for Band I operation.**

government to decide on a date for the analogue TV switch off. Considerations the government will take into account are digital TV coverage, the availability of cheap digital TV receivers, all channels being available across the UK, and sufficient programme competition and quality. The year 2006 is often mentioned.

The *BBC Digital Radio Bulletin No. 1*, June 1999, states that DAB coverage will increase over the next few years, eventually covering all the country "at which point analogue transmissions will be phased out".

The RSL station TV 12 has been given permission to increase the power of its ch. E54 transmissions from Rowridge to 2kW. A new relay should improve reception in West Wight (Yarmouth/Freshwater). TV 12 provided over forty hours of Cowes Week programming and OBs in early August.

**Japan:** The PTT has delayed for at least eighteen months publication of plans for terrestrial digital TV channel allocations. Regular DTT test transmissions are expected to start in late spring 2000.



**Fig. 1: Band I dipole design covering 47-68MHz. The Band I insulators can be obtained from HS Publications. The boom is 1in., the elements 0.5in. outside diameter.**

**Estonia:** System B (5.5MHz sound/vision spacing) PAL is to be adopted, but with the existing OIRT Band I channels R1 and R2. Channels R3-5 are to be moved from Band II to other allocations.

**The Netherlands:** A new ch. E55 H transmitter is to be opened at Wormer. Noord-Holland with 200kW from a 130m mast. Tests start this month (November). Should provide a good UHF tropospheric indicator!

**Czech Republic:** Nova TV is using programmes supplied by a subsidiary, CET-21, instead of the contracted CME group. CME intends to issue an injunction on breach of contract grounds.

**Switzerland:** The 1997 Broadcast Bill allowed commercial TV in the German-speaking parts of the country. Currently Tele-24 is in operation with low programme budgets. Impact on the seven SRG-SSR TV channels has been minimal. The newly-opened TV-3, with higher programme investment, might have greater impact. There are plans to open two more commercial stations within the coming year.

**Gibraltar:** The MW transmitter at Wellington front has closed, replaced by a new 2kW transmitter and higher mast at Maida Vale. RDS tests within the local FM network start early next year. Also next year Eurosport is to become available on ch. E60. A ch. E32 "UHF test transmission" is to start from O'Hara's Battery: this may relate to GBC's intention to end ch. E6 transmissions within the next five years, transferring to UHF. My thanks to George Gaskin for this information.

### Satellite News

Channels ARTE and La Cinquieme now hold some 25 per cent of the French international channel TV5's issued shares. Canal+ is to open a news channel, I-Television, and has been in discussion with Reuters and CNN on the supply of material.

US broadcaster XM Satellite, which is due to come on air within eighteen months, will transmit the BBC World Service in digital form. The American Mobile Satellite Corporation has gained one of only two digital licences issued by the FCC and may include BBC archive programming.

The Iridium satellite telephone service filed for protection under the US bankruptcy laws on August 13th. It had spent \$5bn on 72 low-Earth orbiting satellites before signing up any subscribers, then signed

up just 10,000 in the first five months – at a cost of \$14,000 each from the advertising budget. The Carphone Warehouse UK sold Iridium handsets at about £2,500. Just two weeks later the \$3bn ICO Global Communications venture filed for protection.

Orion-2 is due to be launched into orbit at 12°W this autumn, next to Eutelsat's 'Atlantic Gate' slot (12.5°W) and with similar coverage. The first broadcast TV service has been seen via the Atlantic Gate: SIC Portugal at 12.537GHz V (SR 4340, FEC 3/4) transmits between 1400-0000 GMT.

The Intelsat series IX launch programme is as follows: 901 at 60°E and 902 at 62°E over the Indian Ocean in autumn/winter 2000 respectively; 903 at 24.5°W and 904 at 34.5°W over the Atlantic in spring/early summer 2001 respectively; 905 at 34.5°W though may backup over the Indian Ocean, spring 2002. The satellites will have 44 C-band and 12 Ku-band transponders and a planned in-orbit lifetime of over thirteen years. Intelsat has announced precautions for the Leonids meteor shower in mid-November. The Royal Astronomical Society suggests that this year's shower will be a "strong normal display" that should peak at about 0200 GMT on the 18th, enhanced by debris from the Tempel-Tuttle comet.

The German Kirch group has relaunched its digital and analogue DF1 and Premiere pay-TV services as Premiere World. The analogue transmissions will end in December 2001.

An encrypted Hebrew service, J-Channel, is to be launched shortly via Hot Bird at 13°E. The frequency will be 11-025GHz with SR 1807 (low!) and FEC 3/4.

The Turkish service TRT International is now available in the southern hemisphere via the Optus B3 satellite. It's free-to-air at 12-336GHz V with SR 30000 and FEC 2/3. EIRP levels across Australia are in the range 41-45dBW while New Zealand, with a separate footprint, receives 44-47dBW. This suggests the need for a 1.2m dish with an 0.6dB noise figure LNB.

### An Omni-directional Wideband Aerial System for Band I

A wideband aerial system is necessary for effective SpE DXing in Band I. In this context wideband means from about 47MHz to



70MHz or so. There are nearby channels outside these limits, i.e. ch. 0 (Australia) and ch. 1 (New Zealand), but such an aerial will provide adequate reception of these channels should F2 layer propagation rise sufficiently at the sunspot maximum – I know this from experience!

Until recently I had been using a system with crossed straight 60MHz dipoles phased together via a Triax wideband coupler. Not being too happy with its performance, I decided to resurrect a WB5 crossed folded-dipole wideband aerial that had been languishing in the garage. With a folded dipole the centre impedance rises by a factor of four. To overcome the problem of matching the balanced 300Ω output to the unbalanced 75Ω feeder, I adapted an Antiference VHF wideband transformer intended for matching a 75Ω FM aerial feeder to the 300Ω terminals of an imported FM receiver. This has a white slide-over plastic case to protect the PCB-mounted balun. It's easy to

remove the PCB and cut it down to fit inside a VHF Band I aerial insulator box. Soldered single-wire connections were made between the balun's inputs and the dipole insulators, the 75Ω coaxial cable being soldered to the output, using the PCB riveted connections to take any strain. The coaxial cable emerges from the aerial cap and is taken away carefully, ensuring that the aerial cap holes face downwards to prevent rain getting in. Most aerial caps have a blanked off second hole that can be pierced to allow air in and prevent condensation. Fig. 1 shows details of the folded wideband dipoles.

In my system both dipoles have the PCB mounted in the insulator. The separate coaxial feeders descend for some 15ft and are then connected via PL259 plugs to the Scanmaster aerial switcher unit reviewed last month. Alternatively you could run the feeders indoors and use a switch to select whichever aerial is needed. Check that the relay-operated switcher works before installing it outside. See last

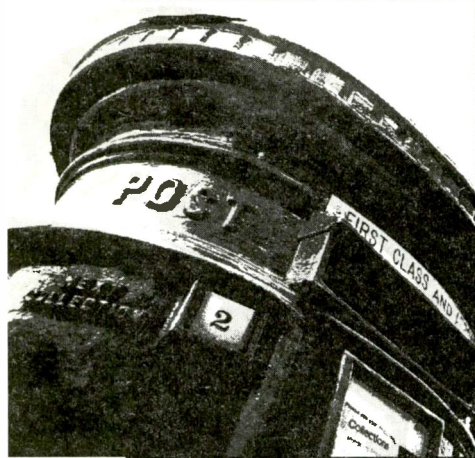
month for connection details.

The accompanying photo shows the aerial system. A folded dipole provides improved bandwidth compared to a straight version, while the Scanmaster provides instant selection from east- to south-facing – a rotator can take perhaps fifteen seconds to move through 90°. In fact the new system is considerably better than the 60MHz crossed dipole arrangement, particularly in the ch. E2/R1 region, and is effective right up to ch. R3 at 77.25MHz.

If you want to use the straight version, the dimensions are similar to those shown in Fig. 1 and a 300/75Ω balun transformer is not required.

Balun transformers are available from aerial dealers: ensure that there is access to the connections for wiring. Straight and folded crossed dipole aerials are available from Aerial Techniques (check on 01202 738 232). Aerial components can be obtained from HS Publications, 7 Epping Close, Mackworth Estate, Derby DE3 4HR (01332 513 399).

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### Spares Buying

In these difficult times it is more important than ever to select the right replacement component at the right price to do the job. Unfortunately many manufacturers will not supply non-account holders, directing them to distributors some of whom appear to charge for parts at the normal retail price.

I personally prefer to use manufacturers' original spare parts rather than pattern parts. This is particularly important with VCR items such as pinch roller assemblies and idlers. Some pattern parts have lasted for only a couple of months.

I've had problems with capacitors obtained from a local source. They were rated at 105°, but in one Philips VCR a 47µF, 35V replacement capacitor went short-circuit after a week. When I used these capacitors to replace C5, C7 and C8 in a Pace PRD800 satellite receiver they failed within a month. As a result the BUT11A chopper transistor also failed. I had to fit a complete kit free of charge to the customer. My capacitors are now obtained from either Farnell or RS Components. The same goes for resistors, especially high-voltage ones.

Replacement memory back-up cells are available from a number of sources but often last for only a few months. Genuine Philips batteries are available from Philips at only a slightly higher price. I now use them exclusively in Philips TV

# Letters

sets and VCRs. The customer usually appreciates this policy and will pay the extra if you explain why you fit only genuine parts.

But there are times when it is not economical to use the genuine part. John Edwards in his letter (April) on an Hitachi receiver fitted with the Salora M chassis says he was advised to use the genuine BS208 FET which cost him £10. I've been servicing these sets, usually the Finlandia version, for some years and have obtained my BS208s from J.J. Components. At £1.10 plus VAT they are a fraction of the price and I've never had one fail. Incidentally I suspect that the trouble with the set John Edwards was repairing was caused by high-voltage capacitors breaking down (see also letter from Chris Watton in the September issue – *Editor*).

Another source of good-quality semiconductor devices is Cricklewood Electronics.

So be careful about what you are buying and fitting. Keep your wits about you, and don't try a cheap repair to keep the customer happy. It could bounce back big time. Each bounce costs you time and money. As a bank manager once said to me, it's the buying that is the real skill in business, not just the selling.

*Michael Maurice,  
Wembley, Middx.*

### VCR Soak Tester

I have to admire the ingenuity and effort Ian Rees put into his VCR soak tester project (August issue). One clever feature, that may have gone unnoticed, is his way of altering a 555 chip's timed period. The use of feedback from the counter back to the timer seems to be quite novel: I've certainly not come across it before!

The use of the CD4066 quad bilateral switch is to be commended – it's better than the use of relays. The device presents a linear, low resistance that's isolated from the input control voltage. But it expects either a high or a low input at a

very fast speed. The use of an RC network to provide a momentary on output can cause problems because, as the capacitor discharges, there occurs a slow transition period that's neither one nor the other and the chip gets confused. Ideally, the interface between the counter IC and the bilateral switches should be digital, in the form perhaps of a Schmitt trigger.

In this application the timer IC has to source little current, so the CMOS 7555 would have been a better option.

There's no need to build a regulated power supply. Why go to the trouble when an AC adaptor can be bought for about £3? There is ripple, but a 1,000µF capacitor across the output cures that.

*Alan Willcox,  
Llanedeyrn, Cardiff.*

### The Repair Trade

I was saddened by Michael Maurice's fears about the end of the trade as we know it (letters, September), as I feel very optimistic about the future of servicing. Following redundancy, I set up my own business fourteen years ago, initially using a small industrial unit, and built up a good turnover, mainly repairing TV sets and VCRs for local dealers and as a result of customers' recommendations. Four years ago I decided to give up the unit, mainly because I was working two days a week to pay the rent and rates, and instead work from home where I have a suitably-sized workshop. As I live twelve miles from the nearest town, I anticipated a loss of work that would roughly equal the reduced expenses. Not so. The workload seems to keep on increasing. For many years I have also repaired in-car equipment and musical and public-address equipment – it's in these areas that I have noticed a big increase recently.

There has been a noticeable drop in the number of VCRs coming in for repair during the last two years, no doubt because of the £99.99 nonsense, but I've recently been



getting more and more modern VCRs of the more up-market variety. Not everyone wants the cheapest equipment, any more than everyone wants a Skoda, and the better equipment will need to be serviced.

I've made a decision not to service digital or widescreen sets, mainly because I cannot physically handle large sets. But I hope that one day my son will go into electronics in some form, as I think there will always be a living to be made from it. Let's face it, most people cannot live without the latest whizzbang gadget, and this ever-increasing amount of equipment of one sort or another will need to be serviced, or at least installed and set up.

Aerials and dishes will be needed for the foreseeable future: most people can't even bang a nail in straight, so there will always be work here. All we have to do is to leave the freebies to the big firms, and charge for what they cannot do.

*Colin J. Guy,  
Boston, Lincs.*

I have to agree with most of what has been said by Michael Maurice and others who have followed up his letter in the September issue. I worked for myself for a while, but found it very difficult to make a reasonable living from everyday repairs. Working from home, not enough jobs were coming in to cover expenses adequately though I was busy enough. Monitor repairs provided a boost for a time, until the price of new monitors fell. New portable TV sets can be bought for £85 at the local Co-op, VCRs for about the same price. Recently I saw a widescreen TV in Tesco's for £350. With this sort of pricing, what future is there for repairs? Most people buy budget-priced equipment and won't pay much for repairs. Only the more affluent can afford to buy good branded equipment and pay correspondingly higher repair bills. Normally however these more affluent types will pay for a five-year guarantee, so you won't see the sets anyway if they go wrong.

I was recently asked to repair a widescreen TV set that was about six years old. It was the set's first breakdown. The line output transformer had failed, and some dry-joints needed attention. To prove the point I borrowed a transformer from a colleague, then gave the customer what I thought was a reasonable estimate (£85) to complete the job. I was told that they didn't want to spend that much on an old set, and asked what assurance I could give that the set

would last a reasonable time? When I said I could only guarantee the work done for six months, the estimate was declined and I was told that they would think about buying new. One ray of light came from this. In the end they didn't want the set back. So I was able to repair it and sell it on – after getting the original owner to confirm in writing that the set could be scrapped.

This all highlights how TV sets and VCRs have been devalued over the years. A certain amount of 'conditioning' from advertising and manufacturers has completed the task. People are now more easily tempted by the latest developments, and expect to buy a new TV set or VCR every six years or so rather than having their old ones serviced. This, along with the fact that a lot of manufacturers ensure that major spares are not available after about seven years, or make the cost of spares prohibitive, rather seals the fate of repair work. I had to write off a five-year old Nicam set last year because the line output transformer wasn't available. It wasn't a cheapie either, but a good branded model.

Digital TV, while a logical development, will probably not make money for engineers. Current set-top boxes are mostly being given away 'free' to subscribers and therefore remain the property of the 'rental' company, so they are unlikely to be seen by the private engineer. Most of the electronics is built on multi-layer panels, and would require specialist equipment to enable repairs to be carried out. This would be beyond the budget of the average workshop, unless you decided to specialise. As most of these panels will be very reliable anyway, you would be unlikely to see enough of them to be able to recoup the cost of the specialist equipment. If you tried to charge more to compensate, most companies would not consider you to be cost-effective.

After thirty years as an engineer I am now employed as a technical consultant for an electronics company. I still do the odd private job at home, but a more reliable work flow has been obtained by making myself known to several local dealers. They provide only limited service themselves, so I offer to take work in for them. This is good for me because it enables me to do something I like doing, and it's good for them because I can offer a good service. It provides a steady income to supplement my wages. It's not a fortune, and I regard it more like pocket money. Handy when the car breaks down or a new

washing machine is required.

If you contemplate doing this sort of thing, I advise you to make sure that the dealer is clear about what you will and won't do. For example, I won't do repairs with sets that have been 'got at' by others – this is normally not a problem if the dealer has no engineers of his own. I only repair sets up to a certain age – no fifteen-year old bangers! If the dealer has a small workshop, make sure his engineers don't cream off all the easy repairs, leaving you with the junk, the difficult ones or the ones they've messed up. You'll spend too long sorting out the latter, and risk bouncers for which you cannot charge.

I am not in favour of being paid only for repairs that can be completed, so I've set a minimum basic charge of £12.50. If I pick up a job that proves to be uneconomical, at least I know I will get something from it. Most dealers appreciate good work, and are prepared to pay for it. But you have to be flexible about it and suffer a loss sometimes. In short, sit down and talk to the dealer and work out terms that suit you both. I am happy with the repairs that come to me in this way. The beauty is that you do the repairs, get them back to the dealer, get paid and pick up the next lot. I don't have the problem of storing sets that customers leave for ages. That's for the dealers to sort out.

*Alan J. Roberts,  
Croydon, Surrey.*

### **A Valuable Antique?**

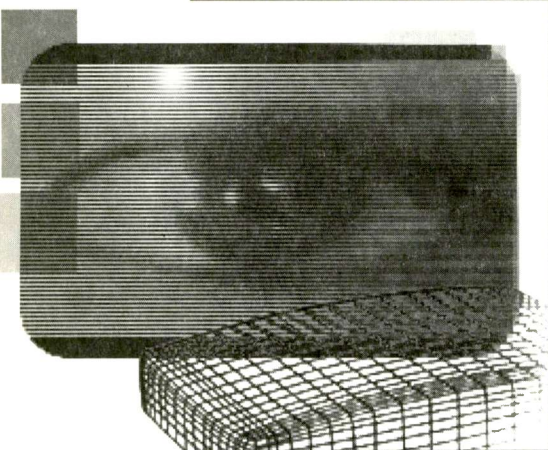
Test Case 441 raised the question of whether the Ferguson 3V16 might be a valuable antique? The criteria for antiques are rather vague. In the VCR world the 3V16 would certainly be deemed ancient, which is usually a relevant point. The 3V00 in which we fitted a new servo chip today is even older. What about valuable?

A good specimen from this period can fetch rather more than say a new Daewoo, and would probably outlast it.

Don't be fooled by the customer who says he/she wants the unit to be repaired because it's a family heirloom. The real value lies in these machines' ability to duplicate tapes. They don't respond to the Disney/Time Warner anti-piracy luminance coding on prerecorded tapes, and a copy made on one of these old JVC/Ferguson VCRs will play very nicely thank you.

*Adrian Spriddell,  
Diss, Norfolk.*

# Monitors



Reports from  
**Philip Blundell, AMIElec  
and Ian Field**

## Mitac AM4050PD

If the monitor trips when switched on from cold but starts up after a minute or so, suspect dried up electrolytics – especially C508 (100 $\mu$ F) and C534 (1 $\mu$ F). **P.B.**

## AST Vision 7L (TE1764G)

Smoky yellow comet tails trailed from any light-to-dark transition in the display. To start with the fault was randomly intermittent, though it was evident that temperature played a part. Much time was wasted taking measurements and flexing the CRT base panel, but no clues were obtained. I put the monitor on soak test and noticed that the fault went away over a period of time.

Some time later I had another go. The CRT base panel had already been spotlessly defluxed and examined. This time I used a powerful magnifier and a strong light and found an almost invisible fracture ring around a connection to the resistor in series with the blue cathode. **I.F.**

## AOC CM333

This encounter was revenge for all those nice easy start-up resistor faults! Both R907 (0.22 $\Omega$ , 2W) and R925 (0.47 $\Omega$ , 2W) in the power supply were visibly blown. R907 acts as a fusible resistor in the feed to the chopper transformer's primary winding, while R925 provides current sensing, being in series with the emitter of the TIPL760C chopper transistor Q901. As Q901 was short-circuit, failure of R907 was understandable. Usually when this

occurs there is very little other damage. But failure of R925 provides a clue that previous repair work has been required. In this situation, time spent carrying out a visual examination pays dividends!

The power supply had been heavily reworked because of dry-joints, but this didn't seem to have been all that well done. From the discolouration of the flux, the work had obviously been carried out some time ago. Several components were obviously not the original ones.

When R925 has blown open-circuit, extensive damage to the chopper control circuit is to be expected. So I decided to remove and test every single component on primary side of the chopper circuit and clean the leads of every re-used component. The following items were found to be faulty: Q906 (2SC945), Q907 (2SA733) and ZD920 (6C2) in the error-sensing stage were all short-circuit; Q909 (2SA733) and D917 (1N4148) in the current sensing stage were short-circuit while R926 (22 $\Omega$ ) and R928 (150 $\Omega$ ) were open-circuit; R923 (22k $\Omega$ ) in the error-voltage sensing potential-divider chain had a burn mark on its casing but measured within specification – I fitted a 1 per cent instrument-grade resistor in this position. Once these items had been replaced the power supply worked correctly.

It's advisable to check all the 1N4148 diodes and zener diodes in the power supply, and the fusible resistors in series with the larger rectifiers. Any small electrolytics and high-value resistors are suspect. The circuitry around Q903/4/8 and ZD948, which provides protection against excess-voltage conditions, is safety critical: a fault here can remove the protection. **I.F.**

## Elonex MN034

This monitor produced a blank, milky raster. Flexing the CRT base panel affected the symptom, so I resoldered all the joints on it. As this made no difference I tried melting the solder at one end of each surface-mounted component:

if one is cracked, this will usually finish it off, revealing the cause of the fault! This didn't work either, so I fitted a panel from a scrap chassis. This produced a normal picture once the first anode (G2) preset had been adjusted, but I then found that the front panel brightness control had no effect.

This control should have -150V at one end and +7V at the other. The positive supply, which comes from Tr7804 (BF423), was missing. Tr7804 was cut off because Tr7805 (BC558C) was saturated. The circuitry that controls Tr7805 is fairly complex. As I didn't have a circuit diagram, I had to resort to checking individual components. This eventually brought me to the surface-mounted resistor R3825 (82k $\Omega$ ), which is in a biasing network. Once it had been replaced the first anode control could be reset to provide normal operation of the user brightness control. **I.F.**

## Unisys 7033

There was no red in the display. This is one of the oldest Acer Peripheral monitors I've come across, with a 'full-box' metal chassis. The cause of the fault was soon found: pin 1 of the VGA plug had been bent and had folded neatly inside the plug shroud. **I.F.**

## X10D

The model 'name' was 29J77C. This is another of those monitors with the 'Jean' brand mark on the PCB, so I feared the worst – the complaint was no operation. Its cause turned out to be a nasty dry-joint around one of the pins of the on/off switch. The arcing had left a fair-sized crater, so I scraped a patch of green varnish off the track a couple of cms away from the solder pad and used 22SWG wire to make a secure connection. The other pin and the two solder tags for mechanical fixing also showed signs of stress, but the soldering on the rest of the PCB wasn't too bad.

No doubt the Nichias-brand degaussing posistor will be the next thing to go – the pellets seem to 'flash-across' round the sides. **I.F.**



## Answer to Test Case 443

- see page 23 -

Having misguidedly replaced the TDA8362 signal-processor chip in the Daewoo TV set Mr X decided to phone Sage, who was driving back from a service course. Sage has a posh mobile phone, but he didn't seem too pleased to get the call while stuck in traffic on the M25! He quickly pointed out to X the way to go about solving the problem.

Sage suggested that the screen/first anode control on the body of the LOPT should be momentarily turned up while the screen was being watched. When this was done a horizontal white line appeared across the centre of the screen, indicating failure of the field scan circuit. This fault symptom is otherwise disguised by the 'guard' system, a link-up between the field scan circuit and the blanking section of the TDA8362 chip. The idea is to prevent the screen phosphors being burnt in the event of field collapse. If only Mr X had tried turning up the screen potentiometer at the outset!

The actual cause of the fault is a bit academic as far as this Test Case is concerned: it could have been almost anywhere in the field timebase or its supply circuitry. In fact however the 27V supply to the AN5515 field driver/output chip I301 was missing because the BYV95C rectifier diode D303 had gone short-circuit, open-circuiting the associated 1.5Ω, 2W fusible resistor R307. A new diode and resistor, a bit of setting up (no auto greyscale tracking with this IC) and the set was ready to go. Hooray for Sage and his mobile phone!

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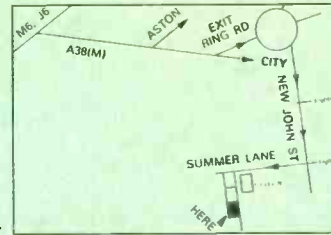
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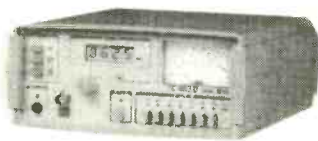
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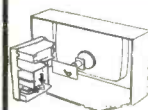
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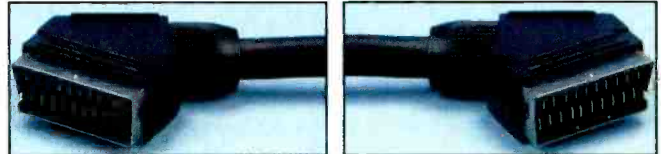
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