

THE LEADING UK CONSUMER ELECTRONICS TECHNOLOGY MAGAZINE

# TELEVISION

SERVICING · VIDEO · SATELLITE · DEVELOPMENTS

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**Workshop Equipment  
Supplement**

**Introduction to  
Digital TV**

**Test Report:  
Multiview RF Modulators**

**Simple Intercom System**

**Mitsubishi Fault Finding**

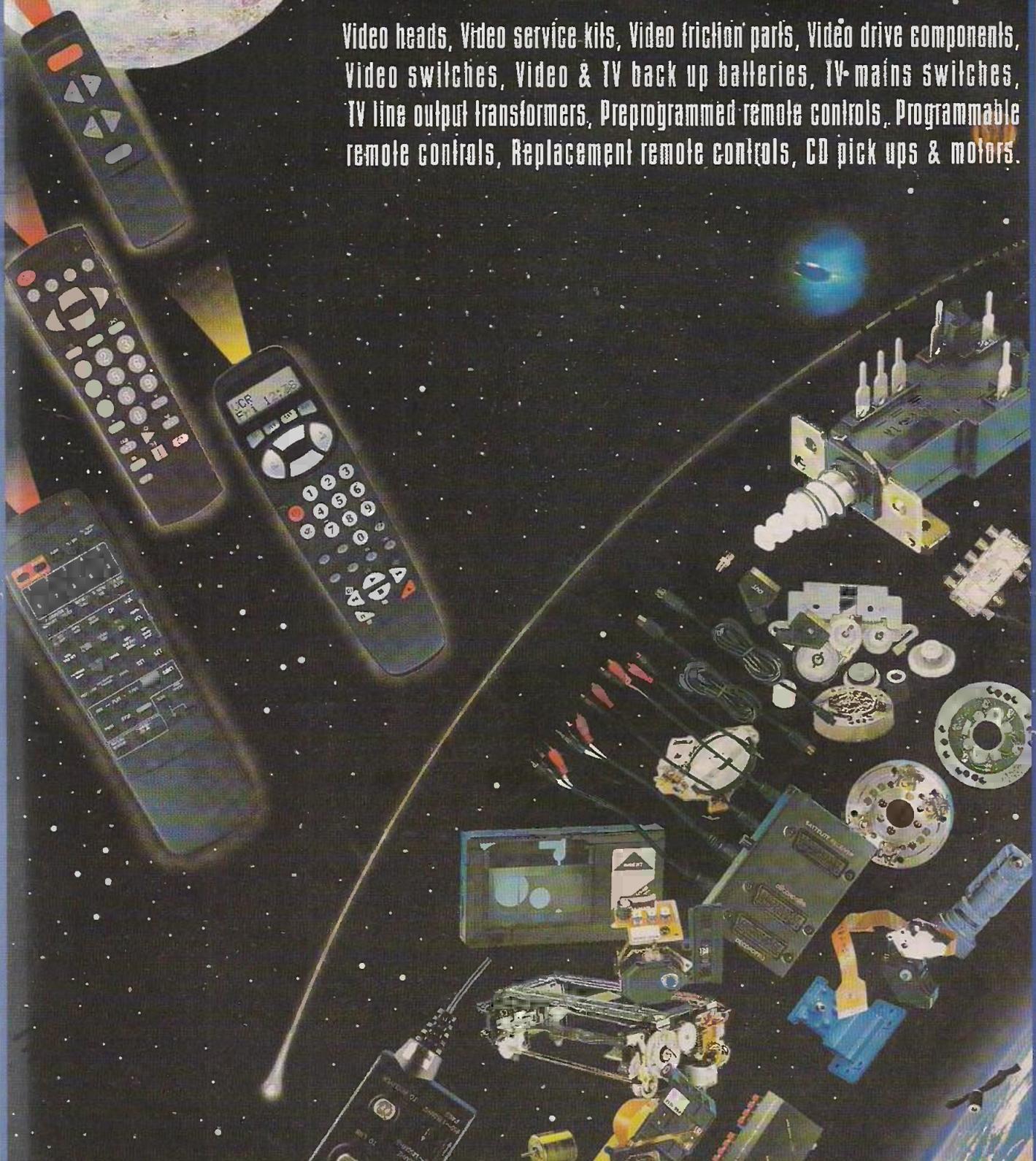
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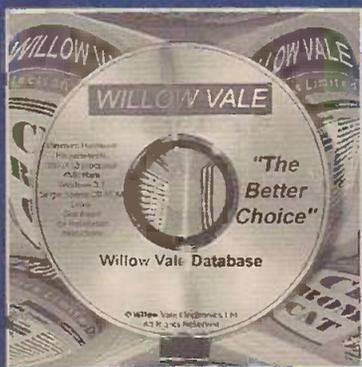
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# Problems with Terminology

**F**or those involved in electronics, one of the nice things is the straightforward terminology used. Resistors resist the passage of current, capacitors have the capacity to store an electric charge, transformers transform voltages, valves control the flow of current, amplifiers amplify, oscillators oscillate, modulators modulate and so on. Couldn't be easier. It is a great help that with a subject which can be very complex we have such an explicit terminology, one that makes it all that much easier to grasp what is going on. The situation could well have been very different. In many fields there seems to be a perverse tendency to use confusing language to make things sound more complex than they really are. There is also the exclusiveness syndrome – those in the know anxious to keep outsiders at bay by using obscure terminology.

But then, by and large, those who first investigated electrical phenomena were anxious that there should be ready public understanding of what they had discovered. And we subsequently had the great help of the British Standards Institute, which devoted quite a lot of consideration to terminology as well as to units and symbols etc. The symbols we use are also mostly clear, and convey a visual impression of the functions performed by components. What could be more appropriate than the inductor or capacitor symbol, or the traditional resistor zig-zag? Pity that the latter has been largely superseded by the rather nondescript box, which doesn't give any visual impression of function. Pity too about the demise of c/s. But we do have the BSI to thank for the adoption of capaci-

tor in place of condenser – the devices don't condense anything! The BSI had less success with its one-time recommendation that we should use the word sender instead of transmitter. Can't say that I have any particular preferences about this one: transmitter is appropriate enough.

There have been some interesting debates in the past, in particular about the word television which, in the early days, was frowned upon because of its mixture of Greek and Latin origins. But television is nice and clear. What about transistor? This seems to go against what has been said so far. But we all know what a transistor does, though its way of doing it is actually quite a complex business. The term stands for transfer-resistor, because those who originally investigated the properties of semiconductor (another nice, to-the-point term) materials were struck by the fact that the device can transfer a current from a low-resistance to a high-resistance circuit. We don't tend to think of transistors as doing that nowadays!

It cannot be other than helpful to use terminology that's to the point. More's the pity that this is not the established practice in other, related fields. I think in particular of computing. There is little problem about the hardware, which is largely electronic anyway. Computers compute, and use memories, processors and controllers to do so. Store might have been preferable to memory, and was widely used in the early days. We can all grasp what a gate does without having to know much about its precise way of doing it. A lot of the more recent terminology stems from the semicon-

ductor industry, and is reasonably clear and to the point. The problems seem to arise in the software and usage side, where clear, relevant terminology would have been a great help. But no, we have to put up with less than clear terminology, largely I suspect because the subject developed at such an extraordinary rate, without anyone giving much thought to niceties of expression. So you don't switch on a computer, you boot it up for heaven's sake. A computer doesn't stop working, it crashes. Those natty little symbols on the screen are icons, which is a word of rather more recondite origin. And so on and on. It seems that a lot of this originated in the US computer industry, with its rather hot-house ethos. They could have done with the BSI to give them some sensible guidance.

Computer use, which is a lot easier than it once was and is now by-and-large user friendly, can nevertheless be less helpful than it could and should be. I think in particular of those confusing messages and questions that appear on the screen – the ones you ignore or just click on to get them out of the way. When our Apple Mac crashes, there is nothing you can do other than switch it off the brute way. When it comes back on again, it has the cheek to tell you that it wasn't switched off correctly! We commented on this to the man from IT. "Do you find that annoying?" he asked. Well yes, in a way. "OK, I'll delete the message then. "What sort of a mad world does this betoken? We have to put up with it, but it would be nice if someone could introduce a bit more common sense and devise a more straightforward terminology. Or is it too late?"

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2SA992	0.31	2SD1554	3.25	BC184L	0.06	BD826	0.43	BUZ90A	3.40	DIC124ES	0.77	SA129302	10.37	TAA550B	1.63	TD44950	1.76
2SB1010	0.35	2SD1555	2.65	BC187	0.47	BD839	0.57	BUZ90AF	3.30	DTCL44ES	0.19	SAB3035	1.71	TAA550B	5.61	TD44950	1.76
2SB1066	0.82	2SD1556	5.11	BC212	0.09	BD901	0.52	BY127	0.18	FR605	1.90	SG264A	12.88	TAA550B	1.12	TD44950	1.76
2SB1143	0.77	2SD1651	2.38	BC212B	0.19	BD902	0.60	BY133	0.08	FXT749	0.43	SG5F344	10.70	TAA550B	1.82	TD44950	1.76
2SB1243	0.60	2SD1858	0.43	BC212L	0.18	BD911	0.52	BY206	0.20	HA13001	3.85	SL1430	1.92	TAA550B	1.06	TD44950	1.76
2SB560	0.43	2SD1877	2.14	BC237	0.12	BDT64C	1.18	BY227	0.13	HA13119	2.05	SL1431	2.82	TAA550B	0.91	TD44950	1.76
2SB563	0.29	2SD1878	2.63	BC237B	0.19	BDT65C	1.68	BY228	0.26	HA13151	13.20	SN74141N	0.17	TAA550B	1.46	TD44950	1.76
2SB647	0.57	2SD1879	3.16	BC238	0.11	BF194	0.22	BY229.000	1.31	HA513385P3	7.69	STK4132I	10.00	TAA550B	4.56	TD44950	1.76
2SB649A	0.77	2SD1884	3.35	BC238B	0.16	BF195	0.07	BY255	0.14	HM6251	14.32	STK4141I	10.23	TAA550B	12.08	TD44950	1.76
2SB688	1.61	2SD1887	3.56	BC307	0.06	BF197	0.18	BY299	0.18	IGH28I	0.26	STK4142I	9.40	TAA550B	1.29	TD44950	1.76
2SB698	0.35	2SD288	0.85	BC307B	0.15	BF199	0.18	BY397	0.20	IP959A	15.79	STK4152I	10.95	TAA550B	1.12	TD44950	1.76
2SB715	0.43	2SD350A	1.97	BC308	0.09	BF258	0.04	BY398	0.16	IRFBC40	5.98	STK4192I	14.64	TAA550B	3.45	TD44950	1.76
2SB772	0.50	2SD381	1.66	BC308A	0.09	BF420	0.21	BY399	0.12	KA6210AH	6.15	STK5332	2.82	TAA550B	3.20	TD44950	1.76
2SB774	1.61	2SD400	0.34	BC308C	0.26	BF421	0.24	BY448	0.30	LA4270	2.73	STK5342	4.07	TAA550B	1.12	TD44950	1.76
2SB891	0.60	2SD401A	0.77	BC309B	0.10	BF422	0.19	BYD14J	0.35	LA4280	3.12	STK5372H	6.84	TAA550B	2.57	TD44950	1.76
2SB892	0.35	2SD468	0.28	BC327	0.10	BF423	0.14	BYD33D	0.12	LA4282	5.11	STK5421	9.52	TAA550B	1.12	TD44950	1.76
2SC1008	0.24	2SD667	0.38	BC328	0.14	BF459	0.43	BYD33M	0.16	LA4445	3.45	STK5481	8.12	TAA550B	7.69	TD44950	1.76
2SC124	0.48	2SD669A	0.64	BC337	0.14	BF471	0.37	BYD33M	0.26	LA4460	2.50	STK7253	7.69	TAA550B	1.64	TD44950	1.76
2SC1318	0.19	2SD718	1.90	BC338	0.06	BF487	0.57	BYV1040	2.55	LA4700	4.27	STK7308	6.41	TAA550B	0.32	TD44950	1.76
2SC1473	0.21	2SD756	0.47	BC368	0.18	BF491	0.41	BYV55B	0.21	LA6524	2.05	STK7348	5.74	TAA550B	1.32	TD44950	1.76
2SC1573	0.52	2SD837B	1.12	BC369	0.18	BF494	0.12	BYV95C	0.28	LA6530	2.94	STR11006	7.37	TAA550B	2.05	TD44950	1.76
2SC1675	0.14	2SD855	0.79	BC372	0.53	BF759	0.38	BYV96D	0.27	LA7830	1.88	STR4211	9.40	TAA550B	2.40	TD44950	1.76
2SC1685	0.21	2SD882	0.43	BC546A	0.11	BF859	0.38	BYV96E	0.53	LA7832	2.40	STR50020	9.38	TAA550B	1.21	TD44950	1.76
2SC1740	0.16	2SD898E	6.41	BC546B	0.12	BF871	0.41	BYW56	0.31	LA7835	2.99	STR50103	4.48	TAA550B	6.13	TD44950	1.76
2SC1815Y	0.11	2SD965	0.67	BC547	0.11	BF959	0.18	BYW95C	0.21	LA7837	4.19	STR50103A	5.56	TAA550B	3.85	TD44950	1.76
2SC2001	0.23	2SD965R	1.05	BC547A	0.04	BF970	0.30	BYW96E	0.50	LC7132	4.70	STR54041	5.15	TAA550B	4.62	TD44950	1.76
2SC2023	3.18	2SK1117	3.40	BC547B	0.11	BF970	0.43	BYX55600	0.23	LED3G	0.10	STR5412	4.02	TAA550B	2.74	TD44950	1.76
2SC2073	1.03	2SK1118	3.40	BC548	0.11	BFR90A	0.68	BZV10	1.34	LED3R	0.10	STR58041					



**PROMAX**

**TEST EQUIPMENT**

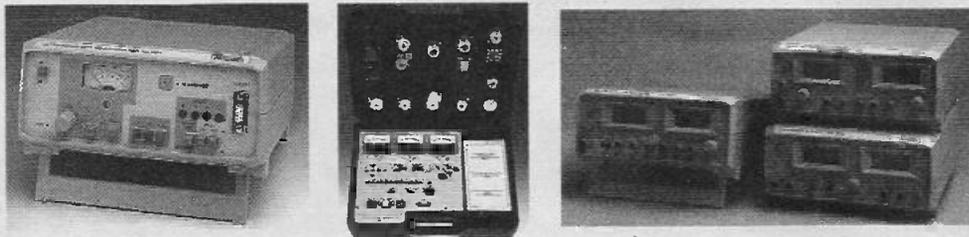
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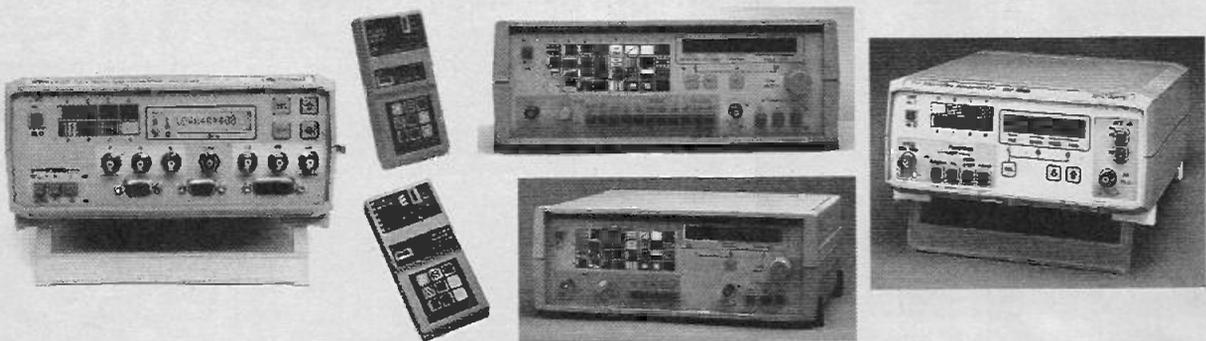
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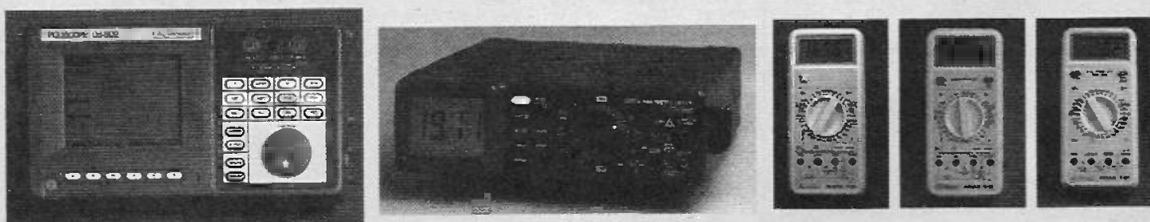
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### SYSTEM SPECIFICATION

686 P200 MHz Computer-PCI Board-512K Cache 16MB RAM-Mini Tower  
2 MB Video Card-1.7GB HDD-1.44 Floppy Disk Drive  
14" SVGA Multisync Colour Monitor  
Panasonic KXP 1150 Dot-matrix Printer

### Plan A 3 Year System Lease

Hardware Cost*	799.00
ServiceBase Lite**	149.00
Full Day System Training	250.00
<b>Total System Cost</b>	<b>1,198.00</b>

Deposit	127.65
Followed By 11 Qtr. Payments of	127.65
Total Paid Over 3 Years	1,531.80
Amount of Interest	333.80

Equivalent Weekly Cost **9.82**

\*System specification as detailed above

### Plan B 1 Year System Lease

Hardware Cost*	799.00
ServiceBase Lite**	149.00
Full Day System Training	250.00
<b>Total System Cost</b>	<b>1,198.00</b>

Deposit 50% of Cost	599.00
Followed By 11 Monthly Payments of	54.45
Total Paid Over 1 Year	1,198.00
Amount of Interest	0.00

Equivalent Weekly Cost **12.47**

\*\*Upgrade To ServiceBase Pro Add £250

### 3 Simple Steps to ServiceBase Lite ...

**Step 1:** Complete a data entry screen to record the customer & unit details then press a single key to produce a receipt.

**Step 2:** Enter the engineers screen to create and display the billing information. Write a description of the work carried out and append any spare parts used.

**Step 3:** A simple print routine will bring all the required information together to produce a professional looking invoice.

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ServiceBase Professional	399.00
Faults Database (78,000 Faults)	299.00
Full Day System Training	250.00
<b>Total System Cost</b>	<b>948.00</b>

Deposit 30% of Cost	284.40
Followed By 11 Monthly Payments of	60.32
Total Paid Over 1 Year	948.00
Amount of Interest	0.00

Equivalent Weekly Cost **13.82**

All prices quoted are + vat at current rate

## ServiceBase *Lite*

If you service consumer electronics you need to keep accurate records detailing:

- Customer Name & Address
- Booking Date
- Fault Description
- Unit Type, Make & Model
- Workshop Repair/Site Visit
- Parts List
- Invoicing Details
- Contact Instructions
- Method Of Payment

ServiceBase *Lite* will breeze through these functions in seconds printing job cards for engineers and invoices for customers.

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- Full Stock Control
- Self Building Bill of Materials
- Field Call Diary
- IRIS Code Selection Tables
- Electronic Mailing
- Contacts Database
- Wants Database
- Enquiry Source Analysis
- Loan Unit Look-up Tables
- Report Generator
- On Board Word Processor
- Mail Merge Facility

ServiceBase will finally allow you to *computerise* *In confidence...*

## ServiceBase *Lite* Order Form

Name: \_\_\_\_\_  
 Company: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 Post Code: \_\_\_\_\_  
 Tel: \_\_\_\_\_  
 Fax: \_\_\_\_\_

Please rush me a full copy of *ServiceBase Lite* at the special TELEVISION price of £149.00 +vat. I understand that I can claim a refund if I am not entirely satisfied within 14 days.

I enclose a cheque to the value of £175.08 made payable to:

PC Control Systems Limited

Please send me information on the full ServiceBase product array.



PC CONTROL SYSTEMS LTD  
 HAMILTON HOUSE  
 66 PALMERSTON ROAD  
 NORTHAMPTON  
 NN1 5EX

TEL: 01604 601677  
 FAX: 01604 601676

Other ServiceBase Products Include: ServiceBase Professional £399 - Retail Module £299 - Rental Module £299  
 Faults Database (empty) £99 - Faults Database (78,000 Faults) £299 - Manufacturers Warranty Module £299.00 - Network Prices on Application

# TELETOPICS

## DVD-RAM Developments

At least the electronics industry was able to agree to a common standard for the basic DVD. It was, perhaps, optimistic to hope that this would mean an end to standards battles in the disc field. Not a bit of it! As the technology has developed, the next innovation will be the re-recordable DVD, known as the DVD-RAM. In April ten leading consumer electronics and PC manufacturers signed an agreement on a specification for the DVD-RAM. The discs would be able to store 2-6Gbytes of data, enough for an hour or so of film footage but not enough to be able to record a feature film. The Hollywood film studios were happy with this limitation.

In July however Sony and Philips, signatories to the earlier agreement, announced their intention to adopt an alternative technology that will provide a storage capacity of 3Gbytes. They are supported by Hewlett-Packard, also Ricoh. This does not give an appreciable increase in playing time, and the discs would be incom-

patible with the basic DVD system – they would be housed in a cartridge. This would give them compatibility with the computer version of DVD, the DVD-ROM, however.

Since then Japanese electronics giant NEC has announced plans to launch, next year, a re-recordable disc with a storage capacity of 5-6Gbytes, i.e. over two hours of video. NEC refers to its disc as a multimedia video file (MMVF). To ease the concerns of the film industry, the discs would incorporate software to prevent duplication of recordings. NEC is seeking the support of other manufacturers. Being the largest PC maker in Japan, NEC could force the issue by incorporating drives for its discs in the PCs it manufactures.

The 'original' DVD-RAM system was due to go into limited production towards the end of this year, with a mass-market launch planned for 1998. The outlook has now become uncertain.

## Multimedia TV

Tatung is about to launch a novel combined TV receiver and computer monitor that's expected to sell for about £400. The receiver-monitor has been designed in the UK and will be produced at Tatung's Telford plant. It is aimed at those who want the convenience of a computer and TV set in a single box – students and those living alone are seen as target customers. Tatung plans to produce 100,000 of the units next year.

Acom, the Cambridge-based computer company, plans to integrate internet access, web browsing and videophone operation into a standard digital TV receiver chassis. According to Acom, a digital TV set could be provided with internet capability for only an extra \$20-\$30. The company is working with NTT of Japan on the development of videophones that can use different transmission media.

## Digital Link

Sony, Philips and Canal Plus are jointly developing new digital consumer electronics products that use an interface called iLink. It's designed to connect digital audio, digital video and computer products, using the IEEE 1394 high-speed serial data bus. This offers a data rate of 400Mbits/sec, which could be increased to 800Mbits/sec

for future products.

Sony has built the iLink into a prototype digital video recorder. Philips and Canal Plus have incorporated it in a D-VHS VCR and a digital IRD (integrated receiver-decoder) respectively. The three companies say that they would welcome association with other companies to develop new products.

## WVE Distributes JBC Soldering Equipment

Willow Vale Electronics has been appointed exclusive UK distributor of JBC soldering/desoldering products to the radio and TV service industry. The range stretches from delicate microsoldering equipment to sophisticated ways of dealing with multipin devices. The equipment is guaranteed to dam-

age neither the board nor the component. Prices compare very favourably with other leading makes. JBC's business was started in Spain in 1929. For further details apply to Willow Vale Electronics, 11 Arkwright Road, Reading, Berks RG2 0LU. Phone 01189 876 444, fax 01189 867 188.



*This cordless, gas-powered soldering iron and precision heating tool, the Vulkan P200, has been launched by BS Manufacturing Ltd., Strawhall Industrial Estate, Carlow, Ireland (phone 00 353 503 30672 from the UK). Made using light-weight plastics, it weighs just 110g while delivering up to 135W. A wide range of attachments is available to enable the device to be used for functions as diverse as fine or silver-soldering, shrink wrapping, hot knife cutting or even blow torch heating.*

## Anti-theft VCRs

Aiwa is the latest company to develop anti-theft VCRs. Earlier this year Sharp launched VCRs that use a post code system – it displays the owner's post code on the TV screen. Aiwa's system goes further in preventing use of the VCR if it has been stolen.

During the initial setting up the owner enters his name, post code and a PIN number, using the remote control handset. When the VCR is powered up after being

disconnected from the mains supply it locks, displaying a blue screen that shows the owner's name and post code. This stage cannot be passed until the correct PIN number has been entered.

The system is available with a number of new models including the HVGX750 (suggested price £200), the HVFX3800 (£300) and the HVFX4800 (£400). These VCRs all include auto set-up, VideoPlus, PDC and NTSC playback.

## Flat-screen Displays

In the fullness of time, flat-screen devices could take over from the CRT as the basic TV display device. Which of several possible technologies will be adopted? Sony has achieved some success with its Plasmatron sets. The Plasmatron uses plasma-addressed liquid-crystal display (PALC) technology that was originally developed by Tektronix. Basically, it makes use of plasma discharges as switches to control a liquid-crystal display, thus providing brightness enhancement. A brief description of the technology was included in our September 1995

issue (see pages 780-1).

Recently, Philips, Sony and Sharp announced that they are to join forces in PALC technology development. A 40in. PALC display is expected to be available before the end of the year. The agreement between the companies is an extension of a previous co-development policy signed by Sony and Sharp in September 1996: the new joint project starts on September 30th 1997. There are plans to develop displays with increased resolution and brightness by the autumn of 1998.

## NVQ Certification

An agreement has been signed by The Electronics Examination Board and the City and Guilds of London Institute to establish a partnership Awarding Body for National Vocational Qualifications (NVQs) and Scottish Vocational Qualifications (SVQs) in electrical and electronics servicing.

The two organisations have been associated in the assessment and certification engineers in these fields since the early Fifties, and

currently operate the popular Course 2240. They will collaborate on developing and implementing a Progression Award in electrical and electronics servicing. This will cover the 'underpinning' knowledge and skill requirements of the new NVQs and SVQs, which are to update and supersede Course 2240. The Progression Award should be ready for a September 1998 start in colleges and training centres.



The Windows '95-based software used in Polar Instruments' PCB fault locator Model PFL760 holds details of more than 2,500 devices. Components on any type of PCB can be checked using analogue 'signature' analysis techniques which even non-specialist users can master in minutes. Handy, but the system will set you back some £3,000 to £5,500 depending on the software provided. For further details apply to Polar Instruments Ltd., Garenne Park, St. Sampson, Guernsey, Channel Islands GY2 4AF – telephone 0148 153 081.

## Video News

Toshiba's new V857B is the first VCR in the UK to feature VideoPlus De Luxe, which enables a VCR to control a satellite or cable receiver via an infra-red link and thus record programmes from several different sources. Other features include long play, Nicam and digital picture noise reduction (DNR). Suggested retail price is £550. VideoPlus maker Gemstar claims that 80 per cent of all new VCRs include the feature and that by the end of the year two million householders in the UK will have the technology available.

The latest Panasonic S-VHS VCR, Model NVHS950, incorporates new image processing circuitry that includes digital Y/C separation, 3-Dimensional digital noise reduction, a digital timebase corrector and feed-forward APC (automatic phase correction). Other features include amorphous Pro heads, NextView link, Crystal View control, various editing facilities and satellite control. Suggested retail price is £800.

## Business News

Tatung plans to double production of TV sets and computer monitors at its Telford plant by the year 2000. Last year Tatung produced some 300,000 TV sets and 200,000 monitors at Telford. Plans are for production of 350,000 TV sets, 250,000 monitors and 100,000 combined units (see note under Multimedia TV) next year, with a further increase to 1m units in 2000, most of the final growth consisting of monitors. Chung Hwa Picture Tubes, part of the Tatung group, is to open a CRT factory at Mossend in Lanarkshire later this year.

Sony is currently producing 1m computer monitors a year at its plant in South Wales. LG of South Korea is building a new factory in South Wales to produce computer monitors. When fully operational in 2000 the plant will have a production capacity of 2m units a year.

Toshiba is to expand production at its two plants in Plymouth,

which will become the company's source for microwave oven magnetrons in Europe. Production of magnetrons at Plymouth is to be increased from 700,000 to 2m a year within eighteen months. There will also be a fifteen per cent increase in TV set production.

China has an unsold stockpile of colour TV sets, the result of excessive expansion in the industry in the early Nineties. In 1996 there were 98 manufacturers, five able to produce more than one million sets a year. During that year 21m colour TV sets were produced, making China the world's third largest CTV producer. Sales reached only 18m however, including 5m that were exported. Some 93 per cent of urban Chinese families and thirty per cent of rural families now own a set. Despite this apparent market saturation, Chinese CTV production capacity is expected to rise to 33m by the year 2000, with 8m exports. Last year, world demand for colour TV sets reached 110m sets. The figure is expected to rise to 140m by 200.



## Reports from David C. Woodnott

### Sharp VLC690H

Although the E-E picture and playback of existing tapes were OK, there was no video recording. Sound was OK in both the record and playback modes. The cause of the fault was traced to the two 22 $\mu$ F, 35V surface-mounted electrolytics C945 and C946 on the main PCB. They had leaked and corroded the print beneath their contacts. After cleaning up, a link was fitted between pin 72 of IC801 (syscon) and pin 5 of Q935 (rec H SW). This restored normal operation. D.C.W.

### JVC GRAX5E

There was no power-up, nor were there any signs of life. The customer had mentioned a "burning smell" at the time of the failure. An inspection showed that D14 (DAN202U) on the main PCB had disintegrated, leaving only some charred remains to indicate its previous whereabouts. The main DC-DC converter had also been damaged – there was no regulated 8V output at pin 5. D14 feeds this supply to pin 3 of an 8-pin DIN socket to power the plug-in RF unit. The line is not fuse protected. A replacement DC-DC converter and diode restored normal working.

The cause of the problem is not uncommon, and can occur with other makes and models. At the time of the failure, the customer was about to transfer a recording to his new VHS machine via a DIN-to-scart lead. The fault occurred as

# Camcorner

he connected this, because it earthed the 8V supply via the wiring to the VHS machine's scart socket. As we didn't have the VHS machine, we decided to disconnect the 8V supply at the scart end of the lead. The customer could still use his RF unit if required, but would hopefully not damage his camcorder again – in this way at any rate! D.C.W.

### Samsung VPU10

There was a tape stuck in this machine, which was active electrically though eject was not possible. After extracting the tape manually, I dismantled the mechanism to allow an internal inspection. The mode switch had a missing tooth, and various parts were either 'bent' or misplaced. A replacement mode switch, slide plate assembly, supply and take-up arm pole assemblies and main roller cam restored normal operation. The deck is reasonably easy to work on but, like most current 8mm units, is rather flimsy and prone to bending if it becomes jammed for any reason. D.C.W.

### Canon A2HiE

This nice Hi-8 machine gave us a few headaches before it revealed its secret! It would power up and operate mechanically in both the record and play modes, but there were no output signals. Correction: in the E-E mode unlocked chroma would occasionally glide across the monitor's screen. In playback even this small sign of life was missing. As anyone familiar with these units knows, they are not all that friendly to work on – the three PCBs at the rear of the mechanism are mounted closely together one above the other. After gaining sufficient access to the video PCB to be able to carry out some checks, we soon found ourselves a little confused (nothing unusual here!).

Video from the camera section arrived at the processing chip IC201, but failed to emerge from it. At first we suspected the chip, as most measurable inputs, supplies etc. seemed to be in order. We then noticed that one input wasn't right. Pin 23 of IC201 is a clock input

that comes directly from the main syscon chip on the syscon PCB. The data signals on the same bus appeared to be OK, but the clock signal was absent.

We traced the line back to pin 16 of the main syscon microcontroller chip IC1601, where the correct signal (CGO/V clock) was present. After this it didn't take long to find the culprit, as only one component was involved: R1659 (1k $\Omega$ ) was open-circuit. It's on the main syscon PCB, on the reverse side of and directly behind IC1601. A replacement restored the pictures and correct operation. D.C.W.

### Hitachi E10E

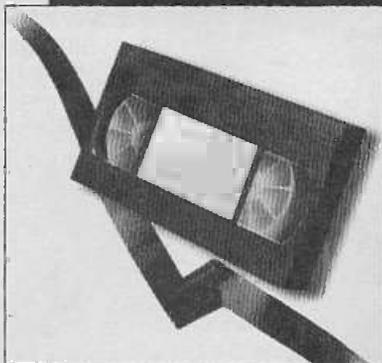
No record picture was the complaint with this camcorder. Playback and E-E operation were OK. I found that C337 (47 $\mu$ F, 6.3V) on the main PCB had leaked. The affected area was cleaned and a replacement capacitor was fitted. On test the machine recorded the video signal, but when rewind commenced it stopped after a few seconds and the machine ceased to operate. The cause was leakage from the 220 $\mu$ F capacitor on the main PCB. D.C.W.

### Canon UC30HiE

This recent Hi8 model's playback was OK, but in the camera mode the picture gradually became darker then disappeared. A clue to the cause of the trouble was provided by the fact that if the machine was switched off then allowed to cool the same situation was repeated at power-up. This reminded us of a similar problem we'd had with a Canon camcorder about a year previously.

A quick check in our Camcorder Faults List (pages cut from the magazine!) led us to the culprit. Capacitor C2115 (1 $\mu$ F) on the camera processing PCB was found to be heat-sensitive. The original fault report related to Model UC16: the same component had failed in the same way. It just goes to show that keeping notes of fault symptoms and cures is a worthwhile exercise! D.C.W.





Reports from  
**Philip Blundell AMIEEIE**  
**Alan Travers**  
**Bob Longhurst**  
**Brian Storm**  
**Gerald Smith**  
**Pete Gurney**  
**David Corcoran**  
**Roger F. White and**  
**Stephen Leatherbarrow**

#### **Mitsubishi HSM58V**

This VCR had no on-screen menu. When menu was selected, all that appeared was a mass of lines. Tests on the plug-in OSD board soon revealed that the 17.73MHz crystal X501 was faulty. The part no. is 285P084010. P.B.

#### **Grundig VS340**

A neighbouring dealer had recently given this machine a deck service. It now damaged the tape as the cassette was ejected. Tape guide 112 failed to return to the eject position because it caught on the pinch roller: the pinch roller return spring 48 had been fitted upside down. P.B.

#### **Sony SLC9**

My latest restoration – it took so long that I could hardly call it a repair! – was to the local school's last Betamax VCR. The school has a lot of programmes on Betamax tape: now that the last working machine had lost its heads these couldn't even be copied over to VHS.

As you often find with an old machine, this one had another, intermittent fault. But the school had been living with it. Nevertheless before buying new heads I thought it best to find the cause of the fault, as the part responsible might no longer be available (the heads are available to order from CHS).

When the machine was switched on from cold, no deck function

# VCR Clinic

would continue for more than three seconds: play, fast forward and rewind all terminated after a few seconds. Once the machine had been on for a few minutes the fault would clear and not reappear until next day.

A look through back issues of *Television* brought the suggestion that the deck state switches can give trouble. But a week spent monitoring them proved that they were without blame. I then checked the reel tacho pulses. Sure enough the take-up reel tacho pulses (the TFG signal at test point TP001) were missing in the fault condition. The voltages at the take-up pulse op-amp were found to be lower than those at the supply pulse op-amp. C004 (10µF, 16V) turned out to be leaky. The heads are now on order! A.T.

#### **JVC HRJ235**

The cassette had jammed inside one of these machines, and the owner had somehow yanked it out. As it was my first encounter with this new mechanism, I obtained a service manual. A subsequent call to JVC Technical made me realise that this was not going to be an easy job. I was told to replace the guide-arm assembly, the pinch-roller assembly, the control cam, the pinch plate and, if it's not the uprated metal type, the lever assembly. Then realign the mechanism. Time to draw the curtains and take the phone off the hook. The job was successfully completed, some hours later, by following the instructions in the manual. Dry runs were also successful. Time to refit and power up. Great! Everything functioned – until the tape was ejected then pushed in again to play. A gear-grating noise came from the right-hand side of the housing. Then everything ground to a halt.

When I removed and dismantled

the cassette housing gears I found that one gear had mangled teeth. A telephone call produced the news that only the complete housing assembly is available. So I wrote to JVC. In response, I received a phone call giving me the part numbers for the damaged black and white gears. The 'drive gear' is part no. PQ35040, the 'helical gear' part no. PQ35039-1-2.

I have just had in another of these machines with identical faults, so maybe this is going to become a common problem. Anyway, ten out of ten to JVC for the company's invaluable help. B.L.

#### **Toshiba V854B**

There was intermittent loss of the E-E sound with screeching noises at times. It didn't take long to discover that the MPX module was microphonic. Establishing the cause was not so easy. To work on the unit I had to solder some fifteen flyleads between its pins and the relevant PCB solder points. This provided 'live' working.

After much flexing etc. I discovered that crystal XD01 was dry-jointed. Resoldering restored correct operation. B.L.

#### **Panasonic NVHD90**

This machine would sometimes accept a tape, try to load it, fail then eject it. My first suspect was the mode switch, but it proved to be innocent. Eventually arm P5 was found to be the culprit. Because it was slightly distorted, it would sometimes jam as it attempted to load. A replacement (part no. VXL2306) provided a reliable cure. B.S.

#### **Panasonic NVV8000**

One of these machines had a mechanism fault. Unfortunately they have a dual VHS-C and standard-VHS cassette loading mechanism.

which means that the cassette carriage assembly is fairly complicated. It would jam – it seemed to stop between the two modes, after which the machine would power down. The main mechanism within the machine stayed in the VHS-C mode.

The cassette carriage was removed after a long struggle. I then realigned the many gears and levers. After that the machine worked consistently. I was unable to find any damaged gears or bent levers that could have been the cause of the misalignment, and was just grateful that the machine now worked. **B.S.**

### Panasonic NVSD40

This machine wouldn't record. Although it entered the appropriate mode, the expected recording didn't take place. A previous recording would not be affected, which proved that the full erase circuitry wasn't being activated either. Some basic checks in the record switching circuitry revealed that the 2SB710 surface-mounted transistor Q3007 was faulty, a replacement curing the trouble. **B.S.**

### Nokia VR3716

This machine would sometimes cut off in the record mode. The cause was excessive noise on the key-scan lines. To reduce this, fit two 330pF capacitors on the function PCB, at plug OA, between pins 4 and 6 and 3 and 6. Also check plug/socket OA/AO for bad connections. **G.S.**

### Daewoo V22

One of these machines was dead, the cause being low drive at the base of the chopper transistor. Replacing IC801 and Q802 cured the fault. **G.S.**

### Samsung VIK326

In the E-E mode this machine would sometimes produce a blue screen. The tuner and the 33V stabiliser were both OK. I traced the cause of the problem to bad contacts at the pins of the power supply plug and socket. **G.S.**

### Daewoo V22

There was sound wow in both the record and playback modes. The capstan and pinch roller were both OK. The cause of the trouble turned out to be the clutch assembly. **G.S.**

### Sharp VCA105/615/60

No operation because of a dead DD capstan motor is a problem I've had

on quite a number of occasions with these machines – the deck is of the type that requires a quick motor shuffle before initialisation is complete, hence the no operation. But before you replace the motor, it can pay to look a bit further. All references in the following note are to the DD motor PCB itself.

The M52440ASP DD motor drive chip is supplied with 12V (at pin 17) via the ribbon connector socket MC. Check the 10µF, 25V electrolytic capacitor next to this plug carefully. It's marked C6. On many occasions I have found that this capacitor has leaked electrolyte, which has rotted away the print between the connector and the capacitor, removing the supply to the drive chip. This is not obvious, as the print still appears to be intact. A check for 12V at the connector and at the positive end of C6 will usually prove the point.

The cure is to remove C6, clean the board thoroughly and, with care, fit a wire link to replace the open-circuit print. Then fit a sub-miniature replacement electrolytic. While I'm in this area I usually strip, clean and relubricate the capstan shaft.

The motor is used in several other Sharp decks and in quite a few Granada and Pye/Philips clone machines. **P.G.**

### Panasonic NVF55

The customer reported that one of these machines had "gone dead" after a local power cut. There was HT across C1103 in the primary side of the chopper power supply, but there were no outputs on the secondary side. The cause was traced to R1103, which was open-circuit. It provides IC1101 with a start-up feed. Replace R1103 and R1133 (both 220kΩ). **D.C.**

### Philips VR6290

This machine came in with a cassette stuck inside. When I switched it on the tape wouldn't eject, and if any function was selected the clock display flashed on and off. I found that the power supply was pulsing because the CNX83A optocoupler IC7124 was faulty. A new CNX83A restored normal operation. **R.F.W.**

### Logik VR950

The E-E picture was very distorted, and part of it was blanked out. The cause was hum on the preset tuning voltage supply, which is identified as PRST VTG. Replacing C4 (47µF, 100V) cured the fault. **R.F.W.**

### Hitachi VTM720

Intermittent stopping was the complaint with this machine. It would sometimes go into play for only a few seconds then switch off. The cause of the fault seemed to be to do with the take-up rotation sensor. I inspected the deck PCB, looking for dry-joints, and thought that I had found the solution to the problem. But the machine was back a few days later with the same complaint. A new Hall effect chip, IC141, restored normal operation. **R.F.W.**

### Ferguson FV32

Tape chewing was the complaint with this machine. When I tried it none of the functions worked. The cause was a wire broken off the loading motor, which made me think that someone had been there before me. After reconnecting the wire I selected play. A strained sound came from the tape, so I removed it and inserted an empty cassette. When play was selected I could then see that the take-up spool was rotating at the full fast-forward speed. The faulty component was the MC14094 chip IT62. **R.F.W.**

### Sanyo VHR291

This machine would stop when in play. Although the take-up sensor was working, it wasn't producing a regular series of pulses. The strange thing was that when the machine was turned on its side or upside down it played all right. The increased space between the bottom of the reel and the faulty sensor somehow improved its response. A new sensor cured the fault. **R.F.W.**

### Granada VSHS5

This Sanyo-based text machine had a tape stuck inside and wouldn't respond to any button pressing. Without a manual it was with some difficulty that we arrived at the 2SD1207 transistor Q5402, which was short-circuit. It appears to provide a switched 12V supply. A nearby 47µF electrolytic was open-circuit.

After replacing these items we gave the machine a soak test then returned it to the customer. It was back a week later, again with Q5402 faulty. This time however there was a short-circuit across the supply. We traced the cause to the RF modulator – the short came and went when pressure was applied to its case. To be sure, we replaced this unit. **S.L.**

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# Simple Intercom System

This very simple system provides full duplex working without the need for push-to-talk operation. Useful for showroom/workshop communications etc. Devised by **Andrew Tebbutt**

Unlike a lot of other designs this simple intercom system does not require push-to-talk operation and has full duplex working. This is achieved by using standard telephone handsets. The only requirements are that they have an earth recall facility (most modern phone units do) and that they are fitted with the modern type of connecting plug (type 600).

You will probably find that you have in your junk box most of the parts required to build the control unit. Its circuit is shown in Fig. 1(a).

## Circuit Operation

Transformer T1 with bridge rectifier D1 and its reservoir capacitor C1 produce a speech supply of some 20V. Half-wave rectifier D2 and its reservoir capacitor C2 produce about 12V to operate the calling relays RLA2 and 3. An extra winding on the secondary side of the transformer provides some 40V AC to operate the bell or tone caller in the called phone. Fig. 1(b) shows, for reference, the basic telephone handset circuit.

When the receiver of station X is lifted and the recall button R is pressed, relay RLA2 will operate, closing its normally-open contacts. Station Y will thus be providing with a ringing signal. When the Y station receiver is lifted a current will flow. A conversation can thus take place via the receivers. In addition relay RLA1 will operate, opening its normally-closed contacts. This disconnects the supply to relays RLA2 and RLA3. Thus the ringing stops as soon as a receiver is lifted.

The same basic sequence of operations occurs when station Y calls station X.

## Notes

The transformer I used was obtained from a scrap VCR. Most such transformers I've come across have higher-voltage AC windings that enable the phones to ring correctly.

If you use the older type of dial phones you may find that they don't have recall buttons. In this case fit a single-pole push-to-make button switch in the body of the phone: connect one wire to the white and one

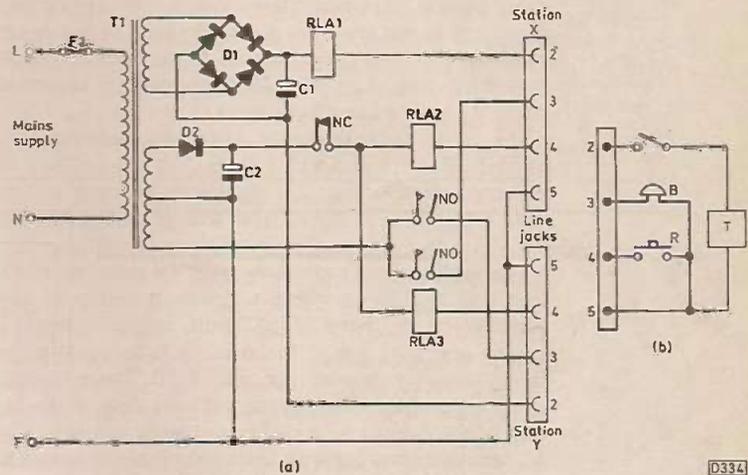


Fig. 1: Circuit of the intercom system control unit (a), basic telephone handset circuit (b). B = bell or tone caller, R = recall button, T = telephone handset circuit.

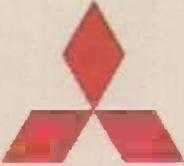
to the green lead connected to the line cord.

The line jacks used must be of the secondary type.

Constructional details of the control unit are not shown. The unit is straightforward and is simple to wire up. Any case that's to hand can be used, provided the ventilation is adequate.

## Parts list

C1	2,200 $\mu$ F, 40V electrolytic
C2	100 $\mu$ F, 50V electrolytic
D1	BY164 or similar
D2	BY133 or similar
F1	1A, 250V
RLA1	6 or 12V DC relay with normally-closed contacts
RLA2, 3	12V DC relays with normally-open contacts
T1	See text
Two BT secondary type line jacks	



# Matters

# Mitsubishi

## John C. Priest and Adrian Farnborough report on various Mitsubishi TV faults

### Euro 4 Chassis

This chassis is used in Model CT2545 and a number of other models. A common fault, which is becoming more prevalent as the sets age, is the presence of heavy herringbone patterning at switch on. In the early stages this patterning may clear after 15-20 minutes. It eventually becomes more or less permanent.

The cause is 12V supply instability because C920 (470 $\mu$ F, 25V) and C925 (10 $\mu$ F, 50V) fail. They are mounted close to the 12V regulator's heatsink and dry out. When it is removed you will probably find that C920 has leaked a gummy red/brown deposit.

The replacement capacitors must be rated at 105°C. But I've had cases where components replaced two-three years ago have failed again. In the interests of cooler operation I now make it my practice to mount these capacitors beneath the main PCB. There is plenty of space, as the PCB is supported well clear of the bottom of the cabinet by a rubber or plastic spacing pillar. Mount the capacitors with fairly long leads to enable the cans to lie flat along the PCB: insulate and secure with a blob of hot-melt adhesive.

It may sometimes be necessary to replace the  $\mu$ PC7812H 12V regulator IC902 as well. Fit the replacement in the original position, secured to the heatsink above the PCB.

The problem with a CT2534TX was no picture or sound, though the set would go into and out of the standby mode. Checks suggested that the power supplies, main and standby, were both working correctly. The cause of the fault was loss of line drive – there was intermittent connection at the legs of the line driver transformer T551. I removed it from the PCB, scraped and tinned the legs then refitted it. This cleared the trouble. J.C.P.

### Model CT37C1STX

The complaint with this gigantic set was that the picture-in-picture facility, though working, produced only a monochrome insert. The main picture had normal colour. As on-site checks on the PinP subpanel for dry-joints, component faults, incorrect adjustments etc. failed to produce any useful pointers, an uplift was reluctantly arranged.

Because of the size and weight of these sets and the poor grip afforded by their well-rounded cabinet base, where the only vantage points seem to have sharp edges,

moving them can be a problem. A useful tip when access, stairs etc. make the use of a trolley or truck impossible is to use a strap of strong two-inch webbing (about 15 feet long) arranged as a figure-of-eight, with the crossover point beneath the centre of the cabinet. Then, with the loops passed over the heads of two carriers, the main weight can be taken by the neck and shoulder muscles, leaving the hands free for general support, balance and guidance.

Back in the workshop some time was spent checking the clock and data lines on the PinP panel, where the video processing is done digitally. After following a few red herrings, sanity returned and, going back to basics, I found that the chrominance buffer transistor Q608 (JC501Q, R) on the main PCB was short-circuit. Further checks revealed that one of the two screened leads which carry separate luminance and chrominance signal feeds from the main PCB to the PinP subpanel showed signs of crushing – it seemed to have been trapped between the back cover and the side panel edges during set assembly. A new JC501Q, R transistor and screened lead restored colour to the PinP frames. J.C.P.

### Another CT37C1STX

There was an intermittent purity problem with another of these brutes I had to deal with a couple of years ago – mainly yellow shading at the top left-hand corner of the screen. The cause of the symptom was not easy to diagnose, as the set was installed in the living room of a suburban semi-detached house. The room measured only about 13 x 15ft, and also contained a large leather three-piece suite, a large coffee table and a whole wall of shelving for video tapes, video discs and other items. It was impossible to view the screen from more than about nine feet without going out into the hall.

I eventually found that the cause of the problem was a loose shadowmask – the symptom could be brought on by thumping the left-hand side of the screen with one's fist. Mitsubishi supplied a replacement CRT, and the set was taken to the workshop for it to be fitted. Because of the size and weight of the CRT this was a cumbersome job, which had to be done on the workshop floor rather than the bench. As the scan coils had to be transferred from the old CRT, the full purity and convergence procedure had to be undertaken. This includes fitting correction magnets for corner beam landing and central convergence. Pretty much a whole day's work altogether.

er, but I was happily surprised by the results. The following day, after a check to make sure that the results from switch on were still good, the set was returned.

At switch on in the customer's house the picture produced was diabolical. There were far worse purity problems than before, and degaussing didn't improve matters. What I had not been aware of was the fact that our workshop, at first-floor level above the showroom, had a couple of whacking great girders under the floor. I had set up the new CRT on the floor, within the field from all that metalwork. The whole set-up procedure had to be done again in the room with all that furniture. J.C.P.

### Models CT21MITX/CT25MITX

I've had several of these sets (Euro 10 chassis) in over the past two months, all with the same complaint – stuck in standby, usually with the comment that the set had been behaving in the same way intermittently for two or three days before the fault became permanent. In each case the cause of the fault was a pronounced halo around the collector tag of the 2SD1878 line output transistor Q552.

Resoldering clears the problem, but as the solder is usually visibly crystallised it's advisable to clean the joint thoroughly with desoldering braid before you remake the joint using all new solder. While the set is on the bench, it is good practice to go round all the line output and line driver transformer tags and the connections to R556 (10 $\Omega$ , 10W). This will avoid possible call-backs.

Another common problem with these sets now that they are a few years old is failure to retain analogue settings after switch-off. The usual symptom is that all is OK as long as the set is only switched to standby, but after a switch off the set will next come on with the brightness, colour and contrast at maximum and the volume at the half-way setting.

If you measure the voltage at pin 2 of the M58630P EAROM chip IC702 you will probably find that it is at rather less than -25V instead of the correct -30V. The cause of the trouble is the -30V supply reservoir capacitor C962 (100 $\mu$ F, 50V) on the power PCB. It may have even come away from the print and be lying somewhere on the floor – having dropped out of the cabinet when you removed the back cover. The replacement should be a high-temperature type (105°C). Be careful over the polarity when fitting the new capacitor – you are dealing with a negative supply.

While working on the power supply PCB, check the rest of the electrolytics. Replace any that could be doubtful – prevention is better than cure! J.C.P.

### Model CT2965STX

This is an old problem that's worth a mention. If the set is dead with no 12V supply, check the ceramic fuse Z950 (PRF3150). If it's open-circuit, check D952 and C956. If these items are OK, replace Z950 but uprate it to PRF5000 (5A) – part no. 299P132010. This is an official Mitsubishi modification. I replaced a lot of these fuses in the early Nineties, but some must have slipped through the net – I came across two more recently. J.C.P.

### Model CT21M2TX

There was no picture or sound. The screen displayed snow or a blank white raster intermittently. Response to the remote control unit was sluggish, and the set would not memorise any analogue or tuning adjustments.

The supplies to the microcontroller chip IC701 and the EEPROM chip IC702 were checked and found to be OK. The other pin voltages were also OK. When I used a scope to monitor the clock and data lines I noticed that

there was a momentary glitch as the channel preset button was pressed. A new ST24C02A EEPROM chip cured the fault. J.C.P.

### Models CT2141BM/CT2142TX etc (Euro 4 Chassis)

I've had several calls to these sets for drifting off tune, loss of sound, patterning etc. since Channel 5 started up. In most cases the cause of the problem has been finger trouble during the retuning process. With these models, press the tuning preset button and check that the on-screen graphic shows AFT ON. If it shows AFT OFF, check the fine tuning of the channel affected then press the AFT button to set to AFT ON before you release the tuning preset button. While you are at it, check all the channels in use for AFT ON.

I don't know what some people have used to press the recessed tuning preset button. I've come across more than one case where the button has been pressed hard enough and off centre to make it lodge behind the front panel, so that it couldn't be released. In one set the switch had been pushed partly off the PCB! J.C.P.

### Model CP140B

This venerable 14in. portable arrived in my workshop with bottom foldover, lack of height and a faint, over-bright yellow picture. It was one of the first Mitsubishi colour portables to be marketed in the UK, and must have been 22 years old (it wasn't even full PAL! – *editor*). I told the old lady who brought the set in that it wouldn't be worth repair if the CRT was as poor as it appeared to be. But the set had been her late husband's retirement present, and had great sentimental value.

Much to my surprise, after cleaning all the potentiometers on the front control subpanel and replacing C291 (47 $\mu$ F, 10V), which is in series with the contrast control, and R291 (1k $\Omega$ ), which is in series with the brightness control, the picture had improved somewhat. When I tried to adjust the field timebase controls I found that they either fell to pieces as soon as the trimmer touched them or they were painted up so solidly that they had to be removed from the panel to be freed. Fitting and adjusting one 2.2k $\Omega$  and two 10k $\Omega$  potentiometers restored normal field scanning. Some resoldering around the beam limiter transistor Q204 and a new video bias potentiometer (VR201, 2k $\Omega$ ) produced a good picture.

Once I'd blown out twenty years' accumulation of dust etc., given the convergence controls a quick tweak, trimmed the grey scale and polished the cabinet the set was almost as good as new. I can't see many of today's sets giving good service for twenty or more years. J.C.P.

### Model CT25MITX

The customers' complaint with several of these sets has been that "it goes on and off". If it's a rental set the customer is on the phone immediately. If it's a chargeable repair, the customer puts up with the condition until the set packs up. The thing to do is to check the line output transistor's collector connection (Q552) with a good magnifying glass. A.F.

### Model CT2517BM (Euro 1 Chassis)

The symptom displayed by one of these sets was interference: it consisted of a diagonal pattern of colour dots that floated across the screen. As chopper power supplies can give rise to many peculiar conditions, we checked here first and found that R914 (100 $\Omega$ , 10W) in the snubber network was open-circuit. Fortunately the chopper transistor Q904 had suffered no ill effects. A.F.

### Correction

In the note on the Mitsubishi Model CT25A2STX (Euro 12 chassis) in TV Fault Finding, September (page 798), the type number for Q202 was given incorrectly. It's type JC501Q.R.

## Test Report

# Multiview RF Modulators

Eugene Trundle checks out three new RF converters that have many applications in the home and workshop



As the number of black boxes in the living room steadily increases, the problems with their interconnections become greater. The best approach is to use AV (scart) leads, but this is not always practical. Scart sockets may not be fitted to the equipment, or may already be in use; the need might be to send a signal over a long distance; or there may be an RF distribution system in use. The little Multiview TIMs (tuner-in-modules) reviewed in this article provide an excellent solution where RF connection has to be used. A brief specification is shown in Table 1 at the top of the next page.

### The Range

The Multiview range of RF modulators consists of three models, as follows:

Model TIM1 is designed to overcome the problem of patterning and interference from Channel 5. It replaces a satellite receiver's modulator, with its restricted tuning range, providing a UHF output in the ch. 40-50 range — well clear of the Channel 5 transmissions and the VCR's own RF output. The TIM1 modulator draws its power from the satellite receiver's LNB supply. It has phono audio and video input sockets, an RF-through path with boost (typically 2dB), and comes with a scart-to-phonos AV connector.

Model TIM2 is intended as a general-purpose, self-contained RF modulator. It comes with a separate mains power supply module and provides an output in the ch. 30-40 range. As with Model TIM1 there are phono

audio and video inputs, a scart-to-phono connector is supplied and there's an RF through path.

Model TIM3 is similar to the TIM2 in most respects but can provide an output on any UHF channel. Instead of the rotary channel-trimmer incorporated in Models TIM1 and 2 the TIM3 has a mini-bank of six tiny two-way switches that enable any channel between 21-69 to be selected for the output. There's also a test signal output (two vertical white bars) on ch. 45. The TIM3 has two UHF output sockets and comes with a coax-to-phono RF lead as well as the scart-phono connector.

### On Test

I tested all three models and found that they work well, with no perceptible frequency drift and a good, strong output signal of around  $4\text{mV}/72\text{dB}\mu\text{V}$ , though this has a double-sideband spread.

With a test pattern input, the video response extended beyond 4.5MHz. Overloading (a white/colour crushing effect) didn't occur until the level of the input signal reached 1.25V peak-to-peak. Grey tones, colour and audio were all faithfully reproduced, the colour, contrast and brightness levels corresponding closely with those of a broadcast transmission. Neither the unit nor the power supply (Models TIM2 and 3) warmed up appreciably during operation.

I found that the illustrated step-by-step instructions are clear and easy to follow. This is important in cases where the unit is to be installed and used by those without technical skills.

While Model TIM1 is basically a problem solver for

TV viewers and Model TIM2 is a useful general-purpose RF converter, Model TIM3 is most likely to be of interest to service technicians – because of its programmable channel 21-69 output facility. Up to now we've had to use a scrapped or redundant Pace PRD-series satellite box to get this feature. It enables you to check and pretune any TV set or VCR in the workshop for any group of TV transmissions. When coupled with a wide-ranging, switched RF attenuator, this little box could form a versatile and inexpensive 'RF centre' for workshop test pattern generators. I understand that it can be supplied for other TV transmission systems, e.g. B/G, to order.

When checked against TV sets and VCRs with direct programming of UHF channel numbers I found that the output channel frequencies of the TIM3 were spot on. Set the little box to ch. 49 or whatever, the TV set or VCR likewise, and up come perfectly-tuned colour pictures and sound – impressive!

Normally when I review anything like this I dismantle the unit and poke about inside. But these modules defeated me – they are sealed. So I contented myself with banging them on the bench: there was little microphony, and nothing rattled afterwards!

**Uses**

Model TIM1 is specifically intended for Channel 5 problem solving, but its use removes a TV set or VCR's stereo sound capability where this is present. The other two units, while still having mono sound and a double-sideband output, have many applications. These include home security/surveillance/baby watching, perhaps in conjunction with a Bull camera and sound adaptation (to

**Table 1: Basic specification**

RF coverage	TIM1 and TIM2 623-25-709-25MHz (chs. 40-50) TIM3 471-25-855-25MHz (chs. 21-69)
Vision carrier	72dBuV typical
Sound carrier	-14dB with respect to the vision carrier
Video input*	1V peak-to-peak composite
Audio input*	1.23V peak-to-peak
Booster gain	+2dB typical
Power supply	TIM1 via LNB feed TIM2 12V adaptor supplied TIM3 16.5V adaptor supplied
Size	96 x 56 x 38mm

\*At phono socket.

be described next month); use with a camcorder – they don't give RF converters away with them any more; multiset TV viewing, using a unit's signal-boosting and splitting capabilities; hook-up with a computer where, for example with Amiga and Apple Mac units, a composite video output is available; and use with TV games and consoles such as the Sega Saturn outfit.

**In Conclusion**

These versatile and useful modules represent, in my opinion, good value for money. The suggested retail prices, including VAT, are £25 for the TIM1, £30 for the TIM2, and £35 for the digitally-programmed TIM3. They are available from Eurotechnic Distribution Ltd., The Courtyard, 41 Filmer Road, London SW6 7JJ (telephone 0171 610 0055, fax 0171 386 8131).

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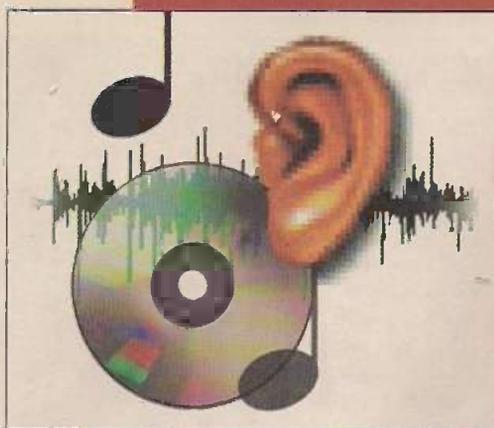
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**P.J. Roberts**  
**Robert Marshall**  
and **R.E. Kemsley**

### **Sony CDPC50M**

This five-disc carousel CD player was largely dead – there was no display and the drawer was sluggish, though the machine would eventually play discs. The cause of the problem was R604 (1.2k $\Omega$ ) in the -25V regulator circuit (Q601/2). It had gone open-circuit. N.B.

### **Murphy MS176CD**

The CD section of this budget music system would not readily read the TOC. Cleaning the lens improved matters but it was still reluctant. A new pattern optical unit – it uses the Sony KSS210A/KSS150A – cured the fault. N.B.

### **Sony CDP502ES**

This CD player had come to sunny Devon from the Middle East and wouldn't register discs. I found that because of a stuck transit lever the traverse was jammed at its outermost extremity. Even when the lever was released it stopped the traverse. A clean cured the problem. N.B.

### **Pioneer DEH66**

This in-car CD player produced no sound output and its case got very hot: the audio output chip IC551 was short-circuit. When this item had been replaced the operating temperature was more reasonable but there was still no sound. The MA3091 surface-mounted zener diode D551 was missing – it appeared to have dropped off because of all the heat from the faulty IC. A new MA3091 restored the 8V supply, but again there was no sound. The bias supply BTB was found to be very low

# cd player casebook

because Q953 (2SB1243) was open-circuit – it's in the separate, screened power supply. Presumably this was another result of the IC failure. N.B.

### **Top-loading CD Players**

If a twelve-track disc was played then a short, four-track disc was inserted the display still showed that twelve tracks were available – the disc could be played. If the short disc was inserted first, four tracks in the TOC would be read. Then, when the twelve-disc was inserted, only four tracks would be played. Everything worked normally if the mains supply was interrupted. Quite simple: the door switch was shorted. Afterwards I wondered whether the laser worked when the door was open? C.W.

### **Saisho CDX101**

I've had two of these personal CD players with the same fault, no operation with the mains power supply. The cause of the trouble is the player's power supply socket, which is mounted on the PCB directly without any mechanical support. When the power plug is inserted, the force results in the socket pivoting about its central lead, breaking the PCB track. Linking the break across will restore operation, but to prevent socket movement I add some hot-melt glue as a fillet between the body of the socket and the PCB.

Another machine would not play with either batteries or the power supply. There was no disc rotation or sled movement. The display was present and operated correctly – pressing skip forward or reverse altered the selected track number in the display. When I dismantled the unit I found that the power socket had already been repaired: but the wire link to the socket was dry-jointed. Remaking the joint restored normal operation. B.R.

### **Hitachi MXW01**

One of these units was brought in because it wouldn't read discs. The usual cause of this is dry-joints on the main PCB. Resoldering these

restored CD operation, but there was digital noise (very loud) on the playback audio. A new DAC chip was tried without success. On further investigation I found that one leg of the RAM IC was dry-jointed. Putting this right cured the problem. P.J.R.

### **Sony CDPC425**

This unit was brought in because it wouldn't play CDs and a mechanical sound came from within. Once the top had been removed I saw that the disc tray moved back and forth without any disc clamping. The cause of the problem was a fractured ribbon cable that connects the disc tray optosensor to the main PCB. A new ribbon cable put matters right. P.J.R.

### **Technics SLP202A**

This CD player's drawer wouldn't open unless it was given a gentle push from behind. As there were no mechanical problems, attention was turned to the power supply. I found that the -7V supply was low because the protector ICP12 had gone high-resistance. Normal operation was restored when it had been replaced (type ICP-N15, 600mA). P.J.R.

### **Sony CDPS37**

This is a separate CD player for use with the TA717 amplifier. The one I had in displayed a zero for a moment then went dead. IC1 (M5294P) regulates the  $\pm 5V$  supplies, which were being shut down because a fault was detected.

The  $\pm 5V$  supplies continued to be present at pins 12 and 3 of IC1 when plug CNJ1 for the front display was disconnected. The cause of the fault was a small electrolytic capacitor, C333 (100 $\mu F$ , 10V), which decouples the 5V line and is mounted amongst the keyboard switches. The replacement doesn't have to be so small as it can be mounted on the other side of this double-sided PCB. R.M.

### **Sharp DX461**

This player loaded all right but wouldn't read the TOC. The loading

switch's plastic pusher was missing. As a result the switch made momentarily on loading, to stop the loading motor, but didn't stay closed. A new switch resolved the problem. R.E.K.

#### **Aiwa RDX01Y**

This machine would play about half a track, stop for approximately two seconds then restart, sometimes returning to the start of the track. We noticed that the sled motor did not move. Voltage checks revealed that there was no sled output from the servo chip during play, except when the forward button was used. A look at the circuit diagram showed that a sled inhibit switch is present in the main microcontroller chip. When this was disconnected the unit worked all right. A new microcontroller chip restored normal working. Perhaps someone could tell us why this inhibit switch is incorporated? R.E.K.

#### **Technics SLPJ20**

This machine wouldn't play discs. It would load a disc, and there was RF at the test point, but nothing else. Disc rotation couldn't be

stopped with the stop button. Scope checks showed that the input to IC304 was OK but the EFM output was incorrect. When IC304 was replaced the machine worked correctly. R.E.K.

#### **Sony HCDD117**

Disc play would stop intermittently. On test I noticed that the disc display flickered. When the function buttons were used to switch from tuner to CD the CD display sometimes flashed before locking on. The cause of the fault was traced to the 7V regulator IC400, on the main board. Its centre pin was dry-jointed. R.E.K.

#### **Sharp DX461**

There was intermittent failure to read a disc. This was because the gear rack didn't go home fully. Correct operation was restored when the gear rack (part no. NGERR0035UFZZ) and the disc holder (part no. GCDV1871UFSB) were replaced. R.E.K.

#### **Sony CDPC325M**

This machine would load but wouldn't read the TOC. Checks

showed that the outputs from the power supply were correct. Most of the voltages on board BD were OK, but there were some variations around IC102. I initially took the readings with the negative probe connected to the zero line on the main board: when the probe was moved to IC102's zero pin all the voltages around this chip were found to be incorrect. The cause was an open-circuit in the ribbon cable between board BD and the main board. A new ribbon cable restored normal operation. I must watch out for multiple zero lines in future. R.E.K.

#### **Sony CDP710**

At switch on there was sometimes no front panel control of disc operation despite the fact that the TOC was read and the RF from the disc was OK. There would also be no sound. A scope check on the data lines between the main board and the front panel showed that the data went missing. Freezing the Mecha Micon chip IC701 restored normal operation. When IC701 had been replaced everything was back to normal. R.E.K.

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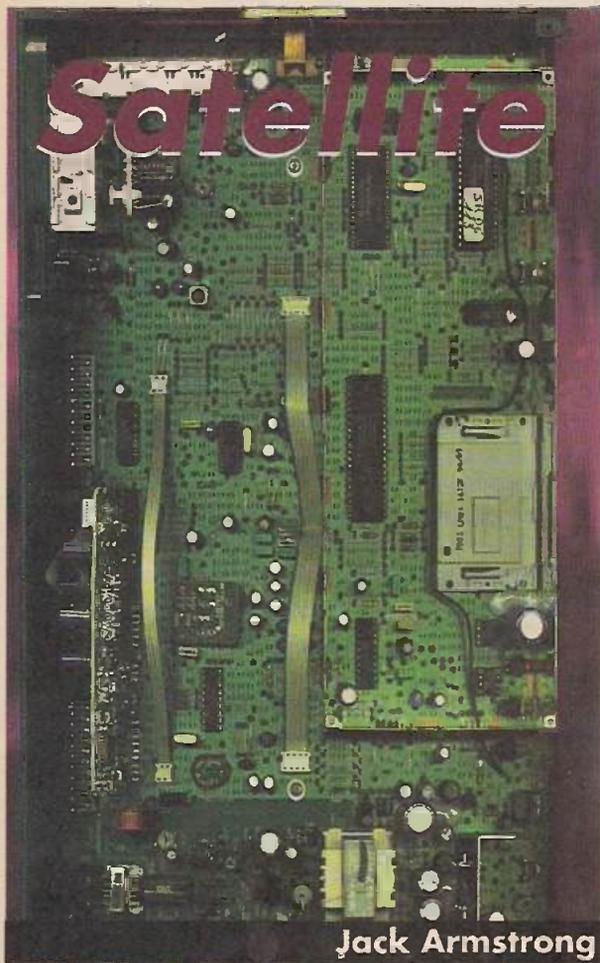
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Jack Armstrong

### An Amstrad SRD500

The local carpenter is Welsh. To be more accurate, he's from Anglesey. I won't try to pronounce the name of his village, but it ends in "gogogoch". Everyone calls him "the artful bodger". I don't know how he ended up in Yorkshire, and he certainly hasn't learnt the language.

"This satellite receiver by hyur dusan't wurk no more look you" he sang, spilling wood shavings across my floor. "When I press this button he flashes minus three then goes back to standby."

He left the receiver with me, and later that day I looked inside it. A generous filling of sawdust had kept it pretty warm, and I concluded that the electrolytics had dried out. Replacing C5 (100µF) and C10 (10µF) on the primary side of the power supply got the receiver working, but the decoder messages were pale grey and the 5V supply was at 4.5V. When I replaced the reservoir capacitors for the 12V and 5V supplies, C13 (470µF) and C14 (1,000µF) respectively, the decoder messages became nice and dark and the 5V line was at 5.05V, which is correct. But I noticed that the

# WORKSHOP

decoder messages flickered as I put the meter's probe on the connector plug. A squirt of switch cleaner and a wiggle cured the bad connection.

My accountant probably won't believe the receipt, which reads "paid with thanks: one rolling pin, one dibber and a garden chair in payment for SRD500 repair". Well, we still like to barter around here. I hope the baker has a fault soon: I'm feeling hungry!

### Pace Problems

I still get a lot of e-mail enquiries about faults with Pace PRL series receivers. Most of them have been covered in these pages before. "My receiver whistles" or "my receiver flashes on and off" is the most common problem reported. Replace C5, C7 and C8, using high-temperature capacitors, keep the unit cool and the fault should not recur.

"I get flashing lines or a blank screen when using the RF output though the scart output is OK" usually means failure of Q105 (type BC846B) which is in the centre of the underside of the board. Pace recommends that R559 is removed and discarded in order to improve the reliability of this transistor. R559 was originally added to the design at the request of an OEM customer. Its effect unfortunately is that Q105 passes too much current. The fault occurs only with later boards that have component identifications on the underside. Earlier boards do not suffer from the problem.

Now that these models are a few years old, I am finding a lot of faulty electrolytics on the secondary side of the power supply. C278 (2,200µF, 16V), which decouples the 5V supply in the display section, causes a noise that I call "next door's vacuum cleaner". Why, you ask? Because of its effect on the LED multiplexing. The symptoms caused by other electrolytics vary. You should check for ripple on the supplies or, preferably, simply replace all the electrolytics in front of the transformer.

If you have problems in getting Pace parts, try Wilf Oldfield of Calder Components in Heckmondwyke (01924 411 089) or try SatCure (01270 753 311). Both supply used and new parts by mail:

SatCure supplies parts for other satellite receiver brands as well.

### How's This One?

While I was on my way to drop off repairs for a local shop I received a call on my mobile telephone. The lady's Cambridge ARD200 receiver was dead and her husband said it needed a new fuse. To reach her involved only a short detour from the main road, so I paid her a call. She showed me into her living room, then trotted off to watch TV in the kitchen.

I spent an exhausting ten minutes extracting the receiver from the floor-to-ceiling cabinet, which had to be lifted because it was standing on the mains cable. Having finally freed the captive receiver I poked my head around the kitchen door to tell the lady that I'd be back with it next morning.

"Oh, you can't take it away" she exclaimed. "My husband's an electrician and says it only wants a fuse."

I explained that I would need to take it to the workshop to find out the cause of the blown fuse – if this was in fact the problem. I don't carry fuses in the van, and also needed a Torx no. 10 screwdriver to release the cover.

"Oh, you can't take it away" she exclaimed. "My husband's an electrician and says it only wants a fuse" she repeated, as if I hadn't said a word.

I handed the unit to her, smiled and left the house, slowly grinding my teeth.

"Do you know where I can buy a fuse?" she shouted.

"Ask your husband – he's an electrician" I replied.

### Ferguson SRD6

"I installed it myself, but there are problems to be sure."

I turned round but there was no one there. Just a Ferguson SRD6 on the counter and a woolen bobble hat.

The hat moved. "I installed it myself, to be sure."

When I peered over the counter an extremely short person confronted me. He was wearing a green anorak, green trousers and a green bobble hat. My first leprechaun? Perhaps not – he was

wearing bicycle clips round his trouser legs. "What seems to be the problem?" I ventured.

"No picture to be sure. Will you be looking at it now, or shall I wait outside? It's probably just the crystal. What time will it be? Where's the nearest pub?"

"It's in Church Street" I replied, answering the last question first, "and it's three thirty. Come back at five."

"God bless you thur, and where would that be?"

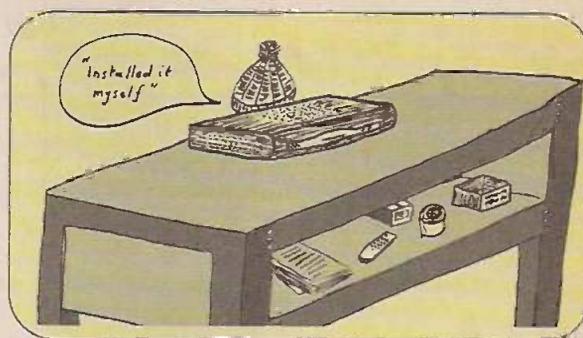
"Well Church Street is easy to find. Turn left out of here and it's on your right, just half a mile, before you see the bus stop."

He thanked me and bobbed off. I carried the receiver into the workshop, where I discovered that there was no LNB voltage. It was probably switched off in the secret installation menu. But no, it wasn't. When I pressed menu, then 4 and held 9 for five seconds the LNB menu appeared and I saw that the LNB voltage was on. The local oscillator had been set to 10.000.

As he'd installed it himself, I thought maybe he'd shorted something out. But in fact there was a genuine fault, which I

traced to the BC848 surface-mounted transistor TP59. When this had been replaced the green screen went and a picture appeared. Channel one was tuned to Sky News. I looked at the channel frequency, which was completely wrong. I was using a Universal LNB, but the menu said that the local oscillator frequency was 10.000. Someone had retuned every single channel instead of setting the LNB's local oscillator to 09.750.

I get a lot of enquiries about this model, because it incorporates a 22kHz tone generator that's not mentioned in the on-screen menus or the printed user instructions. It works like this. You call up the LNB installation menu, as previously described. You then set the local oscillator to 00.000, which tells the receiver you are using a Universal LNB with 9.75 and 10.6GHz local oscillators. When you then enter a channel frequency of 11.649 or less, the receiver assumes that it is connected to an Enhanced (9.75GHz) LNB. When you enter a channel frequency of 11.650 or higher, the receiver switches the 22kHz tone on and assumes that



the local oscillator is working at 10.6GHz. Thus the high/low band switching becomes automatic.

A clever idea, but I defy anyone to use it with an external tone-operated switching box! By the way, it took me an hour spent poking buttons, with an oscilloscope attached to the LNB supply, to figure this out. Even the service manual fails to explain it clearly.

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:

[jack@netcentral.co.uk](mailto:jack@netcentral.co.uk)

## Test Case 418

Cathode Ray, our trainee service technician, continues to make progress. But with no servicing courses now being run by the local tech, with consumer electronics technology progressing so rapidly, and with so many cartoons and other things to watch on the TV set on his bench it's an uphill struggle!

A cross that Ray bore wearily not long since came in the form of a large Panasonic TV set, Model TX25T2, fitted with the Alpha 2W chassis. It came in dead, and a quick resistance check across the HT reservoir capacitor produced a reading of just 10Ω both ways. The line output transistor Q551 had gone short-circuit between its collector and emitter. Pleased to find an exact replacement (type 2SD1441RL) in the component stores, Ray fitted this and was rewarded – after tweaking one or two of the scan control presets – with a good picture. He made out the bill and put the set on the waiting customer-collection rack.

Two days later Mr Wicks came on the phone demanding to talk to whoever had repaired his Panasonic TV set. So abusive and insistent was Mr W that Ray had to drive to the house that day to deal with the problem. On arrival he found that the set was dead, as before, and that once again the line output transistor had gone short-circuit. Ray staggered to the van with the big set and brought it back to the workshop.

When he'd got the set on to the bench Ray removed the newly-fitted line output transistor and found that it was dead short-circuit between all three leadouts. There was just one more in the stores. Ray fitted it, but the likelihood was that it would fail before long, like its predecessor. What to do? Consult Television Ted of course! Even though Cathode Ray refers to Ted as "the

old duffer", he owes him a huge debt of gratitude for the help and advice he has been given.

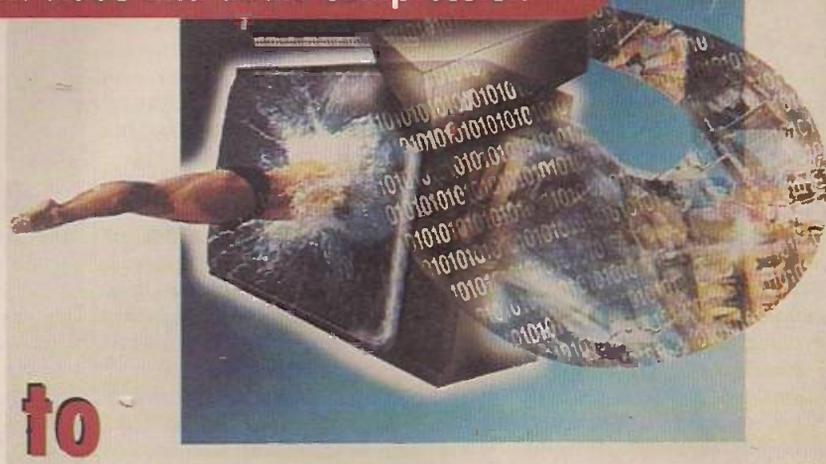
Ted suggested that Ray should take a careful look at the line driver transformer's soldered joints (T531). Apparently he'd had trouble before with these. Sure enough, on close examination with a magnifying glass the solder-bonding of the transformer's legs was found to be suspect. Ray removed the transformer from the board, polished all four of its little leadouts with fine glass-paper, then carefully tinned them using liquid flux. After this he soldered the transformer back in and dealt with a few nearby suspect joints. A complete job this time then, with collection and delivery thrown in, all at no charge to the still-grumbling Mr Wicks who, into the bargain, had been provided with a free loan set.

No one thought that the job would again bounce, except perhaps Mr Wicks. He seemed delighted to be able to report, two weeks later, that the set had again failed in the same way. He demanded that "we sort it out immediately".

Checks confirmed that the line output transistor had failed in exactly the same way. This time the fusible resistor in the HT feed, R567, had also succumbed. These items were ordered from Panasonic, but far from being "sorted out immediately" it was three weeks before Mr Wicks and the troublesome set were reunited. One additional component had been replaced.

So, a real nasty this time. Nasty enough for two clues! The culprit was not in the line timebase, and was something whose failure is not uncommon in Panasonic TV sets. For the solution, see page 909.

Terrestrial and satellite TV services for the UK are due to come into operation next year. In this new series **J. LeJeune** explains the techniques involved, starting with video and audio compression



## Introduction to

# Digital TV

**T**he United Kingdom is to have digital TV services before long. Although there has been some slippage in the programme for the start of transmissions, if all goes according to plan digital satellite TV will be with us next March and digital terrestrial TV next summer. The former will make dozens of channels available to viewers, the latter some thirty channels.

Digital TV uses a lot of processing to deliver pictures and sound. Some of this processing is complex. The aim of this four-part series of articles is to explain briefly and clearly what is done, so that readers will be familiar with the basics of the technology when they find themselves confronted with the snags which will inevitably arise in practice. We will be explaining the differences between satellite, cable and terrestrial transmission methods as we go along.

### Why Signal Compression is Needed

The analogue luminance and chrominance signals produced by the cameras first have to be sampled at regular intervals, with each sample then converted into digital form. Luminance signal sampling is carried out at a rate of 13.5MHz. The two analogue colour-difference signals (B - Y and R - Y) are sampled at a rate of 6.75MHz. Thus 27 million samples are generated every second.

A TV picture is normally described as consisting of 625 horizontal lines (in Europe anyway), with a complete frame of 625 lines scanned out 25 times a second. In digital terminology the television line is also divided into pixels, the new term for picture elements. There are 576 active lines in a 625-line picture (the others are taken up by the field flyback period). With an aspect ratio (picture width to height) of 5:4 and equal horizontal and vertical resolution, there will be  $576 \times 5/4$  pixels per line, i.e. 720.

Each pixel has three values associated with it, a brightness (luminance) measure and two colour-difference measures, Cb which relates to B - Y and Cr which

relates to R - Y. Because colour has a lower resolution (picture detail is indicated by differences in brightness level), one pixel of each colour measure accompanies a block of four luminance pixels.

With a grey scale capable of distinguishing 256 different levels, eight digital bits are required per sample. At a sampling rate of 27 million per second, this works out at a data rate of  $27 \times 8 = 216$ Mbits/sec. Using the simplest modulation system available for a digital system, pulse-code modulation, the transmitted signal would require a bandwidth of over 100MHz. So there clearly has to be considerable compression of the data before a digital system can rival an analogue one in terms of spectrum economy.

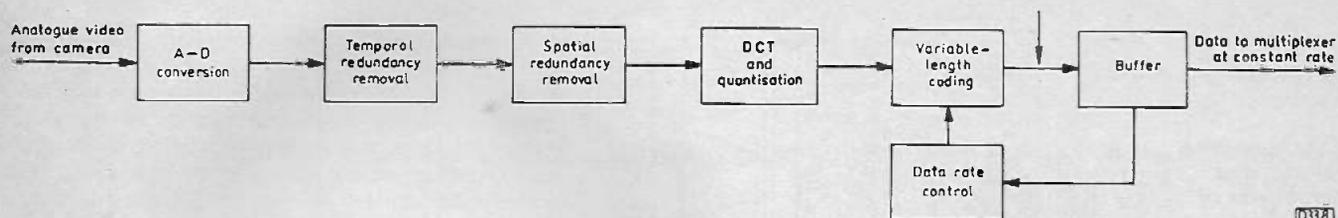
### Basic System Requirements

At the time when our current analogue TV standard was set in stone there was little to be had by way of large-scale, fast-processing integrated circuits. The task of establishing a digital service in the days of valves would certainly have been impossible! Nevertheless the pioneers of the day conjured up magic with the components that were available at the time.

For digital TV to be worthwhile, it should be able to exceed the performance of an analogue system by a very substantial margin. It relies on three factors, which together provide very powerful magic indeed! They are:

- (1) Compression of the picture and sound data.
- (2) Large semiconductor memory capacity.
- (3) A modulation technique that's matched to the transmission requirements.

The prime difference between analogue and digital TV is that with analogue TV the complete picture is transmitted and rewritten on the CRT screen once every 40



0338

**Fig. 1: Basic block diagram of MPEG-2 video processing, from the camera's analogue output to the transmission multiplexer.**

milliseconds (25 pictures per second), whereas with digital TV the picture data is loaded into memory and only information on picture changes from frame to frame is transmitted. At the receiving end, this data is used to modify the memory-stored picture. The updated picture is then read out of the memory and presented on the screen as a normal picture at the standard 25 frames per second. With a still caption, at one extreme, very little data needs to be transmitted. With a fast-action, laser-blasting intergalactic battle at the other extreme the transmitted data rate will be the maximum the system can convey.

The data compression system used for digital TV is called MPEG-2. It's a 'sort-of' standard which is very flexible, with several levels of compression and alternative modes of picture recreation. The MPEG-2 standard at present adopted worldwide is the variant known as "main profile, main level". Fig. 1 shows in block diagram form the signal processing chain from the camera to the feed to the transmission multiplexer.

The terminology used for digital TV can be a stumbling block for those used to analogue systems. Unfortunately some of the long words seem to be used less because they are the best way of describing a process than because they make it sound complex. MPEG-2 is not simple, but it need not be too frightening!

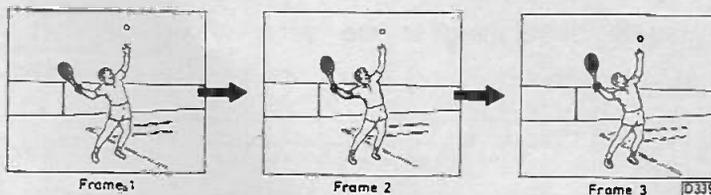
## Redundancy

As Fig. 1 shows, signal analogue-to-digital (A-D) conversion is followed by redundancy removal. This is where the data processing starts. There are two stages, temporal and spatial redundancy removal.

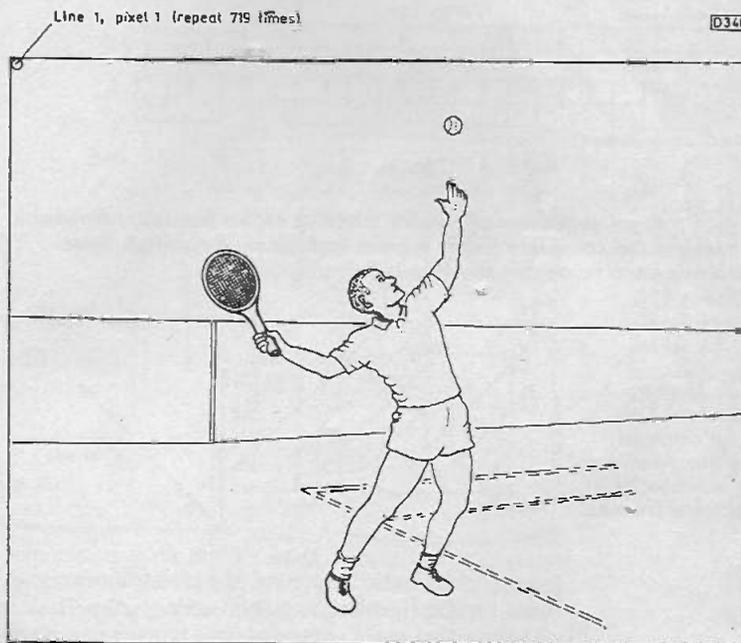
It is often said that for much of the time one TV frame is very much like its temporal neighbours. Adjacent lines of the picture are also very similar for much of the time (advantage is taken of this fact in VCR drop-out compensation). After A-D conversion, the video data in successive frames is examined to check on the similarities and differences.

The temporal redundancy process, which is also known as interframe compression, compares successive frames to see which parts of the picture have changed. Only the changes that have occurred from one frame to the next are passed on. See Fig. 2. With a lot of programme material the temporal redundancy can be as much as 98 per cent.

After removing the repetitive video data in successive frames, the contents of the frame itself are examined. This is the spatial redundancy process. Where for example a line has a long section with the same brightness and colour, a short code is used instead of data repetition pixel by pixel. Fig. 3 gives an idea of this process. Suppose, for example, that the top line of the picture consists entirely of clear blue sky. The data for the line could be transmitted pixel by pixel, but this would mean repeating the same data 720 times just to describe the line. Instead, the repetitive data is coded in the following way:



**Fig. 2: Temporal redundancy. In frames 1-3 only the position of the racket changes. Given frame 1, this is the only information required to construct frames 2 and 3.**



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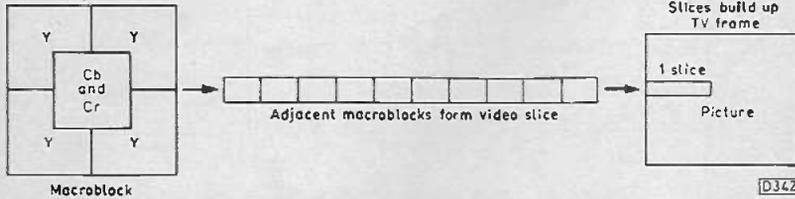
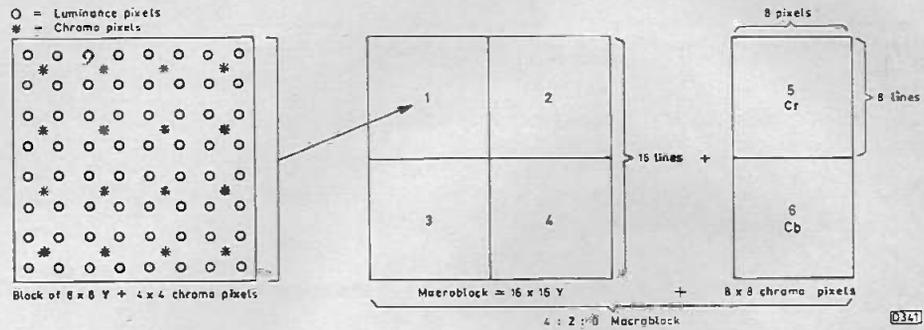
**Fig. 3: Spatial redundancy. There is no change along the top line, which is coded as line 1, pixel 1,  $Y = 0.85$ ,  $Cr = 0$ ,  $Cb = 0.45$ , repeat 719 times. Most of the rest of the frame can be coded similarly.**

- (1) Position co-ordinates, i.e. line one pixel one.
- (2) Luminance/chroma values, e.g.  $Y = 0.85$ ,  $Cr = 0$ ,  $Cb = 0.45$ .
- (3) Repetition instruction – repeat 719 times.

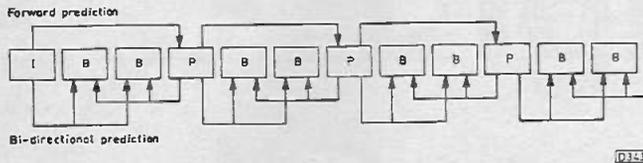
The spatial redundancy process is also known as intra-frame compression. It provides a further contribution to lowering the data rate.

A further stage looks at all the other data sent with the picture. Sync signals, as used with analogue TV transmissions, are not sent. Their place is taken by pixel and

**Fig. 4: Formation of blocks and macroblocks of digital pixel data.**

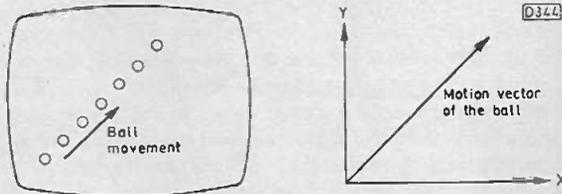


**Fig. 5: Video data assembly into slices to form a picture.**



**Fig. 6: A typical sequence of twelve MPEG-2 video frames. I frames are transmitted complete (after spatial redundancy coding). Interpolation is used to derive the P and B frames.**

**Fig. 7: Motion prediction. This can be derived from the position of macroblocks in successive frames.**



line counting, under the control of a precise clock signal. Black level is signalled by a short code.

As the signal could consist of long repetitions of ones and zeros, these are coded into batches instead of being repeated bit by bit. Thus instead of say

1111110000000000111111

being sent, a statistical redundancy process batches the digits as "1,6:0,10:1,6". This is called "run-length coding".

Up to this point **nothing** has been irreversibly lost from the TV picture. Subsequent processing loses some of the data, relying on the eye being tricked into seeing what's not there. Similar techniques in the audio processing sections trick the ear in much the same way.

**Finer Points**

From this point on things get a bit more complicated, with discrete cosine transform (DCT, Fig. 1) and quantisation. Before the mathematical manipulations raise their ugly heads however, let's examine some of the finer

points involved in temporal and spacial redundancy.

Getting rid of repeats is not the whole story of digital compression. There are more tricks to MPEG-2. Amongst them are motion prediction, quantisation and zigzag scanning.

Before any of these can be implemented, the data that represents the picture is split up into blocks, see Fig. 4. This shows the individual digital pixels organised first as a block of eight by eight luminance pixels with an accompanying four by four red and blue (Cr and Cb) chroma pixels. The basic blocks are further grouped to produce blocks of 16 x 16 luminance pixels and two 4 x 4 blocks of chroma pixels. These are called macroblocks. This grouping of luminance and chroma pixels is referred to as the 4-2-0 format. Other formats - the 4-2-2 and 4-4-4 - give higher quality with a corresponding data rate trade-off. 4-2-2 has four luminance, two Cr and two Cb blocks in each macroblock, while the 4-4-4 format has four luminance, four Cr and four Cb blocks.

The adjacent macroblocks that comprise each frame of non-interlaced digital video are then grouped into strings called 'slices'. The order of assembly is exactly that in which the picture was originally scanned, i.e. left-to-right and top-to-bottom. Slices are essentially data sequences which are arranged in this way to aid with error detection. When erroneous data is detected in a slice, the slice is ignored. Processing continues with the next slice in the series.

The video slices are assembled in sequence to form a picture, see Fig. 5. Note that in this context the term video refers to the data, not the familiar old analogue video waveform!

**Intraframe Coding Sequences**

The pictures (frames) are assembled in sequences of twelve, the first frame in each sequence being known as the reference frame, see Fig. 6. This first frame gives us a complete picture. It has been coded by the spatial redundancy process, but can be considered as independent of the other frames in the sequence. Such a frame is also called an I frame. This doesn't stand for independent but for Intraframe-coded picture. Naturally this frame is less compressed than the others. It serves as a starting point for the decoder when the receiver is either switched on for the first time for a session of viewing, or is switched from one channel to another. I frames normally occur at every twelfth position in a sequence.

There are two other kinds of frames, P and B. The P frames are Predicted frames, which require more than one frame for the prediction process. A predicted frame uses the nearest I or P frame as the prediction basis. It can serve therefore as a reference frame for other P or B frames later in the sequence of twelve. The disadvantage is that an error in a P frame can be repeated in subsequent P and B frames until the next I frame is received. Such an error would last for just under half a second.

The amount of compression with a P frame is more than that with an I frame.

B frames are constructed by interpolating the data from adjacent P or I frames, using past and future frames. They cannot be used as reference frames, and require more than two frames of storage (for interpolation). This represents an additional memory requirement, which is an extra cost in manufacturing a receiver.

**Motion Prediction**

Decisions about temporal redundancy are made by comparing corresponding pixels in adjacent frames. The macroblocks are used to predict the motion of something that moves. This is a relatively simple matter: as the picture is divided into rows (lines) and columns (one per pixel), precise positional information can be derived. Since timing in TV picture transmission is also very precise, the speed as well as the direction of moving blocks of pixels can be measured and further movement predicted. Only relatively small amounts of data need to be sent to describe this. See Fig. 7.

Motion prediction is valuable for correcting errors that occur between I and B frames, as an error signal which can be given a short code can be derived. Prediction is based on luminance information only, but is used for chroma as well.

**Discrete Cosine Transformation**

As part of the intraframe (spatial) coding operation, a complicated mathematical process known as a Discrete Cosine Transform is performed on each of the pixels in a data block. Basically the DCT process converts values from the time to the frequency domain, and takes advantage of the correlation between pixel values in a block. The resulting transformed block of data consists of the coefficients of the frequency components, with each component relating to the amplitude of a pattern within the block.

When there is high spatial redundancy, i.e. many adjacent areas of the picture have the same brightness and hue, the frequency component will be zero and the coefficient will be DC. If the picture contains much fine detail, the frequency component will be high and the coefficient will have a high value.

Conversion of a 16 x 16 block of pixels by the DCT process produces a matrix of numbers, the one at the top left corner being the only absolute number. The others are difference values, which can have a positive or negative sign. The resultant matrix represents rising horizontal frequency from left to right and rising vertical frequency from top to bottom.

**Quantisation**

The values of the coefficients in each block are next quantised: each number is changed by rounding up or down. Fig. 8 best explains quantisation.

This process further reduces the amount of data that has to be transmitted, by reducing the range of values. With MPEG-2 processing, the values are weighted, providing smaller steps for LF video information and correspondingly greater 'definition', while using coarser steps for HF information. As the human eye's perception of luminance graduation in finely detailed parts of a picture is limited, the quantisation steps (or scaling factor) can be larger and the definition more coarse. The overall scaling factor is also modified by the status of the output data stream buffer. More on this later.

**Zigzag Scanning**

The figures in the quantised matrix have maximum

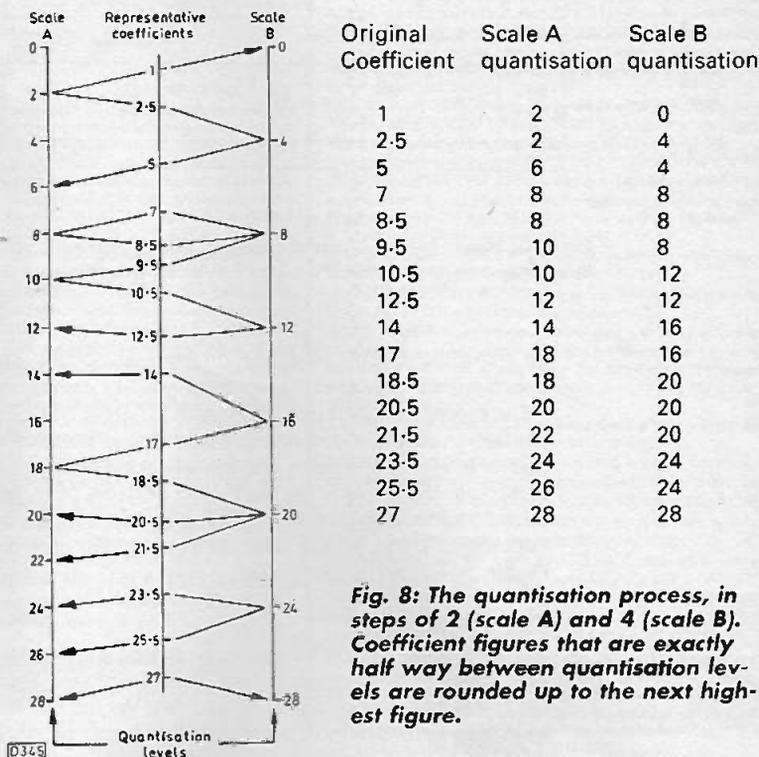


Fig. 8: The quantisation process, in steps of 2 (scale A) and 4 (scale B). Coefficient figures that are exactly half way between quantisation levels are rounded up to the next highest figure.

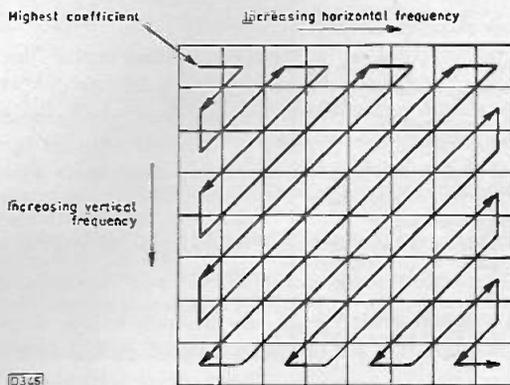


Fig. 9: Zigzag scanning. This process scans the DCT coefficients in order of increasing frequency.

importance at the top left-hand corner, their importance diminishing the farther they are from this corner. A coded bit stream that makes use of this scale of importance is generated by employing zigzag scanning of the cells in each matrix (the original block of 8 x 8 pixels). This is illustrated in Fig. 9.

**Further Data Reduction**

The bit stream can be further reduced by using run-length coding and variable-length coding. The latter is best exemplified by the Morse Code, in which the most common characters have the shortest codes - E is represented by a dot and T by a single dash, while Q and Y have the longest codes. Many blocks contain only zeros towards their ends: a simple 'end-of-block' code is transmitted when all the remaining digits in a block are zeros.

The top left cell in the matrix is not run-length coded. But, as comparisons are made from frame to frame of video, data saving can still be obtained. The top left cell, termed the DC cell, changes little from one frame to another. Thus the difference between the current DC cell and the corresponding cell in the previous frame can

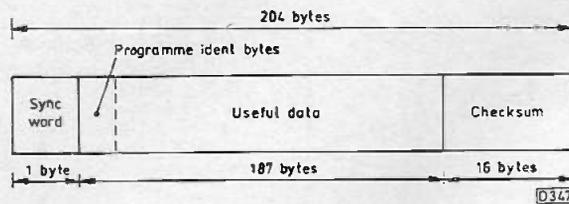


Fig. 10: Basic MPEG-2 data packet. These packets are the components of the transport stream (multiplex).

be transmitted. This is called differential coding, and aids the quest for bit-rate reduction.

The blocks are quantised and variable-length coding is applied to frequent and common data runs. Remember that at intervals of twelve frames the encoder transmits a full reference frame to enable those who have just joined the service to start decoding and to enable any cumulative errors which have arisen over the previous eleven frames to be eliminated.

### The Buffer

The final step in MPEG-2 video processing is to feed the data stream into a storage buffer. This passes the data to the following multiplexer at a fixed rate. As the buffer's incoming data arrives at varying rates, it can on occasions overflow. To prevent this, feedback is applied to the quantisation process (data-rate control, see Fig. 1).

### The Audio Signal

Audio encoding to the MPEG-1 standard enables one or two audio channels to be encoded at bit rates between 32kbits/sec and 448kbits/sec. There are four different coding modes, as follows:

- (1) Mono. Simple single-channel audio.
- (2) Stereo. Two channels, left and right, but with shared data.
- (3) Dual-channel. Two mono channels independent of each other. Half the bit rate is used for each channel.
- (4) A pseudo-stereo system, in which the stereo signal is filtered to produce separate LF and HF bands before coding. The HF band is shared by the two channels. This method reduces the bit rate. The receiver reconstructs the pseudo stereo signal.

Signals can be sampled using one of three bit-rate reduction schemes available with MPEG-1. These are called levels 1, 2 and 3. They operate at sampling rates of 32, 44.1 and 48kHz respectively. Decoders for the higher levels will also work at the lower ones.

The coding system is based on the psycho-acoustic characteristics of human hearing. This sets the lowest audibility level for a series of frequency bands. Sounds that fall below these levels are not transmitted. Further data-compression techniques known as adaptive differential PCM and backward adaptive quantisation make additional useful contributions to bit-rate reduction without damaging the quality of the sound.

With MPEG-2 the two-channel audio capability is broadened to provide up to five channels per video broadcast. It remains downwards-compatible with MPEG-1. Audio quality is lower – it's the usual trade-off between bandwidth and data rate. Bit rates between 64 and 256kbits/sec are usual.

The audio data is multiplexed into the video data stream, forming part of the whole data stream of the multiplex.

### Packets of Data – the Multiplex

We have now arrived at the point where the three components of a channel come together for application to the multiplexer, which combines the data for other channels to form a transmission multiplex of say four channels.

The data that arrives at the multiplexer consists of packets of video, audio and programme data. The latter includes identification codes for the services, time stamps for the packets to ensure simultaneous presentation at the receiver, and service information – an electronic programme guide.

MPEG has a layer system that organises these packets of data into a complex stream – the multiplex. It organises and controls the relationships between the data packets for each individual channel, to ensure that the correct data is sent to a receiver's decoder and that the sound and vision are synchronised.

The programme data enables the viewer to select the channel of his choice. It describes the make-up of the 'transport stream', and identifies and maps the positions of individual data packets within it. The transport stream is the result of multiplexing several channels. Obviously information has to be provided so that the receiver can select the channel required without getting the channels mixed up.

The Programme Specific Information (PSI) includes four basic 'tables' as follows:

- (1) The programme allocation table. This maps the data carried by the transport system and correlates programme numbers with programme table identification numbers.
- (2) The programme map table. This maps the data for a particular programme in the multiplex.
- (3) The network information table. This carries information on all the network parameters, such as transponder numbers and frequencies.
- (4) The conditional access table. This matches encryption data for a particular channel with viewing card data, using the 'entitlement management' messages in the data stream. Service encryption is not mandatory, and any type of encryption can be employed.

### The MPEG Data Packet

The basic structure of an MPEG-2 data packet is shown in Fig. 10. It starts with a one-byte sync word. This is followed by 187 bytes of 'useful data', then 16 bytes of checksum. There are identification bytes at the beginning of every useful data section. These are used by the PSI to select packets that belong to a particular channel. Because time stamps are included, there is correct synchronisation of the picture and sound and any relevant data and on-screen messages.

### Multiplexing

The packets of data are fed to the multiplexer whose output is a data stream, probably at 20-25Mbits/sec, for application to the transmitter. Further data processing is carried out depending on the transmission medium – satellite, terrestrial off-air or cable. We will look at these in a subsequent instalment. But before that we will next month look at a typical digital TV receiver.

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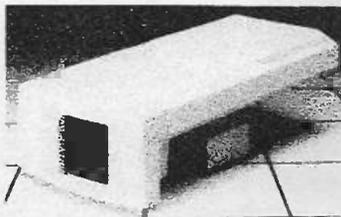
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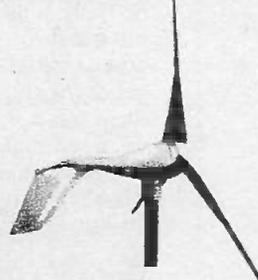
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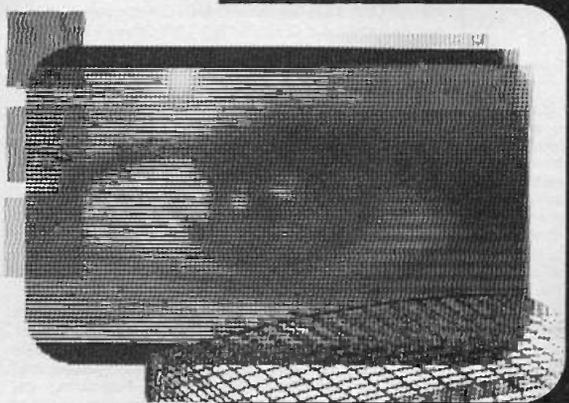
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#### **Philips GR2.2 Chassis**

There was no sound or picture. The standby light was flashing, and the power supply could be heard to pulse. With the line scan coil plug removed to disconnect the supply to the line output stage, and a dummy load connected in its place, there was 140V across C2631. So the power supply was working. A scope check showed that there was no drive at the base of the line output transistor. Further checks around the TDA2579B timebase generator chip IC7470 showed that there was a start-up supply at pin 16, a line ramp at pin 15 but no line drive at pin 11. A new TDA2579B IC brought the set back to life. **P.B.**

#### **Grundig CUC6300 Chassis**

This set would go to standby three seconds after it was switched on. A check at pin 8 (schutz, the protection line) of IC811 showed that it went low. This indicated that the overvoltage/excess beam current limiting was in operation. The protection circuit is centred on transistor T583. Its base didn't go high, but the voltage at its collector was being pulled down by zener diode D586. This monitors the beam current and the operation of the line output stage. D586 was conducting because the signal at connection C

# TV Fault Finding

of the line output transformer was too large. The reason for this was not excessive beam current but a crack in the print between connection C and capacitors C591 and C592. **P.B.**

#### **Philips G90 Chassis**

After ten minutes the power supply would shut down – the 95V HT supply fell to 30V and was pulsing to 40V. A puff of freezer on the BC557C transistor in position Tr7652 restored normal operation. Everything was OK when this transistor had been replaced.

If the power supply produces low outputs (less than 25V on the 95V line), check the BAS32 diode D6653 which is probably leaky or short-circuit. **P.B.**

#### **Hitachi C21-P819 (G8Q Chassis)**

A cup of tea had been spilt inside this set, which had been switched on before it had dried out fully. There was now just a blank raster and no sound. By connecting a signal to the scart socket I was able to prove that the set was switched to AV when it should have been receiving RF. The switching signal comes from the microcontroller chip IC1501, where pin 37 was being held low all the time – it should be low only for AV operation. A new microcontroller chip restored normal operation. **P.B.**

#### **Grundig CUC5360 Chassis**

No vision was the complaint. When I removed the back I became suspicious that the set had been subjected to rough treatment – the text module was disconnected. The picture failed to return when the module was put back in however. I then found that the HT supply to the line output stage was missing. There was a crack in the print just above pin A of the transformer. **P.B.**

#### **Sharp C1431H**

This portable would revert to standby by ten-twelve seconds after switching on. The chassis has a comprehensive trip circuit which can be disabled by disconnecting Q603. If the set works normally after doing this, the cause of the trouble is in the trip circuit. The first thing to check here is the high-value resistors. On this occasion R623 (1-2M $\Omega$ ) turned out to be open-circuit. **D.A.C.**

#### **Nokia 6354 (Stereo Plus Chassis)**

This set would sometimes revert to standby when it had been on for a few minutes. If switched on again it would run for the rest of the day. When it went off there was a loud click from the speakers. The cause of the trouble was traced to the BC858B surface-mounted transistor V071 in the power supply control circuit. **C.W.**

#### **Toshiba 212R4B**

The complaint with this set was distorted sound. We were surprised to find that both loudspeakers were torn all the way around the edge of the rubber suspension. We were even more surprised by the cost of these tiny speakers. **C.W.**

#### **Hitachi CPT2578 (G8Q Chassis)**

"Thin wavy lines, with diagonal bands of interference" the lady said. "Have you got a satellite receiver" we asked? "Yes" came the answer. "Oh, we know what that is, madam, we'll put that right in a jiffy."

Did we? No! When we looked at the set the symptom was just like a VideoCrypt patterning problem. Only it was just the same when the satellite receiver was switched off. We had to take the receiver back to the workshop, where we eventually found that the cause of the trouble

was LT ripple. C932 (470 $\mu$ F, 16V) was responsible. The symptom was more easy to see in the text mode. C.W.

### Panasonic Z5 Chassis

The red LED was flashing very quickly and a whistle came from the power supply. So I checked the line output stage for short-circuits. As there were no obvious ones I connected a 60W bulb as a dummy load between pin 9 of the line output transformer and the live earth section – note that in this chassis the line output transistor is on the primary side of the power supply, with the line output transformer providing mains isolation, so care is required over selection of the correct chassis point when carrying out tests.

As I'd forgotten to disconnect the line output transistor, when I switched the set on it started up with the bulb alight, all functions working and correct voltages. This suggested a power supply rather than a loading fault. I eventually found that R821 (330k $\Omega$ ) was open-circuit, upsetting the trip arrangement. C.W.

### Mitsubishi Euro 12 Chassis

The HT varied as one of these sets warmed up. First it was high then, after less than a minute, it was OK. The customer's actual complaint was that the set came on with a picture that didn't fill the screen. The height appeared to be low, but this was because with the high HT there was too much width.

As the set produced the fault for only a brief time, we brought the freezer and hairdryer into operation. This soon revealed the cause of the trouble: C906 (47 $\mu$ F, 50V, 105°C), which couples the drive to the base of the chopper transistor Q901. Unfortunately when C906 was frozen the HT went so high that the line output transistor failed. Everything was OK when C906 had been replaced and a new 2SD1878 line output transistor had been fitted.

Incidentally, we've had a similar problem with quite a number of Bush, Alba and similar sets. The value of the chopper transistor's base drive coupling capacitor falls and the HT rises. The results have included blown line output transistors and transformers, audio and field output chips, supply resistors and 12V zener diodes. At times we've even had a punctured tube neck. Manufacturers should consid-

er adding an avalanche diode across the HT rail to provide protection against high voltages.

Returning to the Mitsubishi Euro 12 chassis, we sometimes find that these sets come on with a large black box on the screen. The box may contain a few graphics. Intermittent teletext is another symptom. In both cases the cause of the trouble is C958 (1,000 $\mu$ F, 16V). It's the reservoir capacitor for one of the LT rectifiers, D954, which feeds a 5V regulator. C.W.

### Huanya 37C-2

There were two problems with this Chinese 14in. portable. It would intermittently die, and there was no colour. The cause of the intermittent failure was traced to a poor soldered joint at the collector of the line output transistor. When we investigated the no colour fault we found that there were no line pulses at pin 4 of the D7193AP colour decoder chip. R318 (12k $\Omega$ ), R778 or R779 (both 1.5k $\Omega$ ) could have been the cause, but the chip itself was the culprit. It was short-circuit internally. We fitted a TA7193AP as a replacement and this worked all right. It seems safe to assume that all the D prefixed chips in this chassis can be replaced with TA series ones. M.Dr.

### Hitachi G6P Chassis

When this set was switched on it produced a brilliant white raster. The CRT's cathodes were at only 20V, and after three seconds the set tripped off. By removing the CRT base we kept the set running so that we could carry out some checks. The emitters of the RGB output transistors were found to be at near chassis potential instead of about 12V. The culprit was the 12V zener diode ZD301 on the main PCB. It was dead short, and thus unable to fulfil its function of providing the RGB output transistors with emitter bias. M.Dr.

### Beko 15225T

After fitting a new microcontroller chip and line output transformer – the insulation of the original one had broken down, and it was arcing violently – we were rewarded with a good picture. But when text was selected we found that the display had shifted down slightly. Adjusting P702 improved matters, but the display still wasn't quite right. R725 (150k $\Omega$ ), which is in series with P702, had risen slightly in value. A replacement solved the problem.

The cost of the transformer, obtained direct from Beko, was only some £23. This is probably less than that of a pattern one. The service manual is also a worthwhile investment as it seems to cover all Beko models. At £6 for 64 pages it's a snip. M.Dr.

### Beko 12220

This set's symptoms were strange. The top quarter of the screen was lit up but contained no vision information. The rest of the screen was blank. According to the customer the height had started to decrease before this happened. After much headscratching we found that R717 (1M $\Omega$ ) was open-circuit. It's connected to pin 5 of the TEA2029 timebase generator/power control chip. For good measure we also replaced R722 (1M $\Omega$ ), which is in series with R717.

Pin 5 of the chip is connected to the field generator circuit: there should be a 4V peak-to-peak field sawtooth waveform at this pin. M.Dr.

### Ferguson T14R

This newish TV set was dead. We found that RP41 (68k $\Omega$ ), which is right behind the chopper transformer, was open-circuit. A replacement restored normal operation. M.Dr.

### Samsung CI3352 (P68 Chassis)

This set was dead – the power supply didn't start up. The cause of this was the SDH209B chopper control chip IC801. When a replacement had been fitted the set started up, but the HT was at around 170V instead of 125V. Further checks brought us to C852 (470 $\mu$ F, 16V) which was faulty. Everything was fine once this item had been replaced. C.W.

### Sony KVM2171U

There was no EW correction. We found that the amplitude of the parabolic waveform at pin 8 of the MC44007P "do everything" chip was very low at only 0.1V. As this IC is used in Sharp sets, we had one in stock. Fitting it cured the fault. But at £29 it's a bit expensive. M.Dr.

### Protech 3743T

If one of these 14in. colour portables comes in with the "dead set" complaint, check R804 (820k $\Omega$ ) in the power supply. It's connected to pin 3 (under-voltage sensing) of the TDA4605 chopper control chip.

If a set is sometimes reluctant to

start from cold but will fire up if any component in the power supply is touched with a meter, reduce the value of R802 from 75k $\Omega$  to 30k $\Omega$ , 2W. M.Dr.

### B & O L2500 Chassis

This set tripped out at switch on. We found that there was a dead short-circuit across the HT rail. The culprit was the BU508A line output transistor, which had failed because its 220 $\mu$ F, 16V base drive coupling capacitor C28 had dried out. It's worth resoldering R53 and L3, which are also in the base drive circuit. M.Dr.

### Goodmans C140/Nikkai TLG99

There was an intermittent fault with one of these sets, the symptoms being no colour, field foldover and horizontal shift off. The cause was traced to the wire link between R218 and pin 27 of IC101 – loss of the sandcastle pulses produced the symptoms. B.McE.

### Crown CR5014

This set was dead. I found that R121 (3.3 $\Omega$ , 0.5W fusible) was open-circuit and the BUT11AF chopper transistor Q101 was short-circuit. The basic cause of the trouble was that D108 was dry-jointed. B.McE.

### Matsui 1476

There was intermittent loss of the sound and picture. In the fault condition there was no HT at the collector of the line output transistor though the supply was reaching the transformer's supply pin. Desoldering and cleaning the print around the pin then resoldering it cured the fault. B.McE.

### Sharp DV5132H

If the 3.3k $\Omega$  fusible resistor R705 in the start-up circuit is slow to go open-circuit, check R725 (39 $\Omega$ ) which tends to go high in value. B.McE.

### Nikkai TLG1409

This set was slow to come on. When the chopper transistor was sprayed with freezer it would shut off. With a new transistor fitted the symptoms remained the same. Closer inspection showed that there was a slight gap between the transistor and its heatsink. Tightening the nuts and bolts that secure the transistor cured the trouble. B.McE.

### Nokia FS Chassis

There was severe EW distortion.

The cause was traced to the line scan coupling/correction capacitor Ck27 which was open-circuit. Its value depends on the type of tube fitted in the set. In this case (Model 7186) it was 390nF (250V). B.McE.

### Philips GR2.1 Mono Chassis

At switch-on there was a thump from the speaker then the set went into the tripping mode. This suggested failure of the audio output stage, and disconnecting the TDA2613 output chip brought back the picture. Unfortunately a replacement plus R3241 (8.2 $\Omega$ ) failed to cure the fault.

With the trip disconnected we found that the voltage at the chip's output pin started at 12V then, after a few seconds, fell to 0V. The set then worked normally. The soft-start circuit was clearly in trouble. Checks here soon showed that T7247 (BC848) was short-circuit. G.D.

### Amstrad CTV1410

There was no picture though a vague raster could be seen when the first anode control's setting was advanced. A video waveform was present at the input to IC301 but nothing came out. The cause was loss of the sandcastle pulses at pin 17, because R316 (12k $\Omega$ ) was open-circuit.

The same chassis is used in the Alba CTV840 and Hinari HIT14RC. G.D.

### Philips 2A Chassis

The picture was unstable, with rolling and occasional line pairing on scene changes. It seemed logical to check the electrolytic capacitors associated with the TDA2579 time-base generator chip. Replacing C2550 (1 $\mu$ F), C2551 and C2552 (both 22 $\mu$ F) produced a stable picture, though the originals checked out correctly when tested with a capacitance meter. G.D.

### Hitachi C2524R

This set is similar to the C2118, but with additional circuitry on a separate PCB to cope with the extra scanning requirements. The usual fault you get is a dead set, which may or may not have the standby light still on. If you are lucky, the set will work again once the two 82k $\Omega$  start-up resistors R902 and R903 have been replaced. If not, replace the following: Q903 (BUT12AF, selected); R909 (39k $\Omega$ ); R912 (47k $\Omega$ ); ZD903 (180V avalanche diode); R760-3

(all 2.2 $\Omega$ , 0.5W); R901 (6.8 $\Omega$ , 7W) and Q781 (2SD1884) – in addition to R902/3. Resolder any suspect joints on the deflection PCB, also T901 – both at the pins and the top terminations. The HT should be set for 150V. G.D.

### Salora J Chassis

Whenever the power supply has blown up it's worth checking for dry-joints at the pins of the degaussing thermistor. This can be overlooked as a possible cause of the blow up. G.D.

### Philips 2A Chassis

This set produced a good monochrome picture. But the colours were smeared and broke up at the left-hand side of the screen, and there was too much saturation. The culprit was C2263 (2.2 $\mu$ F), which is the reservoir capacitor for the ACC circuit. It's connected between pins 4 and 5 of the TDA3561A colour decoder chip IC7300. G.D.

### Ferguson TX90 Chassis (Later)

We've had a couple of these sets with no picture or sound but EHT present and the standby light on. The cause has been in the line output stage, where the BA157 25V supply rectifier DL38 has been short-circuit and the associated 0.22 $\Omega$ , 0.5W safety resistor RL41 has been open-circuit. G.D.

### Hitachi C2519R (G8Q Chassis)

"Stuck in standby" was the complaint with one of these sets. When it became evident that the power supply was not starting up, my first thought was that the now notorious start-up thermistor TH902 had failed. But this version of the chassis doesn't use it. Instead, there are 100k $\Omega$  (R925) and 33k $\Omega$  (R909) resistors in parallel. R925 was open-circuit. K.E.

### Ferguson TX89 Chassis

Inability to memorise programme locations and other functions is usually a symptom of an exhausted back-up battery. That was not the case with this rarely seen chassis. The memory chip IC14 thus became the prime suspect. A replacement proved the point. K.E.

### NEI 1451 (Indiana 100 Chassis)

This set would behave perfectly for days, then suffer a bout of unexpectedly going into standby and

sometimes becoming completely dead. My fifth-generation copy of the service data was of little use, but the chopper circuit appeared to be a conventional arrangement with a TDA4600 type chip and a BU508A chopper transistor.

After the usual checks for dry-joints, I noticed that the 5-6k $\Omega$ , 3W resistor which feeds the line driver stage was rather tired looking. This was replaced, along with the 100k $\Omega$  resistor connected to pin 5 of the TDA4600 type chip – it was slightly out-of-specification. I then tested the set continuously for several days. As it seemed to be OK, I returned it to the customer. It bounced back two weeks later.

Some serious head scratching and lengthy meter and scope checks eventually revealed an interruption in the drive between the chopper control chip and the base of the BU508A transistor. Coupling is provided by the usual electrolytic capacitor and a small RF choke of unknown value. Replacing the latter with an equivalent-looking device robbed from a scrap VCR chassis restored normal, reliable operation. K.E.

### Philips CTX-E Chassis

One of these sets suffered from intermittent loss of stations and the LED display. The cause turned out to be nothing more than our old friend dry-joints at the line output transformer. K.E.

### JVC C210EK

A dead set can be caused by the STR54041 chopper chip. If a new chip doesn't restore life to the set, replacing the adjacent capacitors C913 and C917 should do the trick. K.E.

### GoldStar CI14A80A

This modern portable came in dead with the 4A mains fuse blackened. R821 (150k $\Omega$ ) read 600k $\Omega$ , the BUZ90 chopper transistor Q801 was short-circuit and I also replaced the TDA4605-2 chopper control chip just in case. S.W.-S.

### Matsui 1420A

There was no line drive with this portable. The 2SC2271 line driver transistor Q401 was open-circuit and the line driver transformer T401, though measuring correctly from the DC point of view, failed to transform the drive to the secondary side. S.W.-S.

### Ferguson ICC8 Chassis

The picture kept going dark and the

grey-scale changed. We discovered that RT24 on the tube base panel had increased in value from 39k $\Omega$  to 300k $\Omega$ . It's the red channel feedback resistor in the version of the panel that has a TEA5101A RGB output chip (IT01). S.W.-S.

### Samsung CI5052 (P68 Chassis)

The words 'store' and 'channel' would intermittently flash up on the screen. This was caused by the fact that the 1N4148 diodes in the key strobe lines to the microcontroller chip RIC01 were leaky. S.W.-S.

### Hitachi G10Q Chassis

When you deal with a field collapse fault by replacing the TDA8178 field output chip, make sure that you use the correct version. Otherwise you will end up with some coloured lines at the top of the screen. S.W.-S.

### Bush BTV10

This smart TV/video unit produced a blank screen with no sound except during tape playback. The 1 $\Omega$  resistor R7024 in the tape deck power supply was open-circuit. Replacing it is a major engineering feat, so estimate accordingly! S.W.-S.

### Toshiba 217D9B

When this set was cold the field scan was very non-linear, with the top of the picture stretched and the bottom cramped. It slowly improved as the set warmed up. We suspected the field scan coupling capacitor or a supply reservoir capacitor, but no. The surprising culprit turned out to be the 2-2 $\mu$ F ramp integration capacitor C303, which is connected to pin 31 of IC501. It would have made an excellent thermometer. G.C.

### Hitachi NP8CQ Chassis

There was an excessively bright picture. The cause was C719, which had dried out. It's the reservoir capacitor for the 180V supply to the RGB output stages. G.C.

### Sony AEIC Chassis

Once again hidden cracked joints caused intermittent operation, this time interrupting the LT supplies. The three-pin LT rectifiers D610 and D612 were affected, but the worst joints were at the 12V regulator IC608 and the 5V regulator IC604. The connections to IC604 and D612 are accessible only when the main PCB has been removed from its carrier frame.

Another of these sets had failed

completely because the TEA2260 chopper control chip IC601 was faulty. G.C.

### Hitachi G7P Mk 2 Chassis

This stereo set came in with no picture or sound and the usual advice "it's the switch". It wasn't. There were no shorts, but the power supply produced an inadequate HT output of 30V. The TDA4601 chopper control chip IC901 had failed. We also replaced the associated small electrolytic capacitors C914/5/6/7. G.C.

### Sony KV2096

This set, which had come from another dealer, would blow its line output transistor after about a week. The dealer had been using transistors obtained from a local wholesaler. I removed, retinned and resoldered a number of components in the line driver stage, then fitted a line output transistor obtained from Sony. This cleared the fault. You should always obtain semiconductor devices like this from S.M.M.

### JVC AV25F1EK (JX Chassis)

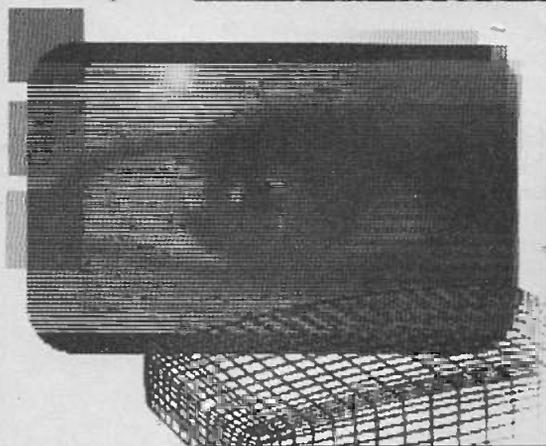
A fault that now occurs on a regular basis is a dead set because of a dry-joint at the chopper transformer pin that's connected to the collector of the chopper transistor. It seems that the rivet itself is not soldered to the print land. Resoldering provides a complete cure. Also check and resolder the pins of the TEA2261 control chip IC001 and the CNX82A optocoupler IC002. M.M.

### Mitsubishi CT2532TX (Euro 4 Chassis)

The fault was lines on the screen until the set warmed up, then lack of height. In addition a shrill noise came from the power supply. The culprit was C908 (10 $\mu$ F, 100V), which is the reservoir capacitor for the -41V feed to pin 1 of the STR59041 chopper chip IC901. M.M.

### Ferguson A51F (IKC2 Chassis)

The original fault was arcing in the line output transformer. A new transformer put this right but the set tripped, with field collapse. On advice from Ferguson I disconnected the field sensing circuit (TV01) and connected pin 20 of the microcontroller chip IR01 to chassis to force the set out of standby. Having got the set to stay on, it didn't take me long to discover that the BC548B field drive shaping transistor TF25 was the cause of the problem. M.M.



Reports from  
**John Edwards**  
**Philip Blundell, AMIEEIE**  
**And Adrian Spriddell**

#### **CTX CPS1760LR**

The 2.5A AC fuse blew immediately when power was applied. You will find the power supply board mounted vertically at the left-hand side of the screening frame. It can be removed by undoing two screws, then placed by the side of the monitor with all leads and plugs/sockets attached. Thank you Mr Design Man!

I couldn't find any shorts and didn't have a circuit diagram. The power supply has a small, vertically-mounted sub-board with a BT136-600 triac on it. Could this be a crowbar protection circuit? I removed the sub-board and powered up slowly via the variac. The monitor then worked normally. Replacing the triac, the TIL431 variable voltage regulator Q901 and the two transistors Q902 (2SC945) and Q903 (2SA733) on the sub-board cured the problem. J.E.

#### **Escom EM1448**

This monitor had produced a cloud of smoke as the picture went to line collapse. C417 (0.68 $\mu$ F, 250V) had melted. Luckily no other damage had been done. A replacement capacitor restored normal operation. P.B.

#### **AOC 4NIR**

If you get line collapse with one of these monitors, check plug and socket P401 for overheating and going open-circuit. P.B.

#### **Dell Ultrascan 15FS-EN**

There was a black line across the

# Monitors

screen: irregular frame scanning was cured by replacing the TDA8172 output chip together with diode D502 (1N4005) which was leaky.

I then noticed that there was excessive width, with no control. Normal operation was resumed when a short-circuit MUR460 diode was removed from the line timebase circuit and replaced with an RURD460 device (obtained from Farnell). A.S.

#### **Princetown ULTRA14**

This monitor was dead with no switch-mode power supply operation. A 2SC1921 transistor in the power supply had failed. When this had been replaced the power supply was in the over-current mode. The cause was shorted turns in the line output transformer. For once it was a practical proposition to fit a replacement, as the transformer is available at a sensible price.

Before boxing up the monitor I removed the glue from around the A1 connection on the CRT base panel. It had become conductive and was probably the root cause of both failures. A.S.

#### **Dell V1528E**

Line twitching was the complaint with one of these monitors. We traced the cause to the EW driver transistors Q406 (2SD667) and Q407 (2SB647), which fell to pieces when we attempted to remove them. A.S.

#### **Brother BC3286 Terminal**

If there is no switch-mode power supply operation, check D8 which is probably short-circuit. Replace with type UF5408. It's a good idea to replace C23, C24 and C25 at the same time. Use 105°C, low-impedance types. A.S.

#### **Hyundai HCM421**

A "narrow display" was the customer's description of the fault. Actually the line frequency was incorrect at all rates. To restore normal operation the NE555C tim-

ing chip U501 had to be replaced. A.S.

#### **Taxan SV787LR**

This monitor was 'dead' with the power supply in the over-current mode. A faulty 2SC4742 line output transistor was the cause of the trouble. Make a note to check this transistor by substitution before ordering a new line output transformer: the one we had read OK with a test meter but broke down under load. A.S.

#### **Acer 7015**

There was no switch-mode power supply operation. The 2SC3460 chopper transistor had failed. Replacing this transistor along with Q708 (2SC2910) and Q709 (2SA1370) restored normal operation. A.S.

#### **Tatung TM3401**

There was field collapse because the TDA1675A field output chip had failed. This was probably because there were numerous cracks and dry-joints around the line output transformer. While you are dealing with the monitor have a really good solder-up in the power supply as well. The few of these monitors we've seen all seem to suffer from poor soldering in several areas. A.S.

#### **Amstrad PC-ED (1640 EGA display)**

It's not uncommon to find one of these monitors dead with the surge limiter resistor R501 open-circuit and the STK7356 chopper chip shorted. In this event check C512 (0.22 $\mu$ F) which tends to go low in value. We now replace this capacitor as a matter of course whatever the repair. A.S.

#### **AST LR14**

If the width was opened out to produce anything approaching a normal picture the line oscillator would shut down and the power supply would go into the over-current mode. C322 was faulty. A.S.



Distributors of Electronic Components

# TRANSISTORS/LINEAR ICs

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price		
BC107	8p	BD434	30p	BU126	65p	BUV48AF	32.5p	MJ4502	300p	4N35	50p	LINEAR ICs		AN6340	600p	BA335	55p	BA7004	200p
BC108	8p	BD435	31p	BU128	125p	BUV48C	250p	MJ10012	300p			AN203	210p	AN6342	200p	BA338	80p	BA7007	200p
BC109	8p	BD436	30p	BU130	125p	BUV90	42.5p	MJ11015	250p			AN210	165p	AN6344	325p	BA340	70p	BA7021	130p
BC109C	10p	BD437	28p	BU132	150p	BUV61	1000p	MJ11015	300p			AN211	150p	AN6345	400p	BA343	60p	BA7022	350p
BC140	20p	BD438	38p	BU183	100p	BUV90	200p	MJ11032	800p	RECTIFIER DIODES		AN214C	70p	AN6346	350p	BA401	10p	BA7025L	100p
BC142	20p	BD439	40p	BU184	100p	BUV90	175p	MJ11033	800p	BY127	8p	AN217F	95p	AN6346	350p	BA402	50p	BA7107	475p
BC143	20p	BD440	40p	BU204	65p	BUV63	375p	MJ15003	250p	BY133	8p	AN228	280p	AN6350	610p	BA402	50p	BA7212S	200p
BC147	8p	BD441	40p	BU205	70p	BUW11A	200p	MJ15004	250p	BY164	40p	AN252	150p	AN6352	450p	BA403	145p	BA7252S	150p
BC149	8p	BD442	50p	BU206	100p	BUW11A	225p	MJ15015	250p	BY179	35p	AN259	250p	AN6356	300p	BA404	160p	BA7504N	100p
BC159	8p	BD443	38p	BU207	150p	BUW12	125p	MJ15016	350p	BY184	32p	AN262	140p	AN6359	500p	BA405	150p	BA7515LS	150p
BC160	30p	BD444	38p	BU208	70p	BUW12A	150p	MJ15022	250p	BY206	11p	AN271	140p	AN6360	320p	BA405	150p	BA7525	250p
BC171	10p	BD445	38p	BU208A	75p	BUW12F	250p	MJ15023	400p	BY227	40p	AN274	250p	AN6362	400p	BA521	100p	BA7555	150p
BC172	10p	BD446	40p	BU208AF	200p	BUW13A	200p	MJ15024	400p	BY228	28p	AN277B	400p	AN6363	230p	BA522	240p	BA7567AS	155p
BC177	14p	BD447	40p	BU208B	200p	BUW13A	200p	MJ15025	700p	BY238	15p	AN278	60p	AN6365	400p	BA524	180p	BA7568A	350p
BC178	14p	BD448	50p	BU208D	130p	BUW14	250p	MJ15026	25p	BY288	15p	AN278S	60p	AN6368	275p	BA527	95p	BA7521B	60p
BC179	14p	BD449	50p	BU209	90p	BUW49	550p	MJ15027	80p	BY289	18p	AN301	330p	AN6371	360p	BA532	100p	CA3140E	38p
BC182	7p	BD447	50p	BU225	120p	BUW50	500p	MJ15028	30p	BY323-1200	150p	AN302	650p	AN6377	480p	BA534	220p	CN52A	80p
BC182L	7p	BD449	50p	BU226	120p	BUW81A	150p	MJE2955T	65p	BY448	20p	AN303	250p	AN6380	100p	BA535	180p	CN52A	160p
BC183	7p	BD451	50p	BU232	90p	BUW81A	150p	MJE305T	70p	BYT11	25p	AN304	360p	AN6381	240p	BA536	180p	CN52A	160p
BC183L	7p	BD452	40p	BU325	55p	BUW85	85p	MJE13004	100p	BYT13-1000	30p	AN315	210p	AN6382	160p	BA537	120p	CN52A	160p
BC184	7p	BD457	38p	BU326A	75p	BUX10	150p	MJE13005	60p	BYV96E	25p	AN316	350p	AN6383	80p	BA538	100p	CN52A	160p
BC184L	7p	BD458	40p	BU406	60p	BUX11	200p	MJE13007	100p	BYV96E	25p	AN317	600p	AN6384	50p	BA539	100p	CN52A	160p
BC212	7p	BD459	40p	BU409D	85p	BUX12	150p	MJE13009	100p	BYX10	15p	AN318	140p	AN6385	35p	BA540	100p	CN52A	160p
BC213	7p	BD460	40p	BU409E	85p	BUX13	150p	MJE13010	100p	BYX56/600	25p	AN319	32p	AN6386	60p	BA541	110p	CN52A	160p
BC217	7p	BD461	45p	BU407D	75p	BUX21	450p	MJE15028	200p	OC26	350p	AN320	150p	AN6387	150p	BA542	110p	CN52A	160p
BC213L	7p	BD462	45p	BU408	60p	BUX22	450p	MJE15030	250p	OC29	350p	AN321	150p	AN6388	150p	BA543	110p	CN52A	160p
BC214	7p	BD463	45p	BU408D	75p	BUX23	450p	MJE15031	250p	OC29	350p	AN322	150p	AN6389	150p	BA544	110p	CN52A	160p
BC214L	7p	BD464	45p	BU409	85p	BUX37	220p	MJE15034	125p	OC29	350p	AN323	150p	AN6390	150p	BA545	110p	CN52A	160p
BC232	7p	BD465	45p	BU412	90p	BUX39	40p	MJE15035	175p	OC29	350p	AN324	150p	AN6391	150p	BA546	110p	CN52A	160p
BC238	7p	BD466	45p	BU411	90p	BUX40	210p	MJE15036	175p	OC29	350p	AN325	150p	AN6392	150p	BA547	110p	CN52A	160p
BC239	7p	BD467	45p	BU414B	250p	BUX41	200p	MJE15037	175p	OC29	350p	AN326	150p	AN6393	150p	BA548	110p	CN52A	160p
BC300	20p	BD468	50p	BU415A	170p	BUX42	200p	MJE15038	175p	OC29	350p	AN327	150p	AN6394	150p	BA549	110p	CN52A	160p
BC301	20p	BD469	50p	BU426A	70p	BUX47A	220p	OC35	350p	OC35	350p	AN328	150p	AN6395	150p	BA550	110p	CN52A	160p
BC302	20p	BD470	50p	BU433	120p	BUX48A	250p	S2350A	250p	OC35	350p	AN329	150p	AN6396	150p	BA551	110p	CN52A	160p
BC303	20p	BD471	50p	BU433	120p	BUX49	250p	S2350A	250p	OC35	350p	AN330	150p	AN6397	150p	BA552	110p	CN52A	160p
BC304	25p	BD472	50p	BU433	120p	BUX49	250p	S2350A	250p	OC35	350p	AN331	150p	AN6398	150p	BA553	110p	CN52A	160p
BC307	7p	BD473	50p	BU500	225p	BUX80	180p	S2000AF	130p	OC35	350p	AN332	150p	AN6399	150p	BA554	110p	CN52A	160p
BC327	7p	BD474	50p	BU505	90p	BUX81	160p	S2055A	175p	OC35	350p	AN333	150p	AN6400	150p	BA555	110p	CN52A	160p
BC328	7p	BD475	50p	BU505D	90p	BUX84	50p	S2055AF	175p	OC35	350p	AN334	150p	AN6401	150p	BA556	110p	CN52A	160p
BC338	7p	BD476	50p	BU505DF	100p	BUX85	50p	S2055AF	175p	OC35	350p	AN335	150p	AN6402	150p	BA557	110p	CN52A	160p
BC441	28p	BD477	60p	BU506	70p	BUX87	50p	OC29	350p	OC29	350p	AN336	150p	AN6403	150p	BA558	110p	CN52A	160p
BC442	28p	BD478	60p	BU506D	70p	BUX87	50p	OC29	350p	OC29	350p	AN337	150p	AN6404	150p	BA559	110p	CN52A	160p
BC444	28p	BD479	60p	BU506DF	100p	BUX88A	350p	OC29	350p	OC29	350p	AN338	150p	AN6405	150p	BA560	110p	CN52A	160p
BC477	18p	BD480	150p	BU508A	70p	BUZ71	75p	OC29	350p	OC29	350p	AN339	150p	AN6406	150p	BA561	110p	CN52A	160p
BC516	22p	BD481	175p	BU508AF	85p	BUZ71AF	100p	OC29	350p	OC29	350p	AN340	150p	AN6407	150p	BA562	110p	CN52A	160p
BC546	8p	BD482	80p	BU508APH	80p	BUZ72A	100p	OC29	350p	OC29	350p	AN341	150p	AN6408	150p	BA563	110p	CN52A	160p
BC547	8p	BD483	80p	BU508D	75p	BUZ72AF	100p	OC29	350p	OC29	350p	AN342	150p	AN6409	150p	BA564	110p	CN52A	160p
BC548	8p	BD484	80p	BU508DF	85p	BUZ73A	150p	OC29	350p	OC29	350p	AN343	150p	AN6410	150p	BA565	110p	CN52A	160p
BC549	8p	BD485	80p	BU508DR	130p	BUZ73AF	60p	OC29	350p	OC29	350p	AN344	150p	AN6411	150p	BA566	110p	CN52A	160p
BC550	8p	BD486	80p	BU508V	110p	BUZ76A	110p	OC29	350p	OC29	350p	AN345	150p	AN6412	150p	BA567	110p	CN52A	160p
BC551	8p	BD487	80p	BU508V	110p	BUZ76C	110p	OC29	350p	OC29	350p	AN346	150p	AN6413	150p	BA568	110p	CN52A	160p
BC552	8p	BD488	80p	BU508V	110p	BUZ76D	110p	OC29	350p	OC29	350p	AN347	150p	AN6414	150p	BA569	110p	CN52A	160p
BC553	8p	BD489	80p	BU508V	110p	BUZ76E	110p	OC29	350p	OC29	350p	AN348	150p	AN6415	150p	BA570	110p	CN52A	160p
BC554	8p	BD490	80p	BU508V	110p	BUZ76F	110p	OC29	350p	OC29	350p	AN349	150p	AN6416	150p	BA571	110p	CN52A	160p
BC555	8p	BD491	80p	BU508V	110p	BUZ76G	110p	OC29	350p	OC29	350p	AN350	150p	AN6417	150p	BA572	110p	CN52A	160p
BC556	8p	BD492	80p	BU508V	110p	BUZ76H	110p	OC29	350p	OC29	350p	AN351	150p	AN6418	150p	BA573	110p	CN52A	160p
BC557	8p	BD493	80p	BU508V	110p	BUZ76I	110p	OC29	350p	OC29	350p	AN352	150p	AN6419	150p	BA574	110p	CN52A	160p
BC558	8p	BD494	80p	BU508V	110p	BUZ76J	110p	OC29	350p	OC29	350p	AN353	150p	AN6420	150p	BA575	110p	CN52A	160p
BC559	8p	BD495	80p	BU508V	110p	BUZ76K	110p	OC29	350p	OC29	350p	AN354	150p	AN6421</					



# NEARICs/JAPANESE TRANSISTORS

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price		
TA8164P	100p	TA1180	120p	TA22760	400p	TA4A661	225p	TA8391	675p	UPC1004C	130p	2SA771	90p	2SA1177	25p	2SB551	30p	25C738	15p
TA8184P	360p	TA1185A	190p	TA22780	600p	TA4A870	475p	TA8395	450p	UPC1009	950p	2SA773	90p	2SA1179	20p	2SB562	20p	25C739	150p
TA8189P	130p	TA1190	80p	TA22791	275p	TA4A880	475p	TA8400	600p	UPC1012	200p	2SA777	60p	2SA1182	20p	2SB564	15p	25C741	110p
TA8190AH	325p	TA1200B	80p	TA22800	200p	TA4A885	475p	TA8415	600p	UPC1020	200p	2SA778	100p	2SA1184	120p	2SB566	30p	25C742	150p
TA8201AK	300p	TA1220	75p	TA22822M	600p	TA4A700A	750p	TA8416	625p	UPC1023	60p	2SA781	150p	2SA1185	20p	2SB568	50p	25C743	80p
TA8205	220p	TA1235	300p	TA22824	85p	TA4A714C	350p	TA8417	550p	UPC1024H	230p	2SA786	25p	2SA1186	50p	2SB569	30p	25C744	50p
TA8207K	175p	TA1236	240p	TA22840	200p	TA4A716C	450p	TA8421	500p	UPC1025	230p	2SA794	60p	2SA1198	40p	2SB570	500p	25C745	30p
TA8210	280p	TA1251	150p	TA23047	100p	TA4A719A	500p	TA8425	600p	UPC1026	95p	2SA798	30p	2SA1201	40p	2SB571	60p	25C746	225p
TA8211AH	280p	TA1261	175p	TA23048	110p	TA4A720	500p	TA8430	600p	UPC1027	95p	2SA802	35p	2SA1202	20p	2SB572	25p	25C747	20p
TA8214K	280p	TA1237	200p	TA23092	200p	TA4A800	350p	TA8433	600p	UPC1031H	150p	2SA814	60p	2SA1204	225p	2SB573	30p	25C748	150p
TA8215	300p	TA1405	50p	TA23083	200p	TA4A810	250p	TA8440	300p	UPC1032	60p	2SA816	70p	2SA1206	60p	2SB574	40p	25C749	150p
TA8216H	300p	TA1410	220p	TA23190	100p	TA4A814A	300p	TA8442	200p	UPC1035C	110p	2SA817	20p	2SA1207	25p	2SB575	35p	25C750	200p
TA8217P	120p	TA1412	35p	TA23031B	400p	TA4A850	475p	TA8443	350p	UPC1043C	125p	2SA825	20p	2SA1208	70p	2SB576	12p	25C751	175p
TA8220AH	500p	TA1506	275p	TA23310	120p	TA4A851	400p	TA8444	200p	UPC1158H	70p	2SA836	20p	2SA1209	100p	2SB577	20p	25C752	100p
TA8221AH	600p	TA1508	175p	TA23320	400p	TA4A852	400p	TA8451	400p	UPC1160	110p	2SA837	200p	2SA1210	120p	2SB578	20p	25C753	300p
TA8225H	475p	TA1510	170p	TA23420	200p	TA4A860	200p	TA8452	200p	UPC1167	125p	2SA839	110p	2SA1215	600p	2SB579	35p	25C754	150p
TA8225L	475p	TA1512	180p	TA23501	340p	TA4A866	325p	TA8453	350p	UPC1170	150p	2SA841	20p	2SA1216	550p	2SB580	100p	25C755	30p
TA8227	250p	TA1514A	450p	TA23502	450p	TA4A881	200p	TA8461	950p	UPC1173	200p	2SA844	20p	2SA1217	100p	2SB581	85p	25C756	140p
TA8228K	200p	TA1515A	200p	TA23504	300p	TA4A835	300p	TA8469	350p	UPC1176C	120p	2SA847	25p	2SA1220	75p	2SB582	90p	25C757	150p
TA8230P	200p	TA1516G	350p	TA23505	300p	TA4A841	250p	TA8475	350p	UPC1184	75p	2SA854	35p	2SA1221	70p	2SB583	90p	25C758	150p
TA8410K	200p	TA1517	250p	TA23506	260p	TA4A842	325p	TA8476	350p	UPC1180C	200p	2SA861	45p	2SA1222	50p	2SB584	200p	25C759	150p
TA8410P	200p	TA1519	200p	TA23507	450p	TA4A944	250p	TA8477	300p	UPC1185H	400p	2SA872	25p	2SA1225	25p	2SB585	200p	25C760	225p
TA8432	200p	TA1519A	200p	TA23510	350p	TA4A950	120p	TA8478	300p	UPC1186	80p	2SA872A	50p	2SA1227	25p	2SB586	20p	25C761	40p
TA8605N	350p	TA1520	275p	TA23520	650p	TA4A903A	150p	TA8479	225p	UPC1187	150p	2SA879	30p	2SA1232	180p	2SB587	60p	25C762	200p
TA8605N	350p	TA1521	250p	TA23530	350p	TA4A100A	250p	TA8482	400p	UPC1188	350p	2SA884	100p	2SA1237	25p	2SB588	100p	25C763	120p
TA8607P	350p	TA1522	250p	TA23531	120p	TA4A101	250p	TA8483	200p	UPC1189	30p	2SA885	100p	2SA1238	25p	2SB589	100p	25C764	100p
TA8611AN	250p	TA1524	200p	TA23541	175p	TA4A331T	175p	TA8487	400p	UPC1197	140p	2SA886	45p	2SA1239	30p	2SB590	35p	25C765	950p
TA8615N	480p	TA1526	225p	TA23560	200p	TA4A332T	150p	TA8474	50p	UPC1198H	200p	2SA887	20p	2SA1240	45p	2SB591	20p	25C766	100p
TA8628N	360p	TA1534	2000p	TA23561	600p	TA4A500	400p	TA8808T	325p	UPC1210	150p	2SA893	15p	2SA1242	40p	2SB592	22p	25C767	225p
TA8631	500p	TA1540	420p	TA23561A	600p	TA4A560	450p	TA8809T	350p	UPC1215V	125p	2SA896	25p	2SA1244	120p	2SB594	66p	25C768	175p
TA8632N	500p	TA1541	750p	TA23562	300p	TA4A562	250p	TA8810	400p	UPC1222	130p	2SA899	40p	2SA1245	55p	2SB595	50p	25C769	70p
TA8634N	500p	TA1542	750p	TA23562TF	300p	TA4A570	200p	TA8811	400p	UPC1227V	225p	2SA900	45p	2SA1246	80p	2SB596	400p	25C770	140p
TA8646	375p	TA1543	300p	TA23563	300p	TA4A571	200p	TA8812C	280p	UPC1227V	225p	2SA904	20p	2SA1248	35p	2SB597	50p	25C771	150p
TA8653N	1500p	TA1552Q	350p	TA23564	325p	TA4A578	400p	TA8813	180p	UPC1228HA	45p	2SA907	650p	2SA1249	100p	2SB598	30p	25C772	250p
TA8658AN	900p	TA1553AQ	375p	TA23565	220p	TA4A579	450p	TA8814	180p	UPC1230	200p	2SA909	500p	2SA1252	30p	2SB599	70p	25C773	40p
TA8659N	700p	TA1555Q	375p	TA23566	280p	TA4A580	850p	TA8815	550p	UPC1237HA	70p	2SA912	70p	2SA1253	30p	2SB600	25p	25C774	280p
TA8691N	700p	TA1557	320p	TA23567	320p	TA4A581	320p	TA8816	320p	UPC1238	130p	2SA913	60p	2SA1256	30p	2SB601	25p	25C775	250p
TA8701AN	275p	TA1560	350p	TA23568	300p	TA4A582	200p	TA8817	300p	UPC1241H	150p	2SA914	90p	2SA1257	30p	2SB602	70p	25C776	100p
TA8718N	550p	TA1560Q	675p	TA23570	375p	TA4A585	175p	TA8818	250p	UPC1241H	150p	2SA915	30p	2SA1258	70p	2SB603	110p	25C777	185p
TA8720	525p	TA1571	300p	TA23580	400p	TA4A590	225p	TA8819	150p	UPC1245V	150p	2SA916	30p	2SA1261	150p	2SB604	35p	25C778	60p
TA8739P	460p	TA1572	175p	TA23586	750p	TA4A600Q	150p	TA8820	80p	UPC1247H	250p	2SA921	40p	2SA1262	110p	2SB605	130p	25C779	350p
TA8742N	450p	TA1574	125p	TA23590	300p	TA4A610T	120p	TA8821	600p	UPC1247V	250p	2SA922A	25p	2SA1263	280p	2SB606	40p	25C780	225p
TA8745	400p	TA1575	150p	TA23591	250p	TA4A611	250p	TA8822	400p	UPC1248	200p	2SA923	25p	2SA1264	200p	2SB607	20p	25C781	100p
TA8120S	250p	TA1578A	210p	TA23592A	350p	TA4A620	750p	TA8823	300p	UPC1278	240p	2SA934	30p	2SA1265	200p	2SB608	15p	25C782	100p
TA8396	70p	TA1579	200p	TA23601Q	375p	TA4A660-2	700p	TA8824	100p	UPC1288V	230p	2SA935	40p	2SA1268	50p	2SB609	160p	25C783	100p
TA8320	120p	TA1589	275p	TA23602	225p	TA4A681-2	1100p	TA8825	100p	UPC1291CA	325p	2SA937	20p	2SA1269	60p	2SB610	175p	25C784	185p
TA8350	100p	TA1591	275p	TA23611	450p	TA4A682-2	900p	TA8826	100p	UPC1298	320p	2SA939	140p	2SA1269B	60p	2SB611	60p	25C785	280p
TA8340	80p	TA1598	200p	TA23640	350p	TA4A700	170p	TA8827	110p	UPC1313H A	100p	2SA940	60p	2SA1269	50p	2SB612	40p	25C786	290p
TA8380	400p	TA1600	275p	TA23651	200p	TA4A702OT	175p	TA8828	100p	UPC1318	300p	2SA942	100p	2SA1270	110p	2SB613	20p	25C787	270p
TA8310AS	40p	TA1602A	200p	TA23652	500p	TA4A7021T	150p	TA8829	200p	UPC1330HA	80p	2SA949	70p	2SA1273	40p	2SB614	135p	25C788	110p
TA820	55p	TA1670A	230p	TA23652T	1000p	TA4A7050	200p	TA8830	150p	UPC1335V	320p	2SA950	18p	2SA1294	460p	2SB615	75p	25C789	250p
TA820M	35p	TA1675	250p	TA23653	800p	TA4A7052	120p	TA8831	100p	UPC1350	115p	2SA951	60p	2SA1295	50p	2SB616	200p	25C790	600p
TA820P	35p	TA1682	300p	TA23654	800p	TA4A7052	120p	TA8832	100p	UPC1352C	240p	2SA952	60p	2SA1300	260p	2SB617	200p	25C791	700p
TA8250	100p	TA1771	250p	TA23654Q	85p	TA4A7056	200p	TA8833	100p	UPC1360C	200p	2SA953	30p	2SA1303	300p	2SB618	75p	25C792	180p
TA8290	60p	TA1870A	200p	TA23710	80p	TA4A7057Q	225p	TA8834	100p	UPC1362C	260p	2SA957	185p	2SA1304	110p	2SB619	50p	25C793	150p
TC5020	200p	TA1872A	275p	TA23720	175p	TA4A7072	175p	TA8835	100p	UPC1363	190p	2SA958	60p	2SA1306	110p	2SB620	110p	25C794	330p
TC5081AP	80p	TA1904	80p	TA23724	600p	TA4A7077	175p	TA8836	100p	UPC1363C	300p	2SA959	120p	2SA1307	100p	2SB621	220p	25C795	210p
TC5022P	170p	TA1905	80p	TA23725	150p	TA4A7211	180p	TA8837	350p	UPC1364C	350p	2SA965	30p	2SA1309	50p	2SB622	25p	25C796	350p
TC5092A	170p	TA1907	90p	TA23726	120p	TA4A7212	180p	TA8838	350p	UPC1375C	240p	2SA966	60p	2SA1310	110p	2SB623	10p	25C797	350p
TC5125BP	410p	TA1910	225p	TA23740	480p	TA4A7222	200p	TA8839	400p	UPC1386C	130p	2SA968	55p	2SA1317	30p	2SB624	45p	25C798	15p
TC9130P	150p	TA1940	180p	TA23750	400p	TA4A7230A	225p	TA8840	101p	UPC1370C	300p	2SA970	25p	2SA1318	20p	2SB625	35p	25C799	110p

# JAPANESE TRANSISTORS

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
2SC1675	90p	2SC2258	30p	2SC2710	60p	2SC3244	45p	2SC3781	150p	2SD287	250p	2SD879	80p	2SD1311	65p	2SD1756	275p	2SK240	140p
2SC1678	80p	2SC2259	60p	2SC2712	20p	2SC3246	50p	2SC3782	75p	2SD291	250p	2SD880	40p	2SD1313	1000p	2SD1758	75p	2SK241	30p
2SC1683	100p	2SC2261	700p	2SC2714	20p	2SC3259	350p	2SC3783	300p	2SD313	25p	2SD882	25p	2SD1326	200p	2SD1760	80p	2SK246	30p
2SC1684	30p	2SC2267	90p	2SC2716	50p	2SC3260	220p	2SC3787	100p	2SD315	75p	2SD889	35p	2SD1327	150p	2SD1761	80p	2SK300	25p
2SC1685	30p	2SC2270	60p	2SC2717	25p	2SC3261	230p	2SC3788	60p	2SD320	30p	2SD892A	75p	2SD1328	60p	2SD1762	80p	2SK301	40p
2SC1729	900p	2SC2271	120p	2SC2719	120p	2SC3262	280p	2SC3789	75p	2SD330	65p	2SD894	35p	2SD1330	50p	2SD1763A	60p	2SK303	40p
2SC1730	100p	2SC2274	15p	2SC2724	15p	2SC3263	280p	2SC3790	120p	2SD348	300p	2SD895	100p	2SD1347	70p	2SD1764	70p	2SK304	25p
2SC1735	70p	2SC2275	50p	2SC2728	200p	2SC3264	390p	2SC3795	140p	2SD350	320p	2SD896	220p	2SD1348	65p	2SD1765	70p	2SK312	750p
2SC1740	10p	2SC2278	70p	2SC2749	350p	2SC3269	50p	2SC3798	220p	2SD357	40p	2SD898	225p	2SD1350	150p	2SD1767	110p	2SK315	70p
2SC1741	35p	2SC2283	700p	2SC2750	300p	2SC3270	50p	2SC3807	120p	2SD358	50p	2SD900	400p	2SD1376	60p	2SD1773	180p	2SK320	120p
2SC1755	95p	2SC2280	1800p	2SC2751	270p	2SC3271	75p	2SC3808	70p	2SD359	50p	2SD905	450p	2SD1378	80p	2SD1774	70p	2SK323	130p
2SC1756	35p	2SC2291	40p	2SC2752	75p	2SC3272	280p	2SC3811	80p	2SD361	100p	2SD916	130p	2SD1379	100p	2SD1783	100p	2SK332	175p
2SC1758	30p	2SC2298	30p	2SC2767	300p	2SC3273	30p	2SC3831	250p	2SD362	100p	2SD917	300p	2SD1380	100p	2SD1785	160p	2SK359	40p
2SC1760	70p	2SC2307	35p	2SC2769	400p	2SC3280	200p	2SC3832	135p	2SD371	240p	2SD921	320p	2SD1382	60p	2SD1789	210p	2SK363	50p
2SC1775	10p	2SC2308	10p	2SC2773	70p	2SC3281	200p	2SC3833	25p	2SD380	650p	2SD923	380p	2SD1384	50p	2SD1798	180p	2SK364	40p
2SC1781	20p	2SC2312	300p	2SC2774	50p	2SC3284	600p	2SC3851	100p	2SD381	50p	2SD946	100p	2SD1390	350p	2SD1802	75p	2SK367	30p
2SC1789	100p	2SC2314	70p	2SC2785	40p	2SC3293	85p	2SC3852	80p	2SD382	75p	2SD947	100p	2SD1391	250p	2SD1806	75p	2SK369	40p
2SC1809	40p	2SC2316	150p	2SC2786	20p	2SC3298	50p	2SC3853	220p	2SD386	70p	2SD950	300p	2SD1392	85p	2SD1812	60p	2SK373	40p
2SC1810	250p	2SC2320	10p	2SC2787	10p	2SC3299	120p	2SC3855	220p	2SD388	150p	2SD951	200p	2SD1395	60p	2SD1825	20p	2SK374	45p
2SC1815	10p	2SC2324	120p	2SC2791	500p	2SC3300	400p	2SC3857	500p	2SD389	60p	2SD957A	520p	2SD1396	120p	2SD1825	20p	2SK386	60p
2SC1819	70p	2SC2328A	50p	2SC2792	220p	2SC3303	100p	2SC3858	550p	2SD400	14p	2SD958	50p	2SD1397	100p	2SD1827	120p	2SK389	115p
2SC1826	60p	2SC2310	25p	2SC2793	700p	2SC3306	130p	2SC3866	275p	2SD401	50p	2SD965	35p	2SD1398	120p	2SD1843	100p	2SK400	700p
2SC1827	50p	2SC2315	175p	2SC2808	40p	2SC3307	600p	2SC3868	100p	2SD402	120p	2SD970	170p	2SD1399	300p	2SD1846	350p	2SK405	450p
2SC1829	60p	2SC2329	480p	2SC2810	360p	2SC3308	150p	2SC3870	200p	2SD414	45p	2SD972	40p	2SD1400	280p	2SD1847	380p	2SK414	660p
2SC1833	27p	2SC2330	300p	2SC2812	40p	2SC3310	125p	2SC3883	210p	2SD415	55p	2SD973	60p	2SD1402	120p	2SD1849	280p	2SK415	500p
2SC1834	50p	2SC2331	300p	2SC2814	40p	2SC3316	280p	2SC3884A	200p	2SD424	35p	2SD973A	70p	2SD1403	225p	2SD1850	325p	2SK423	75p
2SC1841	12p	2SC2333	200p	2SC2824	75p	2SC3317	350p	2SC3885	250p	2SD426	150p	2SD982	90p	2SD1405	80p	2SD1853	40p	2SK427	50p
2SC1844	50p	2SC2334	800p	2SC2825	900p	2SC3326	50p	2SC3885A	290p	2SD427	350p	2SD985	120p	2SD1406	60p	2SD1856	40p	2SK430	200p
2SC1845	15p	2SC2335	55p	2SC2826	200p	2SC3327	60p	2SC3886A	330p	2SD438	35p	2SD986	120p	2SD1407	60p	2SD1857	75p	2SK431	200p
2SC1846	35p	2SC2336A	125p	2SC2827	130p	2SC3328	50p	2SC3890	150p	2SD439	150p	2SD988	70p	2SD1408	125p	2SD1858	40p	2SK411	450p
2SC1847	45p	2SC2344	150p	2SC2832	300p	2SC3330	20p	2SC3892A	400p	2SD468	16p	2SD1010	40p	2SD1409	170p	2SD1863	35p	2SK413	325p
2SC1855	85p	2SC2347	35p	2SC2834	280p	2SC3331	25p	2SC3893	225p	2SD471	20p	2SD1012	40p	2SD1411	85p	2SD1864	85p	2SK426	150p
2SC1856	25p	2SC2353	120p	2SC2837	250p	2SC3333	120p	2SC3895	400p	2SD476	100p	2SD1020	40p	2SD1412	75p	2SD1877	175p	2SK431	350p
2SC1865	70p	2SC2360	120p	2SC2839	40p	2SC3345	100p	2SC3896	400p	2SD525	50p	2SD1021	120p	2SD1413	60p	2SD1878	160p	2SK434	700p
2SC1870	700p	2SC2361	150p	2SC2853	70p	2SC3346	130p	2SC3897	400p	2SD526	70p	2SD1022	250p	2SD1415	190p	2SD1879	275p	2SK437	900p
2SC1871	425p	2SC2362	50p	2SC2873	60p	2SC3352	200p	2SC3907	250p	2SD545	18p	2SD1024	850p	2SD1417	125p	2SD1880	380p	2SK438	350p
2SC1875	220p	2SC2365	280p	2SC2877	120p	2SC3353	280p	2SC3927	250p	2SD549	120p	2SD1027	850p	2SD1425	260p	2SD1881	350p	2SK439	1100p
2SC1881	70p	2SC2369	100p	2SC2878	20p	2SC3355	50p	2SC3940	40p	2SD551	100p	2SD1030	75p	2SD1426	135p	2SD1884	300p	2SK444	30p
2SC1890	15p	2SC2371	25p	2SC2879	3200p	2SC3356	120p	2SC3943	75p	2SD554	225p	2SD1031	70p	2SD1427	160p	2SD1886	450p	2SK452	250p
2SC1895	500p	2SC2373	210p	2SC2882	60p	2SC3358	50p	2SC3944	80p	2SD555	50p	2SD1036	600p	2SD1428	180p	2SD1887	300p	2SK453	125p
2SC1904	125p	2SC2383	50p	2SC2883	60p	2SC3376	300p	2SC3950	120p	2SD556	225p	2SD1046	200p	2SD1430	280p	2SD1894	300p	2SK455	320p
2SC1906	15p	2SC2389	45p	2SC2898	200p	2SC3377	50p	2SC3953	60p	2SD558	200p	2SD1047	180p	2SD1431	200p	2SD1895	225p	2SK456	500p
2SC1907	20p	2SC2407	110p	2SC2899	60p	2SC3378	120p	2SC3955	70p	2SD560	50p	2SD1051	130p	2SD1432	400p	2SD1910	280p	2SK457	400p
2SC1909	25p	2SC2408	120p	2SC2909	60p	2SC3379	1200p	2SC3964	100p	2SD571	20p	2SD1055	60p	2SD1433	400p	2SD1911	300p	2SK459	600p
2SC1913	90p	2SC2412K	50p	2SC2910	25p	2SC3381	130p	2SC3972	250p	2SD575	530p	2SD1060	130p	2SD1438	100p	2SD1913	50p	2SK460	580p
2SC1914	30p	2SC2440	200p	2SC2911	80p	2SC3383	80p	2SC3973	210p	2SD582	25p	2SD1062	150p	2SD1439	165p	2SD1929	50p	2SK466	475p
2SC1921	15p	2SC2458	10p	2SC2912	120p	2SC3393	80p	2SC3975	210p	2SD596	25p	2SD1063	200p	2SD1441	220p	2SD1930	50p	2SK467	70p
2SC1922	175p	2SC2459	60p	2SC2921	650p	2SC3397	20p	2SC3987	220p	2SD600	30p	2SD1064	250p	2SD1442	80p	2SD1933	75p	2SK476	80p
2SC1923	10p	2SC2466	55p	2SC2922	480p	2SC3399	50p	2SC3996	800p	2SD601	40p	2SD1065	160p	2SD1445	200p	2SD1939	75p	2SK484	950p
2SC1929	180p	2SC2486	275p	2SC2923	75p	2SC3400	35p	2SC3997	1400p	2SD602	80p	2SD1069	160p	2SD1446	300p	2SD1941	500p	2SK489	1150p
2SC1940	110p	2SC2492	50p	2SC2928	550p	2SC3401	50p	2SC3998	1000p	2SD612	50p	2SD1073	350p	2SD1450	60p	2SD1944	50p	2SK495	100p
2SC1941	27p	2SC2470	65p	2SC2929	280p	2SC3402	40p	2SC4006	100p	2SD613	70p	2SD1088	150p	2SD1451	200p	2SD1958	80p	2SK719	300p
2SC1942	350p	2SC2481	120p	2SC2934	75p	2SC3405	130p	2SC4020	280p	2SD617	300p	2SD1094	375p	2SD1452	275p	2SD1959	210p	2SK724	500p
2SC1944	350p	2SC2482	20p	2SC2937	250p	2SC3409	400p	2SC4023	325p	2SD633	70p	2SD1110	225p	2SD1453	140p	2SD1978	50p	2SK725	550p
2SC1945	350p	2SC2483	120p	2SC2939	400p	2SC3416	30p	2SC4029	350p	2SD636	10p	2SD1111	20p	2SD1455	260p	2SD1984	460p	2SK726	425p
2SC1946	150p	2SC2484	185p	2SC2944	300p	2SC3417	90p	2SC4043	45p	2SD637	15p	2SD1113	225p	2SD1457	165p	2SD1991	50p	2SK727	475p
2SC1947	450p	2SC2485	400p	2SC2958	50p	2SC3419	120p	2SC4046	40p	2SD638	15p	2SD1128	200p	2SD1458	300p	2SD1994	300p	2SK729	400p
2SC1953	45p	2SC2491	200p	2SC2962	800p	2SC3420	80p	2SC4056	35p	2SD639	20p	2SD1133	65p	2SD1459	80p	2SD1996	45p	2SK730	300p
2SC1957	70p	2SC2498	50p	2SC2979	180p	2SC3421	45p	2SC4059	650p	2SD640	350p	2SD1135	75p	2SD1468	40p	2SD2006	76p	2SK758	500p
2SC1959	10p	2SC2500	25p	2SC2987	25p	2SC3422	75p	2SC4064	140p	2SD655	18p	2SD1138	40p	2SD1487	225p	2SD2010	250p	2SK769	500p
2SC1962	175p	2SC2502	140p	2SC2988	150p	2SC3423	60p	2SC4106	200p	2SD661	60p	2SD1140	40p	2SD1494	200p	2SD2011	60p	2SK786	200p
2SC1967	130p	2SC2503	600p	2SC2995	80p	2SC342													





# Supplement

Supplement text and research by Eugene Trundle

## Workshop Equipment

### Getting it together on the bench

As consumer electronic equipment advances in terms of technology and performance, the test instruments and service aids required to deal with it when faults occur become more sophisticated. The traditional gear – test meter, oscilloscope, bench lamp, soldering iron, isolating transformer and so on – are still there. But they have been joined by anti-static workstations, surface-mount rework outfits and computer-based test, diagnosis and set-up arrangements. Tomorrow's service technician is more likely to be pressing keys and scanning a PC monitor screen than twiddling presets or wielding meters and big, throbbing soldering irons.

The bench-top gear we'll look at in this survey covers an ever wider range of equipment. In this time of transition, it has to meet the needs of 'GP' technicians who may be faced with anything from a monochrome TV receiver with rotary manual tuning to a DVC tape deck, all calling for diagnosis, repair and setting up in the shortest possible time – and at the least possible expense...

#### Oscilloscopes

The oscilloscope is perhaps the most versatile piece of test gear to be found on the repair bench. In addition to its primary function of displaying waveforms it can double as an AC/DC voltmeter, compare two signal sources, select small signal segments in time and, with advanced instruments, test components, store waveforms and data, select Y gain and sweep speed automatically, and give on-screen setting and signal parameter readouts.

A new range of oscilloscopes from GoldStar caters for a wide variety of needs, from the inexpensive 20MHz dual-trace Model 5020P to the 100MHz, three-channel



Are you ready for digital TV? The Promax Prolink 7 from Alban Electronics.

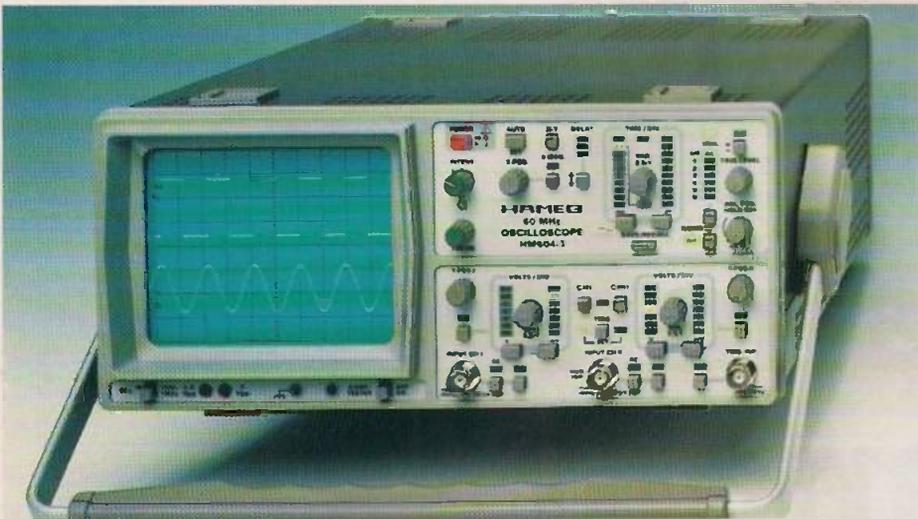
digital-storage Model OS-9100D. Kenwood also has a wide selection, starting with the compact, traditionally-styled CO-1305 (10MHz/5mV) at about £230 and ranging up to Model DCS-8200, a programmable digital-storage instrument at £2,750 plus VAT.

In standard scopes Hameg has the new HM604-3, a dual-beam, DC-60MHz instrument with auto set-up, six set-up memories and a built-in component tester for about £750. For another £240 there's the 100MHz bandwidth HM1004, which in addition has on-screen readout and cursor functions for voltage, time and frequency.

A useful accessory from Kenwood

(available from Vann Draper Electronics) is the SAE1001 1GHz spectrum analyser adaptor. It converts any oscilloscope with X-Y capability into a cost-effective spectrum analyser with a 400kHz-1GHz frequency range, 70dB dynamic range, a built-in calibration marker and digital readout of centre frequency. Cost is £582.

A more modest but very useful oscilloscope accessory is the passive infra-red tester from CPC (order code 1N00307). Priced at £13.50, it enables you to see the waveform of an infra-red command. The CME tester from SEME (order code REM2468) provides a basic go/no-go indication of IR emission for field servicing,



The Hameg HM604-3 dual-beam DC-60MHz scope with auto set-up, six set-up memories and a component tester.

shop or service-reception use.

'Alternative' oscilloscopes for special applications continue to evolve. Fluke's hand-held Scopemeter has recently developed into Model B, with more functions and better performance. Pico Technology now has available an AD converter and special software that enable a PC running either Windows or DOS to emulate the

functions of six test instruments, including a digital storage oscilloscope. It's available from CPC and SEME.

GoldStar has introduced an RS232 interface (type LS3000) for use with digital-storage oscilloscopes. It enables a PC to store waveform data samples and offers colour coding per channel, measurement, calculation, magnification and print-outs.

## Meters

'Virtual meters' for use with a PC are also available, again from Pico. The ADC1000 outfit offers digital or analogue (bar-graph) readout and has additional facilities for frequency counting and spectrum analysis.

The bulk of this market sector consists of more conventional multimeters. There's a huge range to choose from. Starting at below £10, but still with a DC voltage reading accuracy of  $\pm 1$  per cent, hand-held digital multimeters offer ruggedness, portability and economy. They are now being produced in many special-purpose forms: pen types, probe style, dual display, autoranging, ruggedised and so on. Amongst the most sophisticated is the new Fluke 860 series which offers, in addition to the multimeter functions, waveform display, component testing, trend plotting and logic activity detection. The 867, with a computer-transfer facility, is priced at £883.

One sometimes has to check a picture tube's final anode voltage, which with some digital and very large direct-view systems can be in the 30kV region. Hameg has a 40kV probe to meet this need. It's compatible with virtually all multimeters and oscilloscopes. The model number is HZ59 (SEME stock no. 12059HZ), the price £72.

Hand-held meters for the measurement of capacitance, inductance, frequency and other

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### MISCELLANEOUS

Anritsu MF452B - DS-3 transmission analyser	£3000
Anritsu MG642A - Pulse pattern generator	£1500
Barr & Stroud - EFB variable filter (0.1Hz-100kHz)	£150
Danbridge JF30A - 30kV insulation Tester	£1500
Drantz 525 - AGDC Multifunction Analyser	£850
Farnell AP70-30 P.S.W. - (10-70V, 0-30A) auto ranging	£750
Fluke 5100A - Calibrator	£2500
Fluke 5100B - Calibrator	£3500
Fluke 5205A - Precision power amplifier	£1500
Fluke 7105A - Calibration system (As new)	£5000
Guidline 9152 - T12 Battery standard cell	£550
Hewlett Packard 331A - Distortion analyser	£300
Hewlett Packard 435A or B - Power Meter (with 8451A/8484A)	from £750
Hewlett Packard 1630D - Logic Analyser (43 channels)	£650
Hewlett Packard 16500A - Fitted with 16510A/16515A/16530A/16531A Logic analyser	£4000
Hewlett Packard 1661A - Logic analyser (As new)	£5000
Hewlett Packard 3314A - Function generator	£2250
Hewlett Packard 3335A - 2.1MHz synthesiser/function gen.	£1600
Hewlett Packard 3336A - Synthesised signal generator (10Hz-21MHz)	£1000
Hewlett Packard 3456A - 6 1/2 digit multimeter (auto scale)	£750
Hewlett Packard 3456A - Digital voltmeter	£750
Hewlett Packard 3478A - Multimeter (5 1/2 digit) HPB	£950
Hewlett Packard 3488A - HP-IB switch/control unit (various plug-in available)	£850
Hewlett Packard 3560A - Dual channel dynamic sig. analyser	£3750
Hewlett Packard 3711A/3712A/3791B/3793B - Microwave link analyser	£2405
Hewlett Packard 3776A - PCM Terminal test set	£1500
Hewlett Packard 3779 A/C - Primary mux analyser	£500/£300
Hewlett Packard 4275A - Multi-frequency LCR meter	£3500
Hewlett Packard 4278A - 1kHz/1MHz capacitance meter	£3750
Hewlett Packard 4279A - 1MHz, C.V. meter	£6500
Hewlett Packard 4320A - 1MHz, C.V. meter (as new)	£2000
Hewlett Packard 4342A - Q meter	£995
Hewlett Packard 4948A - transmission impairment measuring set	£2000
Hewlett Packard 4953A - Protocol analyser	£1995
Hewlett Packard 4872A - Lan protocol analyser	£2000
Hewlett Packard 5314A - (new) 100MHz universal counter	£250
Hewlett Packard 5328A - 100MHz universal frequency counter	£250
Hewlett Packard 5338A - 225MHz frequency counter	£350
Hewlett Packard 5385A - Frequency counter (1GHz (HPB) with Cpts 001/003/004/005)	£995
Hewlett Packard 6031A - 1000 Watt rato-ranging P.S.U. (20V-120A)	£1550

Hewlett Packard 6261B - Power supply 20V-50A  
DISCOUNT FOR QUANTITIES

Hewlett Packard 8011A - Pulse gen. 0.1Hz-20MHz	£500
Hewlett Packard 8152A - Optical average power meter	£1250
Hewlett Packard 8158B - Optical attenuator with opt's 002 + 001	£1100
Hewlett Packard 8165A - 50MHz programmable signal source	£1650
Hewlett Packard 8170A - Data generator	£1500
Hewlett Packard 8182A - Data analyser	£1500
Hewlett Packard 8349B - Microwave broadband Amp (as new) 2-20MHz	£3250
Hewlett Packard 8354A - Millimeter wave source 26.5GHz-40GHz	£4000
Hewlett Packard 8355A - Millimeter wave source 33GHz-50GHz	£4250
Hewlett Packard 8370A - Vector voltmeter	£500
Hewlett Packard 8629C - Sweep oscillator mainframe	£400
Hewlett Packard 8658B - Synthesised signal generator	£2950

## TELNET

Hewlett Packard 8750A - Storage normaliser	£375
Hewlett Packard 8756A - Scalar network analyser	£2000
Hewlett Packard 8757A - Scalar network analyser	£2750
Hewlett Packard 8901A - Modulation Analyser	£2500
Hewlett Packard 8903A - Audio analyser (20Hz-100kHz)	£1995
Hewlett Packard 8920A - RF Comms test set	£5000
Hewlett Packard 8958A - Cellular radio interface	£3500
Hewlett Packard 11729B - Carrier noise test set	£2000
Krohn-Hite 5200 - Sweep function generator	£350
Leeroy LW 420 - Arbitrary waveform gen. (New) + 1MHz/CH opt.	£14000
Marconi 2019 - 20KHz-100MHz synth signal generator	£1750
Marconi 2019A - 80KHz-1040MHz synthesised sig. gen	£1950
Marconi 2022A - 10KHz-1GHz - AM/FM signal generator	£2000
Marconi 2610 - True RMS voltmeter	£850
Marconi 2611 - data communications analyser	£1000
Marconi 2955 - Radio Comms test set	£4200
Marconi 2955B - Radio Comms test set	£4250
Marconi 2955 + 2958 - Radio Comms test set + tacs adaptor	£3500
Marconi 2960A - Radio Comms test set with cellular adaptor	from £950
Marconi 6860 - Power Meter + sensor	from £1950
Marconi 6860A - Power Meter + sensor	£400
Philips PM 5167 - 10MHz function gen.	£800
Philips PM 5190 - LF synthesiser with GPIB	£525
Philips PM 5716 - 50MHz Pulse generator	£250
Philips PM 6673 - 170MHz high resolution universal counter	£350
Philips PM 6670 - 120MHz high resolution timer/counter	£900
Philips PM 6652 - 1.5 GHz programmable high resolution timer/counter	£800
Racal Dana 1992 - 1300MHz frequency counter opts 4B+55	£500
Racal Dana 9081 - Synthesised Sig Gen 520MHz	£490
Racal Dana 9084 - Synth. sig. gen. 104MHz	£300
Racal Dana 9301A - True RMS R/F millivoltmeter	£650
Racal Dana 9303 - True RMS R/F level meter	£850
Racal Dana 9321 - 3GHz frequency counter	£500
Rohde & Schwarz SMDU - 15Hz-525MHz (FM & AM) Sig Gen	£1000
Schaffner NSG 200K - 100MHz synth signal generator	£995
Schaffner NSG 203A - Line voltage variation simulator	£995
Schaffner NSG 222A - Interference simulator	£750
Schaffner NSG 223 - Interference generator	£1250
Schaffner NSG 431 - Electrostatic discharge simulator	£1950
Schaffner NSG 433 - Electrostatic discharge simulator	£600
Schlumberger 2720 - 1250MHz Freq. Counter	£350
Schlumberger 7060/7065/7075 - Multimeters from	£2500
Syston Dromer 1980B - Microwave Sweeper (12-18GHz)	£1150
Tektronix 577 - Curve Tracer	
Tektronix - Plug ins - Many available such as PG508, FG504, SC554, SWS03, SGB02 etc	
Tektronix TM5003 + AFG501 - Arbitrary Function Gen.	£1750
Tektronix 1240 - Logic Analyser	£750
Tektronix AA501 + TM5001 + PG502 - current probe amplifier	£995
Tektronix AA501 + TM5005 - Mainframe programmable distortion analyser	£1995
Tektronix PG506 + TG501 + SG503 TM503 - Oscilloscope calibrator	£1995
Time 9814 - Voltage calibrator	£750
Wayne Kerr 8505 - Precision LCR meter	£650
Wandel & Goltermann - PRA 1 Frame simulator/analyser	£600
Wavetek 171 - Synthesised function generator	£250
Wavetek 172B - Programmable sig. source (0.0001Hz-13MHz)	£250
Wavetek 184 - Sweep generator	£250
Wayne Kerr 8505 - Precision LCR meter	£650
Wayne Kerr 4225 - LCR bridge	£2750
Wayne Kerr 6425 - Precision component analyser	£600

### OSCILLOSCOPES

Beckman 9020 - 20MHz dual channel	£190
Cossor 3102 - 60MHz dual channel	£250
Gould 9524A/250/255/300/3000/3351/4000 - From	£1250
Gould 4074 - 100 MHz D.S.O. 4 channel	£2750
Hameg 203/203A/203-5/203-6 - From	£150
Hewlett Packard 180A/180C/181A/182C - From	£200
Hewlett Packard 1740A, 1741A, 1744 - 100MHz dual ch	from £350

Hewlett Packard 54100A - 1GHz digitizing	£1400
Hewlett Packard 54100D - 1GHz digitizing	£2995
Hewlett Packard 54200A - 500MHz digitizing	£750
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Meguro MSO 1270A - 120MHz digital storage (as new)	£650
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Kikusui CDS 6100 - 100MHz 5 channel 12 trace	£475
Lektro 8450 - 30MHz/400MHz D.S.O. 2ch	£2250
Nicolet 210 - LF DSO with twin disc drive	£550
Nicolet 3091 - Low freq D.S.O.	£900
Philips 3055 - 50MHz - 2ch	£450
Philips PM 3211/PM 3213/PM 3214/PM 3217/PM 3240/PM 3243/PM 3252/PM 3254/PM 3257/PM 3285/PM 3540 - From	£125
Philips PM 3255A - 400MHz dual channel	£1750
Philips PM 3335 - 50MHz/20MHz D.S.O. 2ch	£1500
Tektronix 434 - 25MHz 2 channel - analogue storage	£250
Tektronix 454 - 150MHz 2 channel	£400
Tektronix 455 - 50MHz dual channel	£350
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Tektronix 465/465B - 100MHz dual ch.	from £350
Tektronix 468 - 100MHz D.S.O.	£150
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Tektronix 2235 - 100MHz Dual channel	£800
Tektronix 2335 - 5100MHz dual ch. (portable)	£750
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Tektronix 7313, 7603, 7613, 7623, 7633 - 100MHz 4 ch	from £250
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Tektronix 7854 - 400MHz Waveform processing oscilloscope	£1500
Tektronix 7904 - 500MHz	from £1000
Tektronix 7934 - 500MHz with storage	from £1000
Tektronix TDS520 - 500MHz/500MHz D.S.O. 2ch	£4000
Tequipment DB3 - 50MHz dual channel	£200
Tequipment DM63 - 20MHz 4 channel	£150
Tro CC - 1022 - 20MHz dual channel	£125

### SPECTRUM ANALYSER

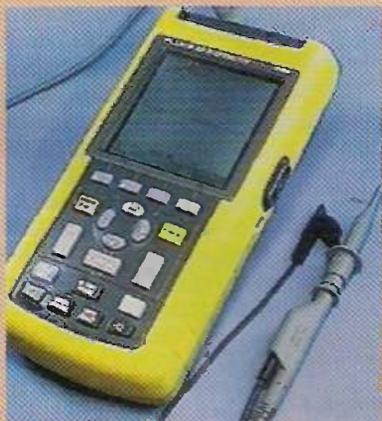
Advantest 4131 - 10KHz - 3.5GHz (GIPB)	£4500
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Hewlett Packard 3562A - dynamic signal analyser, dual channel	£7500
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# Black★Star Monitor Test Pattern Generator

The monitor test pattern generator is a portable, battery powered, easy to use, video pattern generator for quick and simple testing of the most commonly used computer monitors. Its small size and portability make it very easy to test computer monitors without the need to return the monitor to a service centre. The 3 timing modes and 8 test patterns enable rapid verification of monitor performance.



- ▶ Timing modes:
  - VGA: 640 x 480, 31.5kHz, 60Hz
  - SVGA: 800 x 600, 35.3kHz, 56Hz
  - VESA: 1024 x 768, 48.8kHz, 60Hz
  - All models are non interlaced.
- ▶ Test Patterns:
  - White
  - Red Purity
  - Green Purity
  - Blue Purity
  - Black
  - Colour Bars
  - Grey Scale
  - Cross-hatch
- ▶ Video Outputs: Red, Green, Blue 75Ω, 0.7Vp-p
- ▶ Sync Outputs: Horizontal and Vertical at TTL Levels, polarity negative.
- ▶ Power Supply: 9V PP3 Battery, or external 7-10V 150mA d.c.
- ▶ Controls:
  - Timing mode select button with LED indication.
  - Pattern select button with LED indication.
- ▶ Outputs:
  - Standard 15-way VGA connector.

Order Code  
**EQU474**

Price  
**£165**

## KENWOOD Hand-held Frequency Counter

- ✓ Portable, battery powered frequency counter.
- ✓ 5Hz to 1300MHz frequency range
- ✓ Very high sensitivity at all frequencies
- ✓ Frequency and period measurement, 0.0001mHz resolution
- ✓ Reciprocal counting technique gives superior accuracy
- ✓ Push-to-measure function with auto power-down
- ✓ Large 8 digit display with full range of annunciators



Order Code  
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Price  
**£99**

## KENWOOD Hand-held Digital Multimeters



The DL Series of Digital Multimeters comprises of four models providing comprehensive features to suit a wide range of applications.

All Models

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  - ★ Auto/Manual Ranging
  - ★ Large LCD Display
  - ★ Analogue Bargraph
  - ★ Data Hold
  - ★ Supplied With Test Leads & Protective Holster
  - ★ Diode-Continuity Range
  - ★ Mathematical Functions (DL-92, 94, 97)
  - ★ Capacitance/Frequency (DL-92, 94, 97)
  - ★ dBm (DL92, 94, 97)
  - ★ Square Wave Output (DL-97)
  - ★ True RMS (DL94, 97)
  - ★ Accuracy/MAX Display
- |       |       |       |
|-------|-------|-------|
| DL-91 | 0.5%  | 3200  |
| DL-92 | 0.3%  | 3999  |
| DL-94 | 0.1%  | 5000  |
| DL-97 | 0.06% | 40000 |

MODEL	ORDER CODE	PRICE
DL-91	EQU472	£59.00
DL-92	EQU471	£65.00
DL-94	EQU470	£120.00
DL-97	EQU469	£185.00

FOR FURTHER INFORMATION ABOUT THE ABOVE, OR FOR  
DETAILS OF OUR COMPLETE RANGE OF TEST EQUIPMENT  
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**01664 481818** or FAX on: **01664 63976**

  
**Seme**

parameters are available from several makers. The Vann Draper DM9023 measures capacitance values in ranges from 200pF to 20,000µF: it's available at £81. Another worthwhile meter is the Tenma Extended Range LCR type from CPC at £107. It has seven inductance and resistance ranges and eight capacitance ranges.

## Signal Sources

The Promax GV698 remains foremost in value-for-money terms as a 'test card' generator. Conventional pattern generators range from the hand-held Ozan Teletest range to the bench-top Promax GV298 at £433 and the new Kenwood Models CG922 at £525 and CG932 at £825.

RF signal generators for audio servicing typically provide a range of frequencies from 100kHz to 150MHz. An excellent example is the Lodestar Model SG4162AD from Vann Draper. Its £280 price compares with that of conventional generators, but it has in addition a 150MHz counter with a six-digit LED readout. Lodestar and Leader offer conventional RF signal generators with large calibrated dials at £152 and £263 respectively. Altai's TE20D from Willow Vale is priced at £136.

Specialist audio signal generators are intended mainly for testing and fault diagnosis with expensive hi-fi gear. A new product in this category is the Kenwood Model AG204, which provides 10Hz-1MHz coverage with waveform distortion less than 0.02 per cent.

## Audio Servicing

Signal generators apart, audio servicing = assuming that the equipment on the bench is not a cheaply integrated 'stacker' - calls for specialised gear. The Kenwood FL140 and FL180A provide wow and flutter checks. So does the Promax AA-930 audio analyser, which also measures distortion. There are dedicated distortion meters such as the Kenwood HM250 and the new Tenma IN0038 from CPC. Prices here vary from £500 to over £1,000. This is OK perhaps for a specialist hi-fi workshop, but more difficult to justify for a general servicing department. The Altai TE22D is worth considering as an inexpensive audio signal generator. It's available from Willow Vale at £109.

In-car entertainment is a specialised sector of the audio servicing scene requiring, perhaps, a mighty power supply (20V/54A types are now available) and sometimes a radio security code reader like the Joule A-400 system, which comes with dedicated software for use with a PC.

## Bench PSUs

Car audio servicing excepted, more than 3A or so is seldom required from a bench-based power supply and a maximum output of 30V suffices for most needs. Units with analogue meters are less expensive than those with a digital readout, but in all cases separate and simultaneous indication of voltage and



**For satellite work the Promax ST240 from Alban checks both the receiver and the LNB.**

current are ideally required.

The AL series of variable PSUs, made by ELC, is newly available from Philips Euroservice (0181 689 4444). They have dual-LED readouts and are rated at 0-30V and up to 5A. The AL936 is a triple type. The most affordable bench PSUs are probably the Altai models, which provide 0-30V/2.5A with dual meters. Prices are £64 and £72 with analogue or digital readouts respectively. Both incorporate adjustable current limiting.

Conventional regulated bench PSUs are based on 'linear' voltage regulation. They can run very warm in some circumstances. An innovation from Promax is the PA series of units, which use the switch-mode technique. They have maximum ratings of 30V and 2A, prices ranging from £179 to £232.

Mains variacs come loosely into the power supply category. They are useful when dealing with 'kamikaze' power supply and other circuits. The market leader here is Regavolt (Claude Lyons), whose products are marketed by CPC, HRS, SEME and Willow Vale amongst others. The 4A and 2.5A types are most suitable for repair workshop use: the latter is available in portable (expensive!) and safety-protected versions. These variacs do not provide mains isolation, so care is required in use.

## Frequency Counters

A counter is not the sort of instrument you're

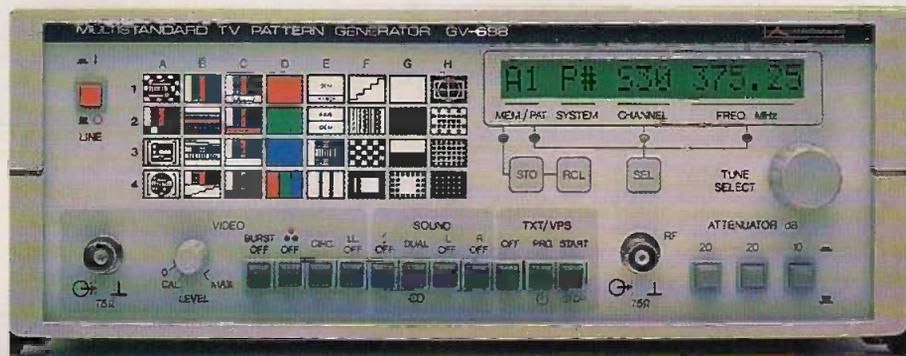
going to find on every bench in a service department. But there needs to be one on the premises for those jobs where nothing else will do. You don't get new designs coming along every month, but a complete range is newly available from Tenma. It consists of four very accurate types with maximum capabilities of 100MHz, 175MHz, 1.3GHz and 2.4GHz. Prices range from £122 to £231. They are all mains powered with eight-digit LED displays.

Amongst hand-held frequency counters the new Cub, made by Optoelectronics, is designed for RF applications with a range of 1MHz to 2.8GHz and a nine-digit LC display. It uses internal rechargeable Ni-Cad batteries or a mains charger/adaptor that comes with it, and is available from CPC (order code IT44014) at £114.

## Satellite Installation and Servicing

Satellite receivers, the analogue type anyway, can be checked and repaired using the sorts of test equipment currently employed for TV and video work. So most specialised test gear in this field is concerned with signal reception and dish alignment. For simple, i.e. fixed-dish, one-satellite, installations, the popular Satfinder finds competition in the form of the PG-753 kit (£24) and SAMM4 checker (£30) from CPC. The Promax MS250 carries a higher price tag at around £50, while the Promax ST240 at £125 checks both the receiver and the LNB - it generates sound and vision test signals on a 1.385GHz carrier.

The TC90 TV/FM/satellite signal-strength meter is new from Sadelta. It's a portable type with true microvolt/dBm and dBm readout, covering the 45-862MHz (terrestrial) and 950-2,050MHz (satellite) spectra with digital frequency and analogue strength indicators. Yours for £597. Sadelta has also introduced a VHF/UHF signal strength meter/spectrum analyser/monitor, Model TC-500, with a colour LC display for pictures and data, a five-digit frequency indicator, microprocessor control and 100 status memories. Unusually, its spectrum display is arranged horizontally. The unit is intended primarily for use with cable/MATV distribution systems. It costs £1,995, and you can watch TV on it!



**The Promax GV698 test pattern generator from Alban.**

## Digital TV

UHF spectrum analysers like the TC-500 and the less exotic but more affordable Promax MC177 (£595) are useful for Channel 5 aerial installations but will really come into their own in the coming era of terrestrial DTV broadcasting. Meanwhile, the first piece of test gear specifically designed for domestic DTV reception checks has appeared in the form of the Promax ProLink 7, which can measure signals and check modulation (e.g. MPEG-2, QPSK-1), symbol and code rates and, most important, bit-error rates (BER). Its on-board data logger produces an on-screen display in spreadsheet form, which can also be downloaded to a PC or printer.

## Alignment Tapes and Discs

Mechanical and electrical adjustment of players and recorders requires reference software with precise, format-centre track alignment and closely-specified signal levels and frequencies. König supplies a good range of test cassettes for audio work, including tape-path mirror and torque-meter types. Maxel has a range of three types for head alignment, mechanism adjustment and wow/flutter tests. Special discs are available from Philips, Pioneer and Sony, in the £30-£50 price range, for CD player tests. CPC has recently introduced some less expensive discs by Parsons/Court and Burosch.

VCR alignment cassettes are traditionally

expensive but are vital for reliable checks on mechanisms and the playback electronics. The König types are less expensive than those from manufacturers such as JVC, but are still not cheap. They are available from several distributors in a range that includes torque checkers as well as alignment masters.

Video disc player test, setting up and alignment is catered for by the Video Essentials disc, a CAV type with a wide range of sound and vision signals and tests, by Joe Kane: it can be ordered from specialist LaserDisc suppliers.

## SERVICING AIDS

The service aids and the tools used for component replacement and general repairwork are every bit as important as the test gear that enables fault diagnosis to be carried out and equipment to be set up.

## Consumables

The most used 'consumables' include solder, flux and a wide range of sprays – freezer, lubricants, cleaners and others. For fine and surface-mount work, 26 SWG (0.5mm) is the narrowest gauge of cored solder commonly available. Solder cream is sometimes a better alternative – it's available in syringes from about £7. Multicore has several new solder products, while Warton (available from CPC) offers "no residue, no clean" solder wires and creams. For desoldering,



This Tema meter from CPC has seven resistance and inductance ranges and eight capacitance ranges, from 20pF to 2,000µF.

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## SENCORE

### CM2220/2125 New Computer Monitor Troubleshooter & Colour Analyzer

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### LC102 "AUTO-Z" Dynamic Capacitor/Inductor Analyzer

Push a button and the LC102 "AUTO-Z" analyzes capacitors for all four failure modes: Value, Leakage, Dielectric Absorption, and ESR. The automatic Ringing test checks yokes, flybacks, and switching transformers.

### SC3100 "AUTO TRACKER" Automatic 100 MHz Waveform & Circuit Analyzer

Measures DC voltage, peak-to-peak voltage, RMS AC voltage, dBm level, frequency, DC current, ohms, continuity, and includes a full performance 100 MHz oscilloscope in one instrument. Its 2 mV to 2,000 volt input range automatically adjusts to complex waveforms, even the TV's horizontal output circuit.

### CR70 "BEAM BUILDER" Universal CRT Analyzer & Restorer

The "BEAM BUILDER" is the only CRT tester that gives you the ability and confidence to test every type of CRT in use today. The CR70 is pin-switched and tests all CRTs with its six dual socket adapters and a universal adapter.

### TC100 Computer Monitor Servicing Course (in your workshop)

This self study course provides a solid technical foundation on computer monitors and their circuit operation. It includes in-depth troubleshooting information on all complex computer monitor circuits.

### PR570 "POWERITE II" Variable Isolation Transformer & Safety Analyzer

Simultaneous digital displays of voltage and current draw help prevent parts damage and wasted time. The PR570's isolated output reduces shock hazards and prevents damage to the chassis and your test equipment.



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Chemwick also has a no clean braid product which has recently been introduced.

Aerosol dispensers range very widely in type and price, from £1.21 for Servisol head/drive cleaner to £13.35 for a new antistatic freezer product from Chemtronics. 'Duster' aerosols, which contain inert gas, leave absolutely nothing on the treated surface: you might pay some £12.90 for a can.

A new innovation in consumables is Chemask solder-mask, which protects components from the application of heat during surface-mount assembly and rework – it peels off afterwards, leaving no residue. Made by Chemtronics, it is supplied in squeeze bottles.

Liquid flux helps things along in all soldering and desoldering operations. It is available in aerosol form (from Electrolube at £10) and in bottle-and-brush form (from SEME, order code AID2067, at £3.80).

## Optical Aids

Work on small and intricate equipment calls for a bright, concentrated light source and, more often than not, a magnifying lens. Both are combined in the excellent bench lamps/magnifiers from Ledu. They are widely available from component suppliers



The JBC JT6040 hot-air desoldering station, which is available from Willow Vale, will deal with all types of surface-mounted devices. The control unit has an 800W heater.

and distributors. Top of the range is the new Saturn Model 771, which is an improved version of the popular 271 with three dioptre circular lens and a 22W fluorescent tube. Price is £132. Lesser magnifier-type lamps

with a fluorescent light source are available for about £60 or, with hot-filament bulbs, £40-£50.

A hand-held magnifier with fluorescent lantern can be handy for close examination of small items at the bench and in the field. Wiltsgrove has one available for £11.95, order code SER-3111.

Conventional bench lamps are available for around £36 with a compact fluorescent tube (Ledu 428) or with a filament bulb from £15 upwards. These all have long, spring-balanced, hinged arms. They can be used with a separate magnifier if required: the Vision Visor (SEME, £14) straps round your head; CPC does clip-on spectacles and hand-held types with up to ten times magnification.

## Soldering and Rework

A surface-mount rework station is perhaps the largest investment you may have to make

in servicing aids. It's one that becomes increasingly important as consumer equipment evolves. Ranging from £500 to £1,300, a typical outfit provides desoldering and soldering facilities with temperature control and hot-air or hot-contact heating systems.

Weller and Pace are leaders in this field, with top-end systems WMD3 (at £1,170) and MBT250AE (at £1,290) respectively. There is now competition in the form of the JBC JT6040 hot-air station from Willow Vale: it has a vacuum pump, 800W capability, ten different extractors and three nozzles. JBC also makes the 32N Pulsomatic soldering iron, with built-in solder feed for one-hand operation, and a new gas iron with piczo ignition (Model SG1070 at £44).

Further down the price/capability scale there's a wide range of temperature-controllable irons and special tip cartridges to suit many different types of surface-mounted chips. They include the Metcal system from SEME, the Leister Hot Jet system from CPC, and 'Pic' and 'Twceze' tools and accessories from Pace. Adcola, Denon and Nimrod solder rework stations are available from CPC, which also lists Adcola, Cliff and Pace fume extractors.

Simpler equipment may suffice for occasional or small-scale SMD work. Gas-powered, hot-air blowers in hand-held form are available from Antex, Oryx and Weller (the Pyropen) at from £15 to £70. There's a comprehensive kit from Antex at £25, and a wide range of accessories from Weller to go with the Pyropen. These devices all work with standard butane gas refills. They are capable of carrying out a good SMD fitting job with solder cream.

## Antistatic Precautions

Many semiconductor devices, including the vast majority of SMD chips, are sensitive to electrostatic charges that can build up to

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danger point without the operator being aware of their presence. To prevent this build up, and the immediate or postponed device failure it causes, an armoury of equipment is available for use in a static-free work area.

Static-dissipative sheets and mats for the bench and floor are available from SEME at £29 and £36 respectively; the same distributor lists a complete workstation for bench use at £40. For field servicing, outfits with accessories are available from SEME at £34 and CPC at £47. Wrist straps, earthing cords and earth bonding plugs are available

separately, also 3M shoe heel and toe earthing assemblies (from CPC).

A 'high-profile' wall-mounted wrist-strap test station is available from SEME at £93 (order code AID2076). CPC has a more modest type, the MiniMeg touch test, at £38. You can even get an executive antistatic wrist band, for Chief Engineers presumably, if you want to pay three times the cost of an ordinary one.

## In Conclusion

These then are the tools of the trade in 1997. Those who aspire to good test gear but

cannot readily manage the prices quoted here can contact Stewart of Reading (01189 268 041): this company stocks a wide range of used and nearly-new instruments at lower than brand-new cost.

Note that all the prices quoted in this supplement are net of VAT.

I can recall when a roll of twelve-gauge solder, a big solder gun, a can of jungle juice (paraffin-based switch cleaner), an analogue multimeter and a neon screwdriver would get you through the working day. In my case it was all carried around rural Sussex in a white Morris 1000 van. Happy days!

## TEST EQUIPMENT MANUFACTURERS AND DISTRIBUTORS

**Note that many items are available from several different sources. The suppliers listed below have been selected because they carry a reasonable range of the named brand of equipment.**

**Adroit Technology Ltd.** Available from CPC.

**Alban Electronics Ltd.**, 6 Caxton Centre, Porters Wood, St Albans, Herts. AL3 6XT. 01727 832 266.

**Altai.** Available from SEME.

**Avo/Megger.** Avo International, Archcliffe Road, Dover, Kent CT17 9EN. 01304 502 100.

**Black Star.** 4 Harding Way, St Ives, Huntingdon, Cambs PE17 4WR. 01480 462 440.

**CHS.** Prospect House, Barmby Road, Pocklington, York YO4 2DP. 01759 303 068.

**Coastal Aerial Supplies.** Unit X2, Rudford Industrial Estate, Ford, Arundel BN18 0BD. 01903 723 726.

**CPC plc.** Component House, Faraday Drive, Fulwood, Preston, Lancs PR2 4PP. 01772 654 455.

**Daiwa.** Available from SEME.

**Fluke.** Available from Willow Vale Electronics.

**GoldStar.** Available from Maplin.

**Hameg.** Available from CPC, SEME, Willow Vale Electronics.

**Huntron.** Available from SEME.

**Instek.** Available from Maplin.

**JVC (UK) Ltd.**, JVC House, JVC Business Park, Priestley Way, Staples Corner, London NW2 7BA. 0181 450 3282.

**Kenwood.** Available from SEME and Vann Draper.

**Konig.** Available from CHS, Willow Vale Electronics.

**Leader.** Available from CPC.

**Lodestar.** Available from Vann Draper Electronics.

**Maplin Electronics plc.** PO Box 3, Rayleigh, Essex SS6 2BR. 01702 554 161.

**Maxcom.** Available from Vann Draper Electronics, Willow Vale Electronics.

**Metex.** Available from CPC, SEME.

**Müter.** Available from SEME in the UK, from Donberg Electronics, Ranafast, Co. Donegal (075 48 275) in Ireland.

**Ozan.** Freeport, Wimborne, Dorset BH21 7BR. Freecall 0500 009 070.

**PC Control Systems Ltd.**, Hamilton House, 66 Palmerstone Road, Northampton NN1 5EX. 01604 601 677.

**Philex plc.** 110-124 The Broadway, West Hendon, London NW9 7PP. 0181 202 1919.

**Precision Gold.** Available from Maplin.

**Promax.** Available from Alban Electronic Ltd.

**Sadelta.** Available from Coastal Aerial Supplies and Willow Vale.

**Satellite Solutions (UK) Ltd.**, 1 Hartburn Close, Crow Lane Industrial Estate, Northampton NN3 9UE. 01604 787 888.

**Satfinder.** Available from Willow Vale Electronics.

**Satlook.** Available from Satellite Solutions.

**Seaward.** Available from CPC, SEME, Willow Vale Electronics.

**SEME Ltd.**, Unit 2, Saxby Road Industrial Estate, Melton Mowbray, Leics LE13 1BS. 01664 481 818.

**Sencore.** UK agents ITM Ltd., 34 Beaufoyo Avenue, Ferndown, Wimborne, Dorset BH22 9RH. 01202 872 771.

**Tenma.** Available from CPC.

**Thandar/Thurby.** Available from Willow Vale Electronics.

**Unaohm.** Available from Satellite Solutions.

**Vann Draper Electronics.** Unit 5, Premier Works, Canal Street, South Wigston, Leics LE18 2PL. 01162 771 400. Stocks a wide range.

**Willow Vale Electronics Ltd.**, 11 Arkwright Road, Reading, Berks RG2 0LU. 01189 876 444.

**Test gear is also available from:**

**HRS Electronics Ltd.**, 100 Great Barr Street, Birmingham B9 4BB. 01217 666 668.

**Stewart of Reading.** 110 Wykeham Road, Reading, Berks RG6 1PL. 01189 268 041. Also supplies used equipment.

# Television reader offer

## 100kHz to 150MHz RF signal generator for just £129

Normally, the Loadstar SG4160B 150MHz signal generator sells for £129 plus 17.5% VAT and delivery costs. But Television readers can obtain this instrument for just £129 – fully inclusive of VAT and delivery. This represents a saving of well over 15%.

Distributed by Vann Draper, the SG4160B bench generator covers 100kHz to 150MHz in six ranges – and up to 450MHz via third harmonic. It has an internal 1kHz oscillator for amplitude modulation up to 30%, which is also accessible on the front panel. There are also facilities for connecting an external modulation signal of between 50Hz and 20kHz.

Featuring a crystal checker with a range of 1 to 15MHz, the mains-powered 4160B provides an RF output of up to 100mV RMS, unloaded, at all frequencies up to 35MHz. Attenuation is controlled via a high/low switch and fine adjuster.

To receive your RF generator, simply fill in the coupon on the right and send it, together with payment to Vann Draper Electronics at Unit 5, Premier Works, Canal Street, South Wigston, Leicester LE18 2PL. Alternatively fax credit card details with order on 0116 2773945 or telephone on 0116 2771400. Address orders and all correspondence relating to this order to Vann Draper Electronics



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\*Overseas readers can also obtain this discount but details vary according to country. Please ring, write or fax to Vann Draper Electronics.

# PINCH ROLLERS

Model	Price	Model	Price	Model	Price	Model	Price	Model	Price
<b>AKAI</b> VS10, VS9300, VS9500, VS9700, VS9800, VF7000, VF7700 VS1, VS2, VS3, VS4, VS5, VS6, VS8, VS9, VS12, VS15 VS105, 112, 115, 116, 120, 125, 126, 155, 165, 205, 220, 240, 244, 245, VS247, 248, 250, 512, VS515, 516, VSX9 VS201, 301, 303, 304, 603, 606, 607, VS98, VS982, VS98, VP82 VS125, VS155, VS165, VS220, VS240, VS250, VS512 VS22, 23, 25, 35, 37, 38, 53, 66, 75, 422, 425, 426, 427, 462, 465, 467, VS485, 765, 766, 767, 768, 865, 867, 965, 967, VS477, VSA650 VSF10, 11, 12, 15, 190, 200, 210, 220, 221, 222, 230, 240, 30, 33 VSF330, 4, 500, 550, VS98, VSR100, VSX400, 450, 470 VSF260, 261, 262, 265, 270, 274, 275, 280, 290, 340, 350, 410, 420, 430 VSF41, 440, 450, 455, 480, 490, 497, 510, 660, 580, 590, 599, 600, VS620, 21, 23, 24, 25, 30, 33, 34, 35, 51, 54, 55, 60, 64, 65, 70, 73, 74, 75, VSP110, VSX650, VSX580 VS17, 20, 22, 23, 24, 25, 26, 27, 35, 37, 38, 53, 55, VSA77 PINCH ROLLER ASSEMBLY VS422, 425, 426, 427, 462, 465, 467, 485, 498, 765, 766, 767, 768, 865, 867, 965, 967, VSA650, VSF10, 11, 12, 14, 15, 18, 190, 200, 210, 220, 221, 222, 230, 240, 30, 300, 301, 310, 320, 33, 330, 4, 500, 510, 600 VSR110, VSX100, 400, 450, 470 PINCH ROLLER ASSEMBLY VSS99 ALBA VCR3000X, VCR4000 VCR5000, VCR6000 VCR161, VCR222 VCR7000, VCR7600, VCR8000, VCR8800 VTV10 AMSTRAD VCR1000, 2000, 4500, 4600, 4700, 5200, 6000, 6100, 6200, 8600, VCR8602, 8603, 8604, 8700, 8704, 8714, 8800, 8804, 9000, 9005, VCR9244, 9340, DD8900, 8904, TVR1, 2, 3, 4 VCR7000 DD8900, DD9300, VCR6000, 6100, 6200, 8600, 8602, 8603, 8604, VCR9700, 8600, 9000-8, 9140, 9244, 9340 PINCH ROLLER ASSEMBLY PART NO: 153148 TX3650, UF20, VCR3000, VCR3600, VCR4000, VCR9500 PINCH ROLLER ASSEMBLY PART NO: 2554966 DD9900, 9904, TX3650, UF20, 22, 24, VCR3000, 3002, 9500 VS1004, VS1104 FERGUSON 3V00, 3V01, 3V16, 3V22, 3V23, 3V24, 3292, 8900, 8901, 8902, 8903, 8904, 8906, 8905, 8912, 8922, 8923, 8924, 8925, 8929 3V29, 3V30, 3V31, 3V32, 3V52, 8930, 8931, 8933, 8940, 8941, 8942 3V35, 3V36, 3V38, 3V39, 3V42, 3V43, 3V44, 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FVHD230, 250, 270, 370, 2000D, FVHP3, 210, 250, 300, 310, 1100, FVHP1200, 1250, 130, 132, 1340, 1340, 1400, 1410, 1440, 1500, 200, FVHP320410, 420, 430, 440, 445, 470, 475, FVSP2905, 495, 2905 FVHD140, FVHD40, FVHD55, FVHP1, FVHP10, FVHP20 FVHP10, 40, 55, FVHP1, 10, 25, 30, 40, 4000, FVHS10, 30 PINCH ROLLER ASSEMBLY GOLDSTAR GHV51, 1221, 1232, 1233, 1240, 1241, 1242, 1243, 1244, 1245, 1246, 1250 GHV1241, 1242, 1250, 1255, 1259, 1291, 1295, 1296, 1382, 1393, GHV1891, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV3210, 8215, 8430 GHV1240, 1241, 1242, 1248, 1290, 1291 GHV1295, 1295, VCP4000, 4100, 4130, 4200, 4300, 4301, 4305, VCP4305, 4310, 4311, 4315, 4316, 4320, 4321, 4325, 4326, 4356, GSE1290, 1291, 1295, 1296, 1297, 1891, 1910, 2005, 2000 HITACHI VT7, 11, 14, 16, 17, 18, 19, 33, 34, 35, 350, 38, 39, 88, 330, 680, 4200, VT5000, 6000, 5500, 6500, 6800, 7000, 8000, 8300, 8500, 8700, 9300, VT9500, 9700, 9900, VM800 VTR, 52, 57, 61, 62, 63, 64, 65, 85, 86, 88, 100, 110, 111, 113, 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90, 101, 102, 103, 200 VXL2, VXL3 VXL4, VXL20, VXL35 VXL100, VXL110, VXL11, VXL9, VXL30 PINCH ROLLER ASSEMBLY V20H, VXL5, VXL6 MOO KIT J.V.C. HRZ200, 3300, 3330, 3360, 3660, 4100, 7700 HRZ650, 7200, 7300, 7350, 7600, 7610, 7650, 7850 HRD110, 111, 120, 121, 140, 141, 142, 143, 150, 152, 155, 157, 158 HRD160, 170, 225, 250, 257, 445, 455, 565, 568, 725, 755, HRP50, BRP5000, BR7000, BR8561, 811 HRD520, 540, 550, 560, 580, 600, 610, 620, 637, 640, 641, 650, 660, HRD670, 720, 730, 740, 770, 820, 830, 840, 860, 870, 880, 910, 960, HRD980, HRD20, 22, 25, HRJ200, 205, 210, 215, 300, 315, 316, 318 HRJ400, 405, 407, 410, 411, 415, 416, 507, 600, 605, 610, 615, 715, 815 HRJ97, HRJ470, 5800, 5900, 6600, 6900, SR3200, 330, 368 HRD110, 171, 180, 210, 211, 217, 230, 300, 320, 330, 337, 350 HRD370, 400, 430, 440, 441, 470, 500, 530, 700, 750, 950, HR55000, 5500, 8000, 9000, BR7030, 7040, 9060, HR5800, 605, 747, 777, 920, 925 HR510 BRP5000, HRD110, 111, 120, 220, 225, 455 HRD140, 141, 142, 143, 150, 152, 157, 159, 160, 565, 566, 725, 755, HRP50 PINCH ROLLER ASSEMBLY HRD1520, 510, 520, 521, 522, 525, 527, 580, 600, 610, 620, 637, 641, HRD650, 720, 890, 840, 910, HRJ205, HR55800 HRD230, 271, 300, 310, 320, 321, 330, 337, 350, 400, 430, 440, 441, HRD470, 500, 530, 700, 750, 950, HR55000, 5500, 9000 PINCH ROLLER ASSEMBLY HRD470, HRD550, HRD580, HRD660, HRD680, HRD980 HRD980, HRD550, HRD580, HRD660, HRD680, HRD980 HRJ600, HRJ605, HRJ815 HS2300 MATSUI MV3000, 730, 735, 750, 755, 765, 800, 850, VS988 VX1000, VX2000, VX2500, VX3000, VX5000 MITSUBISHI HS12, 5300, 5424, 5600, HS811, 12, 18, 21, 27, 31, 32, 41, 51, 52, 82, HS12, 15, 17, 21, 22, 27, 31, 32, 41, 51, 52, 82, HSM1000, 110, 120, 15, Q, 16, 170, 190, 210, 23, 25, 250, 27, 33, 34, 35, 36, 37, 370, 380, 45, 450, 5 4, 55, 555, 57, 58, 59, 68, HSM2, 9, HSS11, 14, 15, 17, 19, 25, 5600, HV FL25, 50, 303, 85, SV8900, 8930 PINCH ROLLER ASSEMBLY PART NO: 9480020010 HSE11, 12, 16, 17, 21, 22, 27, 31, 32, 41, 51, 52, 5300, 5424, 5600, HS811, 12, 18, 21, 27, 31, 32, 41, 51, 52, 82, HSM1000, 110, 120, 150, HSM16, 170, 18, 190, 210, 23, 25, 250, 27, 30, 33, 34, 35, 36, 37, 370, 380, HSM380, 40, 45, 450, 50, 54, 55, 555, 57, 58, 59, 60, 68, HSM2, 9, HSM21, 18, 19, 2, HSS11, 12, 14, 15, 17, 19, 21, 25, 5600, HVF125, HVF150, 203, 85, SV8900, 8930 PINCH ROLLER ASSEMBLY HS210, HS240, HS710, HSB 10, HSB20, 30, HSE10, HSE20, HSB30, HSB30, HSB30, HS300, HSB20, HSB30, HSB30, HSB30, HS300 HS300, HSB37, HS318, HS319, HS337, HS338, HS347, HSB39, HSB40, HSB410, HSB411, HSB412, HSE10, HSB40, HSB710, HSB 10, HSB20, 30, HSE20, HSB30, HSB30, HSB30, HSB30, HS300 HS300, HSB37, HS318, HS319, HS337, HS338, HS347, HSB39, HSB40, HSB410, HSB411, HSB412, HSE10, HSB40, HSB710, HSB 10, HSB20, 30, HSE20, HSB30, HSB30, HSB30, HSB30, HSB30, HS300 NATIONAL PANASONIC NV100, 180, 300, 330PX, 332, 333, 340, 366, 600, 688, 777, 788, 3321, AG6710, 6015, 6100, 6200, 6400, 6800, 7450 NV230, 250, 260, 280, 370, 380, 430, 431, 433, 450, 460, 465, 470, 480 NV630, 650, 730, 770, 780, 810, 830, 850, 870, 890, 2000, 2010, 3000, NV7000, 7200, 7800, 9050, 8150, 8170, 8200, 8300, 8400, 8500, 8600, NV8610, 8620, NVG114, 14, 16, NVG7, 10, 12, 15, 18, 30, 130, 400, AG 1000, 1050, 1200, 1500, 2100, 2200, 6500, 8810, 7500, 7510, NVH70 NV69, NVG120 AG6840, 6720, 7150, 7330, 7350, 7355, 7560, NVH65, 75, NVJ30, NVL20, 23, 25, 28, NVG300, NVF85, NVF70, NVF51 NVF5, 100, NVG 19, 20, 25, 33, 40, 50, NV8000 NVH48, NVH80, NVG21 NVG45 NVJ700PX NVH1000, NVH1010, NCHD90, NVSD30, NVSD40 PINCH ROLLER ASSEMBLY AG5150, 6250, 5700, 6024, NVH38, 48, 80, NVF55, 65, 70, 75, 77, NVF51, 100, 200, 88, 90, NVG 19, 20, 21, 22, 23, 25, 28, 300, 33, 40, 45, 46, NVG50, NVH65, 75, 77, NVJ30, 33, 35, 37, 40, 42, 45, 47, NVL20, 23, 25, 28, NVW 1 PINCH ROLLER ASSEMBLY N.E.C. N830, 831, 832, 833, 895 PVC2300, 2400, 740, 744, 746, 780, 764, 768 N9100, 1600, 1800, 2000, 3000, N9012, 9013, 9014, 9016, 9039 N9304, 9063, 9054, 9055, 9056, 9066, 9056, 9100, 9120, 9510, 9200, N9530, 9100, PX 1520 DS6000G, DX4000, N9077 NS7000 ORION VH1, VH2 VH150, 180, VH3, 33, 200, 201, 205, 212, 250, 254, 288, 300, 303, 312, VH404, 555, 700, 704, 712, 770, 780, 844, 900, 900, 2948, 3030, 3312 VH48, VH2848 VH48, VH2848, 16000, HV03, LVH50, NEVH, NEVHM, NEVHML TVP2300, VCR VH04, 30, 103, 300, 358, 360, 362, 400, 416, 512, VH530, 532, 535, 536, 600, 630, 635, 640, 666, 730, 735, 744, 774, 790, VH800, 820, 850, 888, 893, 900, 930, 940, 942, 974, 1012, 1040, 1050, VH1060, 1070, VH1100, 1120, 1204, 1440, 1500, 1660, 1800, 2004, VH2151, 2308, 22042400, 2500, 2600, 2700, VH2960, 2970, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4300, 5020, VH10, 200, 220, 225, 245, VR21, 925, 1032, 2949, 2959, 2957, 2966, 2979, 2980, VTV300, VXL20, 25, 30 PHILIPS VR660 VR620 VR2020, VR2021, VR2022, VR2023, VR2024 VR6711 VR6540 DV856, 586, VR702, 703, 6485, 6585, 6589, 6785, 6880, 6948 VR445, VR6442, VR6542, VR6843, VR6843, VR6943, 44S89 DV454, 662, VR2220, 2300, 2324, 2330, 2334, 2340, 2350, 2414, VR2480, 2485, 2486, 2489, 2490, 2498, 2840, 6462, 6463, 6464, 6560, VR6660, 6860, 6861, 6862, 6863 N-VR100, VR2870 VR2025, VR6580, VR6581 49S86, VR3260, 6349, 6448, 6449, 6548, 6648 PRESSURE ROLLER ASSEMBLY PS403-40205 DV186, 190, VR211, 2115, 212, 213, 223, 286, 291, 292, 311, 312, 313, VR3210, 3210, 322, 3229, 323, 53580, 486, 471, 562, 562, 571, 571, VR1, 202, 202, VR203, 302, 303, 305, 6180, 6182, 6185, 6285, 6290, VR5291, 6293, 6362, 6367, 6390, 6391, 6393, 6467, 6468, 6470, 6561 VR6570, 6581VR6670, 6676, 6710, 6760, 6761, 6762, 6870, 6970, VX8310, 6881, 63S87, 68S84, 71S84, 71S85, 72S88, 72S88, 92S81, 20DV1, 20DV2, 20RW7, 21DV1, 21DV2, 25S80, 25S82, 25S811, 25S812, 30DV2, 31DV1, 31DV2, 31DV3, 35S80, 35S83 35S80, 35B11, 35B12, 35B13 VR231, 232, 332, 422, 4229, 512, 5229, 722, 727, 723 VR501 PR38 165p SANYO VHR1100, 1110, 1150, 1200, 1300, 1500, 2100, VHR120, 2500, VHR2700, 3300, MVR2200 VTC2000, 5150, 5300, 5350, 5400, 5500, 6000, 6010, 6500, VTCM10, 20, 11, 21, 30, 31, 40, 50, VTC9300, VTCM10, 20, 11, 21, 30, 31, 40, 50, VPR5800 VHR3100, 3300, 3310, 3400, 3500, 3700, 3800, VHRD500, 700 VTC3000 VHR120, 130, 141, 143, 14, 150, 151, 153, 154, 15, 16, 171, 194, 22, OVHR23, 235, 240, 244, 250, 251, 274, 27, 297, VHR1100, 330, 335, 350, VHR4100, 4105, 4150, 4200, 430, 4300, 4350, 4400, 474, 4770, 5080, VHR5100, 5200, 5300, 5350, 5600, 5700, 6850, 7000, 7200, 7250, VHR7250, 7300, 7400, 7440, 7500, 7520, 7530, 7540, 7700, 774, 780, OVHR7810, 8000, 8070, 8100, 8200, 8250, 8500, 8800, VHRD4000, 4410, 4500, 4600, 4610, 4710, 4880, 6700, VHR5700 VCR100 VHR120, 135, 150, 190, 4150, 4160, 4350, 5200, 5240, 5350, 7200, 7250, 7260, 7700, VHRD4410, 4610, 4710, 4880, 6450, VHR5700 PINCH ROLLER ASSEMBLY VHR3100, 3200, 3300, 3310, 3400, 3700, 3800, VHRD500, 700 PINCH ROLLER ASSEMBLY SHARP VC200, 381, 383, 384, 385, 386, 388, 390, 393, 800, 2300, 3300, 6000, 838, 9100, 9300, 7900, 7700, 7750, 7800, 8300, 838, 9100, 9300, 9400 VC500, 9600, 9700, 9800 VC300, 387, 402, 471, 473, 477, 481, 482, 483, 486, 488, 498, 500, 571, 573, 581, 582, 583, 584, 585, 8481, VC5F3, VC5W20E, VCA1031 VC198, 208, 405, 408, 550, 600, 651, 671, 674, 681, 682, 684, 685, 693, VC699, 700, 772, 750, 779, 780, 781, 7810, 782, 782MK2, 7822, 783, VC785, 786, 787, 793, 800, 7810, 7822, VCT72, VCG63, VCG63, VCA 100, 102, 104, 131, 140, 170, 202, 203, 211, 234, 303, 501, 502, VCA602, 5011, VCD801, 802, 851, 852, 881, 882, VCM73, VCT73, VCT72, VCR386 VC220 VCA10, 30G, 60, 103, 105, 106, 111, 113, 131, 211, 244, 254, 33, 35, 36, VCA37, 39, 40, 42, 454, 46, 47, 48, 50, 505, 51, 52, 53, 54, 55, 57, 58, 505, VCA60, 605, 615, 62, 63, 67, 68, 1031, 11613, VCR311, 320, VCS97, VCD805, 805, 810, VCS100, 81, 865, 910, VCS 1000, VCT310, VCT410, 610, VCT 1314, 5313, VCT90 VCR790, VCA10, 103, 1031, 105, 106, 211, 244, 254, 255, 30, 35, VCA340, 43, 47, 50, 60, 605, 615, VCD806, 815, VCH800, 81, 83, 85, VCH865, 87, 910, VCS 1000, VCT212, 310, 9									

# VIDEO SERVICE KITS

<b>AMSTRAD</b> VCR700 Contents BELT SET, PINCH ROLLER, REEL IDLER VIDEO LAMP Order Code: SK41	<b>HITACHI</b> VT11/V133 Contents BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK08	<b>NV600/NV588</b> Contents BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND Order Code: SK25	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER TYRE, FF/REW IDLER TYRE Order Code: SK26
<b>FERGUSON &amp; JVC</b> 3V42/43 HRD45/HRD725 Contents BELT SET, PINCH ROLLER, CLUTCH MECHANISM, TENSION BAND Order Code: SK37	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, SUPPLY CLUTCH, TAKE UP CLUTCH Order Code: SK38	<b>NV730/NV770</b> Contents SLOT IN BELT, LOADING BELT, PINCH ROLLER, IDLER UNIT, TENSION BAND Order Code: SK19	<b>Economy Kit Contents</b> SLOT IN BELT, LOADING BELT, PINCH ROLLER, IDLER TYRE Order Code: SK20
<b>3V58/39/64/65</b> HRD170/180/210/230/300/320/370/400/430/530/700/750 HR5500 Contents BELT SET, PINCH ROLLER, IDLER ARM, TENSION BAND Order Code: SK44	<b>VT52/61/62/63/64/65/85/86/640</b> Contents BELT SET, PINCH ROLLER, FF/REW ARM, CLUTCH PLATE, TENSION BAND Order Code: SK49	<b>NV370/NV380/480/630/780/830/850/AG2100PK/AG2200PK</b> Contents BELT SET, PINCH ROLLER, IDLER, TENSION BAND Order Code: SK21	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK22
<b>3V29/3V30</b> HR7200/7300/7350 Contents BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK05	<b>VT400/405/410/13/14/15/16/420/25/28/28/430/31/35/48/450/490/510/520/25/26/530/35/36/540/545/48/48/570/75/576/580/85/88</b> Contents TIMING BELT, PINCH ROLLER, FF/REW ARM, CLUTCH BASE, TENSION BAND Order Code: SK52	<b>NV777/NV788</b> Contents BELT SET, PINCH ROLLER, IDLER UNIT, TENSION BAND Order Code: SK17	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK18
<b>3V35/36, 38/39/49</b> HRD110/111/120/225 Contents BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK04	<b>VT100/110/111/131/15/118/120/125/128/130/135/138/145/150/175/220/225/250/255/258/260/V130</b> Contents BELT SET, PINCH ROLLER, FF/REW ARM, CLUTCH PLATE, TENSION BAND Order Code: SK51	<b>SHARP</b> VC381 Contents BELT SET, PINCH ROLLER, REEL IDLER, TENSION BAND, VIDEO LAMP Order Code: SK47	<b>Economy Kit Contents</b> REEL IDLER TYRE Order Code: SK48
<b>3V31/3V42</b> HR7600/7610/7650/7655 Contents BELT SET, T/U REEL TABLE TYRE, PINCH ROLLER, REEL IDLER, T/U CLUTCH, T/U IDLER, TENSION BAND, VIDEO LAMP Order Code: SK33	<b>PANASONIC</b> NV2000/NV2010/NV7000/NV7200/NV7800 Contents BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK03	<b>VC500/VC571/VC581/VC582/VC583/VC584/VC5F3</b> Contents BELT SET, PINCH ROLLER, REEL IDLER, TENSION BAND Order Code: SK60	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, REEL IDLER Order Code: SK61
<b>3V35/36/38/39/49</b> HRD110/111/120/121/225 Contents BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, T/U CLUTCH, T/U IDLER, REEL IDLER, TENSION BAND Order Code: SK05	<b>NV300/NV330/NV333/NV340/NV366</b> Contents BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRE Order Code: SK01	<b>VC781/VC781B/VC782/VC785/VC786/VC793/VC800/VC810/VC810A/VC810B/VC810C/VC810D</b> Contents BELT SET, PINCH ROLLER, REEL DRIVE UNIT, TENSION BAND Order Code: SK64	<b>Economy Kit Contents</b> REEL DRIVE UNIT TYRE Order Code: SK65
<b>3V29/3V30</b> HRD7200/7300/7350 Contents BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, REEL IDLER, T/U CLUTCH, T/U IDLER, TENSION BAND, VIDEO LAMP Order Code: SK31	<b>NV2000/NV2010</b> Contents BELT SET, PINCH ROLLER, FF IDLER, PLAY IDLER, TENSION BAND, VIDEO LAMP Order Code: SK13	<b>VC681/VC682/VC684/VC685/VC693/VC696/VC6F3/VC700</b> Contents BELT SET, PINCH ROLLER, REEL DRIVE UNIT, TENSION BAND Order Code: SK62	<b>Economy Kit Contents</b> REEL DRIVE UNIT TYRE Order Code: SK63
<b>3V44/45/48/53/54/55/57</b> HRP60/HRD140/150/158/160 HRD250/257/565/566/755 Contents BELT SET, PINCH ROLLER, CLUTCH MECHANISM, TENSION BAND Order Code: SK39	<b>NV7000/NV7200/NV7800</b> Contents BELT SET, PINCH ROLLER, IDLER UNIT, PLAY IDLER, TENSION BAND Order Code: SK11	<b>NV300/NV330/NV333/NV340/NV366</b> Contents BELT SET, PINCH ROLLER, IDLER UNIT, PLAY IDLER, TENSION BAND Order Code: SK15	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, IDLER TYRE, CLUTCH TYRE Order Code: SK12
<b>FISHER</b> FVHRP905/906/907/908/910/911/916/918 Contents BELT SET, PINCH ROLLER, IDLER, GEAR IDLER UNIT, TENSION BAND Order Code: SK57	<b>NV332</b> Contents BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND, FF/REW TYRE Order Code: SK29	<b>NV67/NV69/NV610/NV611/NV612/NV614/NV615/NV616/NV618/NV630/NV6120/NV6130/NV6400/NV655 (PX/ACV/AG1810 (P/K))</b> Contents LOADING BELT, CAPSTAN BELT, PINCH ROLLER, IDLER, TENSION BAND Order Code: SK27	<b>Economy Kit Contents</b> LOADING BELT, CAPSTAN BELT, PINCH ROLLER, IDLER TYRE Order Code: SK28
<b>FVHP615/618/620/622/710/711/715/716/720/721/722/725/730/830/840</b> Contents BELT SET, PINCH ROLLER, IDLER, GEAR IDLER UNIT, TENSION BAND Order Code: SK68	<b>NV230/250/260/280/430/450/460/470/650/810/890/AG2100PK/AG1500PK</b> Contents BELT SET, PINCH ROLLER, IDLER, TENSION BAND Order Code: SK23	<b>NV332</b> Contents BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND, FF/REW TYRE Order Code: SK29	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK24

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## REPLACEMENT VIDEO CASSETTE HOUSINGS

Name	Models	Code	Price	Name	Models	Code	Price	Name	Models	Code	Price
<b>AKAI</b>	VS35, VS53, VS55, VS56, VS75	CH18	3200p	<b>F318</b>	HRD515, 520, 527, 540, 590, 580, 600, 610, 620, 660, 670, HRD830, 840, 850, 860, 860, 860, 860, FV37H	CH20	2200p	<b>VCA103, T03GV, 106, 106GVM, 254GVM</b>	CH23	2500p	
<b>GRANADA</b>	VHSDP1, VHSYJ2	CH05	1100p	<b>HRD540, 580, 830, 860, 910, 960, HRD970, HRD X20</b>	CH27	2400p	<b>VCS211, 244, 5055, 605, VCB230, VCD806G, 810G, VCT121, 310, 410G, 610</b>	CH24	2500p		
<b>GOLDSTAR</b>	GHV1290P, 1291P, 1295P, 8400, 73401, GSE1295P, GSE1891P, 20001Q, 20051Q, VCP4200, 4300, 4301, 4305, VCP4306, 4311, 4315, 4316, 4320, 4321, 4325	CH25	2000p	<b>FV57H</b>	VR3605, VR3905	CH01	2800p	<b>VCD806G, 810G, VCT121, 310, 410G, 610</b>	CH24	2500p	
<b>FERGUSON &amp; J.V.C.</b>	3V38, 3V39, 8943, 8944, 8951, 3V35, 3V36, 3V49, HRD 110, 111, 120, 121, 225	CH01	2800p	<b>VR3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6943</b>	CH02	2800p	<b>VCD806G, 810G, VCT121, 310, 410G, 610</b>	CH24	2500p		
	3V42, 3V43, 3V44, 3V45, 3V49, 3V53, 3V54, 3V55, 3V57, 8945, 8947, 8948, HRD 140, 141, 150, 157, 158, 160, 250, HRD257, 455, 565, 566, 725, 755	CH02	2800p	<b>VR3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948</b>	CH06	4300p	<b>VCD806G, 810G, VCT121, 310, 410G, 610</b>	CH24	2500p		
	8948, 8950, FV10B, 12L, 13H, 14T, 20B, 21R, 22L, 26, 395, HRD230, 430, 530	CH03	2800p	<b>NV730</b>	N830EG, N831EG, N831EG, N832, N833EG, N895	CH01	2800p	<b>VCD806G, 810G, VCT121, 310, 410G, 610</b>	CH24	2500p	
	3V58, 3V59, 3V64, 3V65, FV11R, 8950, 8951, HRD170, HRD180, HRD370	CH04	2800p	<b>PHILIPS</b>	CASSETTE LIFT ASSEMBLY (69120366)	CH02	2800p	<b>VCD806G, 810G, VCT121, 310, 410G, 610</b>	CH24	2500p	
				<b>DV186, 190, 286, 471, 562, 761, VR6180, 6182, 6185, 6295, VR6290, 6291, 6293, 6362, 6367, 6393, 6467, 6468, 6470, VR6561, 6670, 6780, 6781, 6870, 6970</b>	CH05	1100p	<b>VCD806G, 810G, VCT121, 310, 410G, 610</b>	CH24	2500p		
				<b>VR6443, VR6448, VR6548, VR6588</b>	CH22	2900p	<b>VCD806G, 810G, VCT121, 310, 410G, 610</b>	CH24	2500p		
				<b>VCA100, VCH851, VCH852</b>	CH24	2900p	<b>VCD806G, 810G, VCT121, 310, 410G, 610</b>	CH24	2500p		

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 FITS:  
 VCR 4500, 4600, 4700, 5200, TVR 1,2,3  
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**PRICE : £2.75 + VAT each**  
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## MODE SWITCH

NV2000, 2010, 7000, 7200, 7800 (VS50048)	
NV230, 260, 430, 810, 870, 2300, 4300 (VSS0110)	<b>£3.50</b>
NV830 (VSS0091)	<b>£2.25</b>
NV300, 333, 340, 366, 688, 777, 778 (VSS0060)	<b>£2.10</b>
NVG21, 25, NVH65, NVD80 (VSS0175A)	<b>£3.75</b>
	<b>£2.00</b>

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**AMSTRAD ORIGINAL NO: 150751**  
 Used on: AMSTRAD TVR1, 2, 3, VCR4600, 4600MKII, 4700, FUNAI VS2, VCR4600, 4800, 5200, 5600, VIP3000, 5000  
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**AMSTRAD ORIGINAL NO: 153134**  
 Used on: AMSTRAD DD8900, 8904, VCR2000, 6000, 6100, 8600, 8602, 8603, VCR8604, 8700, 8704, 8714, 8900, 9005, 8244  
 Also fits: ANTECH, BONDSTEC, CASIO, CROWN, FIDELITY, GOLD-HAND, GRANADA, HINARI, MARQUANT, OMEGA, PROFEX, SCHNEIDER, SEG, SENTRA, SHINTOMI, TASHIKO, TATUNG, TOWADA, UNIVERSUM **ORDER CODE: AH02 PRICE: 1450p**

### Replacement Audio Control Video Sound Head for National Panasonic

PART NUMBER	MODELS	PRICE
VBR0091	NV67 etc	875p
VBR0050	NV300, NV340 etc	875p
VBR0061	NV777 etc	875p
VBR0103A	NV250, NV450 etc	625p
VBR0125		625p

## VIDEO TOOLS

### VIDEO CLEANING STICKS

Price 17p each 15p each pack of 10pcs  
 13p each pack of 25pcs  
**Order Code: SP14**

### VIDEO MAINTENANCE TOOLS

Set of 8 Allen keys packed in a plastic wallet  
**Order code: TOOL 9, Price 125p**  
 Specifically designed for video maintenance

### UNIVERSAL HEAD EXTRACTOR

Hand tool designed for extracting hard to remove heads without damage to either the head or the mounting assembly. Adjustable so as to suit various heads.  
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**CONTAINS: SET OF 7 HEAD & TAPE PATH ALIGNERS**  
 • RCA TYPE AUDIO & CONTROL HEAD POSITIONING TOOL  
 • RCA ADJUSTMENT TOOL FOR TAPE GUIDE POSTS  
 • RCA TYPE BACK TENSION TOOL  
 • TENSION ADJUSTMENT TOOL FOR VARIOUS USES  
 • VCR ADJUSTMENT TOOL

**SET OF 8 ALLEN KEYS**  
 0.77mm 0.90mm  
 1.27mm 1.50mm  
 1.60mm 2.00mm  
 2.40mm 3.00mm

**3 REVERSIBLE SCREWDRIVERS**  
**3 SPRING HOOK**  
**CIRCLIP PLIERS**  
**MICRO SCREWDRIVER**

### VCR HEAD EXTRACTOR

**Order code: TOOL 10, Price 2900p**

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## BACK UP BATTERIES

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Part Nos: 138 - 101138, 138 - 10313 1.2v 90mAh

Order Code: BB01

Part Nos: 138 - 10229, 2.4v 100mAh

Order Code: BB02

Price: 75p

Price: 135p

### FERGUSON

Part No: 00E6 - 067 - 001 1.2V 100mAh

Order Code: BB03

Part Nos: 00E6 - 606 - 8001 2.4V 100mAh

Order Code: BB04

Price: 90p

Price: 150p

## SATELLITES

MAKE & MODEL	CODE	PRICE
PACE PRD800, PRD900	SATPSU1	650p
PACE SS9000, 9200, 9010, 9210, 9220	SATPSU2	650p
AMSTRAD SRD510, SRD520	SATPSU3	650p
AMSTRAD SRD500	SATPSU4	650p
AMSTRAD SRX340, SRX345, SRX350	SATPSU5	650p
PACE D100/150	SATPSU6	650p
CHURCHILL D2MAC	SATPSU7	650p
PACE MSS100	SATPSU8	730p

MAKE & MODEL	CODE	PRICE
PACE MSS200/300 APPOLL	SATPSU9	900p
PACE MSS500/1000	SATPSU10	1230p
FERGUSON SRD4	SATPSU11	835p
ECHOSTAR SR5500	SATPSU12	1735p
ECHOSTAR 6500/7700/8700	SATPSU13	3125p
AMSTRAD SRD600	SATPSU14	3125p
MIMTEC (Surensen)	SATPSU15	775p
AMSTRAD SRD700, SR950, SRX100, 301, 501, 502, 1002, 2001, SRD2000 SAT250	SATPSU16	730p

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PACE PRD900/MSS1000 2Ghz (221-21770112)  
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PACE 9000  
**ORDER CODE: PACE9000 PRICE: 800p**

PRD800/PRD900  
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### SATMETER

The Satmeter is a professional portable satellite strength meter designed for the installation and maintenance of satellite TV systems. The Satmeter can be used as stand alone with powering the LNB as well as in loop.

Through operation with satellite RX powering the LNB.

\* Acoustical signal: On signal strength \*LED indicator: Vert/Hori

\* Frequency Range: 900 to 2050 Mhz \*Input impedance: 70 Ohm

\* Power amplifier: 18db \*Detection Range: -60 to -10 DBM

\* Max. input signal: -10 DBM

**ORDER CODE: TOOL22**

**PRICE: 8500p**

## REPLACEMENT TV SWITCHES

### GRUNDIG

PART No: 29703, 29102

USED ON:

C7500, C8500, C8502, C8712... ETC

Order Code: SW1

Price: 140p

### PHILIPS

USED ON:

K30, K35, K40, KT3, KT4

Order Code: SW13

Price: 95p

### SONY

USED ON:

KV1612, KB1612, KV1614, KV2052, V2056

KV2062, KV2067, KV2212... ETC

Order Code: SW5

Price: 150p

USED ON:

KV1400, KV1440, KV2040, KV2060

(POWER SWITCH 26mm)

Order Code: SW12

Price: 125p

### SONY

USED ON:

KV2020

(POWER SWITCH 21mm +Remote)

Order Code: SW6

Price: 200p

### SONY 2 PIN FUNCTION SWITCH

Order Code: SW9

Price: 35p

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- "SCRUBS" cleans the filthiest hands without water or soap , where and whenever wanted .
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- The usage of "SCRUBS" is unlimited , it can also be used to clean tools and surfaces as it does not affect metals or synthetic materials and is not combustible.
- Just remember No Rinsing , No Drying , No Residue.
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### VOLTAGE TESTER

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### SPRING HOOK

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SILICONE GREASE	200ML	SP03	210p
FREEZE IT	170ML	SP04	320p
FREEZE IT	400ML	SP16	600p
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AEROKLEANE	135ML	SP07	220p
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AERO DUSTER	400ML	SP17	550p
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COLDKLENE	250ML	SP13	220p
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ADHESIVE 120	400ML	SP19	190p
LABEL REMOVER 130	200ML	SP20	240p
REFURB 140	400ML	SP21	240p
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TUBE SILICON SEALANT WHITE	75ML	SP22	280p
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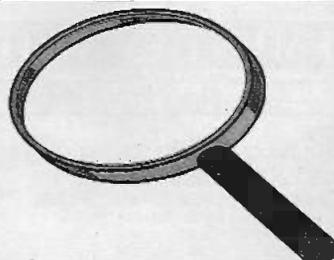
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DESCRIPTION	CODE	PRICE
<b>ANTEX SOLDERING IRONS</b>		
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15 WATT 240 VAC (XS15W 240V)	S102	900p
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AKAI			2424593			4515 03 01	LOT168	1500p	TUF 14568 F	LOT40	1500p	094-01038/0.7	LOT245	1900p	1-438-311-11	LOT95	1550p
45150344	LOT56	1650p	2432101	LOT79	1800p	4515 03 02	LOT180	1550p	TUF 14584 F	LOT41	2000p	094-01052/0.8	LOT186	1825p	1-438-311-13	LOT95	1550p
101-214017-03	LOT278	1600p	2432461	LOT169	1500p	4515 03 04	LOT169	1500p	TUF 14586 F	LOT42	1800p	094-01057/1.1	LOT285	1450p	1-438-311-31	LOT95	1550p
101-220005-03A	LOT72	1600p	2432611	LOT80	1800p	4515 03 05	LOT180	1550p	TUF 15006 F	LOT256	2500p	610.018.6620	LOT189	1650p	1-438-311-32	LOT95	1550p
D 05037	LOT27	1450p	2432651	LOT80	1800p	4515 03 06	LOT168	1550p	TUF 70012 F	LOT78	1500p	610.018.6637	LOT178	1500p	1-438-331-22	LOT96	1650p
O 05337	LOT207	1550p	2432761	LOT169	1600p	4515 03 08	LOT22	1500p	TUF 70012 A	LOT78	1500p	SHARP	LOT39	1850p	1-438-331-41	LOT98	1550p
D 06637	LOT56	1650p	2432981	LOT37	1300p	4515 03 09	LOT178	1500p	TUF 70012 A	LOT78	1500p	RTRNF 1220 CEZZ	LOT202	1800p	1-438-332-00	LOT99	1700p
D 06937	LOT200	1600p	2432981	LOT37	1300p	4515 03 10	LOT168	1550p	TUF 70018 F	LOT274	1500p	RTRNF 1783 BMZZ	LOT202	1800p	1-438-332-11	LOT99	1700p
D 06937	LOT56	1650p	2432982	LOT37	1300p	4515 03 13	LOT30	1500p	TUF 70018 F	LOT274	1500p	RTRNF 1786 BMZZ	LOT211	1850p	1-438-332-12	LOT100	1700p
FCM 2015 AL	LOT78	1500p	2433011	LOT171	1650p	4515 03 14	LOT174	1700p	TUF 70161	LOT72	1500p	RTRNF 1786 CEZZ	LOT211	1850p	1-438-332-13	LOT101	1700p
FERGUSON			2433012	LOT171	1650p	4515 03 15	LOT22	1500p	TUF 70162 A	LOT72	1500p	RTRNF 2000 BMZZ	LOT214	1750p	1-438-332-42	LOT100	1700p
00 D-3-508-001	LOT38	1650p	2433014	LOT171	1650p	4515 03 18	LOT192	1500p	TUF 70162 A	LOT72	1500p	RTRNF 2002 BMZZ	LOT207	1450p	1-438-332-52	LOT100	1700p
00 D-3-508-002	LOT38	1650p	2433212	LOT168	1500p	4515 03 19	LOT30	1500p	TUF 70162 B	LOT72	1500p	RTRNF 2002 CEZZ	LOT307	1450p	1-438-333-11	LOT100	1700p
00 D-3-508-003	LOT276	1550p	2433291	LOT172	1700p	4515 03 20	LOT190	1650p	TUF 70162 G	LOT72	1500p	RTRNF 2003 BMZZ	LOT308	1425p	1-438-333-12	LOT100	1700p
00 D-3-515-001 PL1	LOT276	1550p	2433301	LOT246	1600p	4515 03 22	LOT195	1550p	TUF 77001 B	LOT274	1500p	RTRNF 2005 BMZZ	LOT308	1425p	1-438-333-13	LOT100	1700p
00 D-4-208-001	LOT79	1800p	2433441	LOT188	1900p	4515 03 24	LOT195	1550p	PHILIPS	LOT142	1800p	RTRNF 2005 BMZZ	LOT308	1425p	1-438-333-14	LOT100	1700p
00 D-4-208-002	LOT79	1800p	2433442	LOT181	1600p	4515 03 25	LOT22	1500p	4822 140 10142	LOT134	1450p	RTRNF 2005 BMZZ	LOT308	1425p	1-438-333-15	LOT100	1700p
00 D-4-235-002	LOT240	1250p	2433451	LOT82	1400p	4515 03 26	LOT198	1500p	4822 140 10145	LOT112	1700p	RTRNF 2007 BMZZ	LOT307	1450p	1-438-333-21	LOT100	1700p
00 D-4-235-002 HT1	LOT81	1600p	2433452	LOT82	1400p	4515 03 28	LOT27	1450p	4822 140 10146	LOT132	2150p	RTRNF 2007 BMZZ	LOT307	1450p	1-438-337-11	LOT101	1600p
00 D-4-235-002 HT2	LOT81	1600p	2433453	LOT82	1400p	4515 03 29	LOT193	1500p	4822 140 10151	LOT102	1500p	RTRNF 2023 BMZZ	LOT310	1500p	1-438-387-21	LOT131	1600p
00 D-4-235-002 HT3	LOT81	1600p	2433454	LOT234	1600p	4515 03 30	LOT179	1550p	4822 140 10161	LOT103	1250p	SONY	LOT275	1700p	1-438-416-11	LOT255	1750p
00 D-4-260-004	LOT38	1650p	2433521	LOT85	1600p	4515 03 31	LOT207	1650p	4822 140 10171	LOT104	2150p	3753100	LOT275	1700p	1-438-416-12	LOT255	1750p
00 H-0-701-2400	LOT182	1550p	2433581	LOT22	1500p	4515 03 34	LOT56	1650p	4822 140 10176	LOT114	1150p	1-438-243-00	LOT91	1700p	1-438-416-21	LOT255	1750p
06 D-3-083-001	LOT82	1400p	2433721	LOT83	1600p	4515 03 35	LOT193	1550p	4822 140 10194	LOT106	1750p	1-438-243-11	LOT91	1700p	1-438-416-23	LOT255	1750p
06 D-3-083-002	LOT82	1400p	2433751	LOT01	1500p	4515 03 38	LOT77	1450p	4822 140 10198	LOT116	1750p	1-438-243-12	LOT91	1700p	1-438-416-41	LOT255	1750p
06 D-3-084-001	LOT23	1400p	2433752	LOT01	1500p	4515 03 40	LOT200	1600p	4822 140 10201	LOT104	2150p	1-438-243-13	LOT29	1700p	1-438-416-51	LOT255	1750p
06 D-3-087-001	LOT23	1400p	2433752	LOT250	1600p	4515 03 41	LOT56	1650p	4822 140 10206	LOT118	1750p	1-438-244-00	LOT229	1700p	1-438-430-21	LOT271	1650p
06 D-3-088-001	LOT84	1400p	2433891	LOT23	1400p	4515 03 43	LOT195	1650p	4822 140 10245	LOT111	1750p	1-438-244-21	LOT28	1800p	154125A	LOT275	1700p
06 D-3-093-001	LOT204	1600p	2433892	LOT84	1450p	4515 03 44	LOT56	1650p	4822 140 10247	LOT105	1750p	1-438-244-22	LOT48	1800p	TOSHIBA		
06 D-3-095-001	LOT87	1450p	2433893	LOT23	1400p	4515 03 46	LOT201	1550p	4822 140 10254	LOT107	1600p	1-438-244-23	LOT48	1800p	37010	LOT131	1450p
06 D-3-096-002	LOT87	1450p	2433894	LOT33	1200p	4515 03 50	LOT27	1450p	4822 140 10263	LOT117	1750p	1-438-244-24	LOT48	1800p	37011	LOT131	1450p
06 D-333-512-001	LOT204	1600p	2434002	LOT200	1600p	4515 03 51	LOT27	1450p	4822 140 10269	LOT210	1650p	1-438-244-31	LOT48	1800p	37012	LOT131	1450p
FETX 100 90 DEG	LOT04	1500p	2434141	LOT33	1200p	4515 03 75	LOT22	1500p	4822 140 10271	LOT208	1650p	1-438-256-00	LOT45	1800p	37013	LOT131	1450p
FETX 90 WHITE	LOT06	1650p	2434274	LOT44	1250p	4516 16 01	LOT22	1500p	4822 140 10274	LOT123	1600p	1-438-256-10	LOT45	1800p	37014	LOT131	1450p
FETX 100 100 DEG	LOT34	1500p	2434453	LOT85	1600p	4516 16 01	LOT22	1500p	4822 140 10282	LOT122	1600p	1-438-256-21	LOT45	1800p	37015	LOT131	1450p
GRUNDIG			2434455	LOT234	1600p	731003	LOT81	1650p	4822 140 10283	LOT104	1450p	1-438-256-22	LOT45	1800p	37016	LOT131	1450p
29201.006.01	LOT153	1750p	2434593	LOT44	1250p	276-16399	LOT49	1800p	4822 140 10294	LOT125	2100p	1-438-256-23	LOT280	1700p	37017	LOT131	1450p
29201.014.01	LOT140	1850p	2435062	LOT296	1600p	334 B 07803	LOT50	1700p	4822 140 10305	LOT110	1600p	1-438-256-30	LOT92	1700p	37018	LOT131	1450p
29201.015.01	LOT149	1400p	2435121	LOT87	1450p	334 B 08104	LOT74	1600p	4822 140 10325	LOT132	1850p	1-438-256-31	LOT92	1700p	37019	LOT131	1450p
29201.017.01	LOT60	1250p	2435131	LOT251	1600p	334 B 08108	LOT74	1600p	4822 140 10326	LOT122	1850p	1-438-256-32	LOT45	1800p	1810951	LOT55	1700p
29201.018.01	LOT163	1300p	2435141	LOT282	1450p	334 P 08108	LOT295	1600p	4822 140 10328	LOT124	1450p	1-438-256-33	LOT45	1800p	2433751	LOT01	1500p
29201.018.02	LOT61	1700p	2435301	LOT88	1450p	334 P 18506	LOT51	1650p	4822 140 10349	LOT106	1450p	1-438-256-34	LOT45	1800p	2433752	LOT250	1600p
29201.019.01	LOT62	1250p	2435671	LOT88	1600p	334 P 18507	LOT75	1600p	4822 140 10353	LOT284	1450p	1-438-256-35	LOT45	1800p	2433753	LOT281	1550p
29201.019.02	LOT62	1250p	2436201	LOT109	1450p	5908-05008A-AA	LOT70	1500p	4822 140 10356	LOT284	1400p	1-438-256-36	LOT45	1800p	2433754	LOT281	1550p
29201.022.01	LOT63	1700p	2436202	LOT109	1450p	D 10837	LOT49	1800p	4822 140 10367	LOT286	1400p	1-438-256-37	LOT45	1800p	2433755	LOT131	1450p
29201.022.02	LOT166	1800p	2432101-2	LOT79	1800p	DCF1577	LOT273	1700p	4822 140 10369	LOT109	1450p	1-438-256-38	LOT45	1800p	2433756	LOT288	1400p
29201.022.03	LOT165	1750p	2433451H	LOT81	1600p	DCF2077A	LOT272	1650p	4822 140 10381	LOT128	1450p	1-438-256-39	LOT47	1800p	2433757	LOT288	1400p
29201.022.04	LOT165	1750p	2433453H	LOT82	1400p	KFS 60226E	LOT279	1550p	4822 140 10384	LOT127	2150p	1-438-256-40	LOT47	1800p	2433758	LOT288	1400p
29201.022.04A	LOT165	1750p	2433891H	LOT23	1400p	MSH-1FBW08	LOT116	1750p	4822 140 10395	LOT116	1750p	1-438-256-41	LOT47	1800p	2433759	LOT289	1500p
29201.024.01	LOT65	1700p	2433892G	LOT84	1450p	NIKKAI	LOT87	1450p	4822 140 10406	LOT73	1500p	1-438-256-42	LOT47	1800p	2433760	LOT289	1500p
29201.024.04	LOT164	1800p	I.T.T.			BABY10	LOT87	1450p	4822 140 10421	LOT109	1450p	1-438-256-43	LOT93	1650p	2433761	LOT289	1500p
HINARI			4515 01 08	LOT113	1400p	ORION			4822 140 10421	LOT109	1450p	1-438-256-44	LOT93	1550p	3122113837011	LOT131	1450p
154 138 K	LOT24	1500p	4515 01 15	LOT136	1600p	3714002			4822 140 10421	LOT109	1450p	1-438-256-45	LOT93	1550p	150F6D	LOT131	1450p
51 139 14 1	LOT24	1500p	4515 01 16	LOT139	1675p	PANASONIC			094-00020/0.9	LOT113	1400p	1-438-303-00	LOT94	1700p	TFB 4039 AD	LOT293	1550p
51																	

# John Edwards'

## Service Notebook

### Fujitsu TV/PC Combi (ICL DB10301E)

This is the first time I've worked on a computer-TV. In the near future, as the TV and PC markets get closer to one another, it will probably become a common event. Fortunately this Fujitsu equipment is well designed and easy to work on. Physically, it is similar to the Amstrad TVR combi units. The PC slides in and out beneath the TV, which also serves as the monitor. Selection of the TV or monitor mode is carried out via the handset.

I was called in because at switch on the AC fuse would blow, accompanied by a puff of smoke. Actually the posistor in the degaussing circuit caught alight, emitting a flame that rose to over an inch in height before the fuse gave up. Another first for my eyes!

The posistor's body markings were charred and of no use, and I discovered long ago that circuit diagrams and manuals seem to be a closely guarded secret with monitor manufacturers. Even the job of tracking down a phone number can be a daunting experience. Some of the monitors I've come across have a model number but no manufacturer identification - strange! Unless this problem is resolved soon, council tips are going to be full of discarded monitors and PCs. Perhaps that's the idea!

Some while back I bought a supply of P181 posistors from Chas Hyde. They can be used in a very wide range of sets, and have proved to be extremely useful in 'suck it and see' situations, with a high success rate. A whole day on test proved that the P181 was suitable here as well.

Note that there will be no sound if, after a repair, you switch the TV/monitor on with the PC tray removed. The audio circuit is routed via the PC section, which has to be in place.

### Akura CX25

Intermittent field collapse was cured by resoldering dry-joints in the field output stage, including some at the pins of the TDA8172 field output chip. A high-wattage, 2.4k $\Omega$  stand-off resistor is mounted near the scan coil connection plug. Its legs were badly dry-jointed, and there was board charring around them. It was necessary to remove the resistor and clean up the board.

The plug's plastic body had a deep burn mark that was caused by heat from the resistor. In case the terminal hidden within its plastic body had been damaged, I cut the lead closest to the damaged portion of the plug and soldered it directly to the board.

### Philips Anubis A Chassis

Although the power supply delivered the correct HT voltage to the line output stage one of these sets remained dead. On investigation I found that the

5.6k $\Omega$  feed resistor R3444 in the supply to the line driver stage was burning up because the driver transistor (Tr7440) had a steady 9V at its base instead of line drive pulses.

At switch on the TDA4504 IF/timebase generator chip IC7015 should produce short-generation pulses at pin 29 to get the line output stage going. Once this happens, the line output transformer provides the supply to the chip. As the transformer was faulty, this didn't happen. Tr7440's base voltage was being held high because pin 29 of IC7015 was virtually open-circuit and the 2.7k $\Omega$  pull-up resistor here (R3359) is fed with 9V from the chopper circuit. Presumably the symptoms would be the same if IC7015 developed a fault that stopped it producing line drive pulses.

### Beko

This 26in. set had no readable model number label. The only clue as to the model/chassis was the legend printed on the mother board, "Beko Siesta Stereo TV". Although it looked as if the model number label had been torn off, I was confident that the set belonged to the customer. Having been burgled a couple of years ago, I reject any suspect equipment. If I'm certain that the equipment has been stolen, I notify the police. Normally you find that with stolen equipment an attempt has been made to obliterate or destroy the make/model number. Quite often the customer will let on that it has been "knocked off".

Anyway, back to the Beko set. When I switched it on it remained lifeless for about two minutes then entered the trip mode, ticking away quite merrily. I tried again, this time with a meter connected across the mains rectifier's reservoir capacitor. The meter's reading rose gradually to 150V, then the tripping started. It took me what seemed like ages to discover the culprit: one of AC input legs of the bridge rectifier was dry-jointed. In my defence, I have to say that the soldering looked perfect - even under a magnifying glass.

### Ferguson IKC2 Chassis

As I'm not familiar with this chassis, it took me a long time to track down the cause of intermittent going into the standby mode. The fault was very intermittent - maybe once an hour, or a few minutes from switch-on then OK for the rest of the day. Heating and freezing didn't seem to have any effect, neither did blanket resoldering on the main PCB.

I disconnected the field scan plug, turned down the first anode voltage to protect the tube, and left the set running. It operated for a couple of days without going to standby. The most likely suspects in the unusual thyristor field output stage seemed to be the TL082C driver chip IF01 and the BY398 diode DF16. I replaced these two items and left the set on test for a further two days. Everything now seemed to be OK.

# What a Life!

**Don gets them all, from the rough (very) to the well-dressed lady magistrate, not to mention the supercilious school teacher . . . All in a day's work**

**S**ome of the flying insects here in Spain are quite bizarre. One is a huge, stocky-looking dragonfly thing. It has a black-bronze, bullet-shaped body. The problem is that it swoops and cruises around noisily at head height.

Whilst here lately I ran into Mike and Karen, a popular couple who run a friendly and efficient television and video business. As we were swapping yarns, one of these bugs droned by. It reminded Mike of a technical tale.

A rather bolshie man had called him out to look at his set. For most of the time it produced a perfect picture. But from time to time the picture and sound would fade out and remain absent for ages. Then a perfect picture would suddenly return, only to go again. After listening carefully to the complaint, Mike popped outside to examine the aerial system, starting with the dish. The customer followed him out. After completing his examination, Mike voiced his suspicions.

"I think something lives in there" he grinned, pointing at the LNB.

"Never mind the jokes" said the customer, "I want this bloody lot working."

At that point a huge insect flew out of the LNB horn and swooped on the customer.

"See what I mean" said Mike when the customer had recovered.

Mike's remedy was simple. He crumpled up a piece of plastic mosquito netting and shoved it into the horn.

It took the customer longer to regain his equanimity enough to find his wallet . . .

## Back in Blighty

"I wish you'd call on Mrs Salcombe" said Steven. "She's a rough handful, I can tell you. I can't handle her type. But you, with your experience and tact. . . Then there's Mrs Stannard, the local magistrate. She likes you."

I blew on my nails. Delightfully humble of Steven I thought — though it's true that I *am* very clever, a cut above average. So I breezed along in the van to No. 17,

with my service case. I was greeted at the door by a huge, seventeen-stone lady.

"Go on up, Doctor" she bawled in a voice like a saw on a sheet of tin. "Don't take no notice of 'is nasty mouth. Just give him a shot of summat quieting, I would. Proper pain in the neck the old boy is. Time he was put away with some of that Yoothnasia, if you asks me."

I stopped and coughed. She shielded her eyes and glowered at me. "Good God" she brayed, "what's the National 'Ealth comin' to?!"

"I'm not the doctor" I faltered. "I've called to see your television."

"Oh, 'av you indeed. An't you got one of your own then?" She turned to her scruffy, fat daughter. "Ear that Beryl? Man wants to watch our telly! Whatever next?!"

"You called me here" I said, waving my job card. "Bullock's it is."

She drew herself up to her full four feet two. "Get out, you filthy-mouthed beast. How dare you! In front of my daughter, too. You could do with a good spell in the army. And the birch!"

I know when I'm beaten. So I ducked back to the van and headed for the Stannards.

## At the Magistrate's

They live amongst the toffs on Paradise Hill. As I went through their gate a dog as large as a horse came licking and nudging and sniffing at me. I must say that I'm not particularly partial to dogs, big or small.

The well-dressed Mrs Stannard



"Do give him a pat and tell him how good he is!"

glided out. "Oh, Collingbourne wants to be friends!" she said as the dog pushed me over. "He likes you, Mr Bullock! Do give him a pat and tell him how good he is."

I got to my feet and tried to smile. Then I wove towards the set in her lounge. It was a 24in. Panasonic, Model TX24T1 (Alpha 2W chassis), with a very fuzzy picture. So much so that all you could make out were vague shadows. It looked as if heavy frost covered the screen.

I flicked over the service switch. Instead of field collapse, the image looked like a horizontal lemon. After checking the EHT and the supply to the RGB output stages I moved to the tube base panel. The red and green cathodes were both about right at 150V, but the blue cathode reading was zero. Further checks revealed that the blue drive peaking coil L352 was open-circuit. A replacement restored perfect results.

Mrs Stannard was pleased. "We've just returned from holiday, Mr Bullock" she laughed. "A friend of ours stayed here. When the set failed they called that awful Snoddies place. Apparently the tall, thin man called. Quoted £250 plus VAT to repair the set!"

### Sleepy Ossie

I arrived back at the workshop just as Sleepy Ossie Ointment rolled in with a Bush 1408 portable. His face curled into a smokey grin. Then he locked his eyes on mine and talked as though he'd had a couple.

"There ain't no picture on 'im, Mr Bullock. Just a snowy screen. Do 'im if 'e's cheap. Not if 'e's dear."

"What's cheap and what's dear, Ossie?" I asked. But he'd slunk off.

The cause of the trouble turned out to be simply a dry-joint in the tuner. So I charged Ossie £9.99 for doing the job and a penny for the solder.

### Another Portable

As I was about to shuffle off to make the tea Mr Strange loped in carrying a 14in. Toshiba Model 145R7B. He looked at me, smacked the set on the bench and simply said "dead".

Son Paul tackled the set. He found that the 6.2Ω surge limiting resistor R801 was open-circuit and the SR2M overvoltage protection

diode D808 was short-circuit.

There had obviously been an HT surge. The STR50020 chopper chip IC801 is suspect in this event.

Another suspect in these sets is C813, a 47μF, 50V electrolytic in the regulation feedback circuit.

After replacing these items Paul switched the set on. There was now HT at the mains bridge rectifier's reservoir capacitor C810, but the set remained dead with no standby light. A check on the 5V supply at pin 42 of the microcontroller chip ICA06 produced a reading of only 0.22V.

The 5V supply is derived from the front of the power circuit, where a feed from the bridge rectifier is taken via RA25 (6.2kΩ) to the BC337 standby switching transistor QA08. This transistor was short-circuit, but a replacement didn't restore results. Further checks showed that the 5.1V zener diode DA03 and the BC557 transistor QA05 were both short-circuit. Hence the low voltage at pin 42 of the microcontroller chip. Replacing these last two items finally restored normal operation. Paul, looking relieved, sunk into a chair with his tea.

### Walter Bean

Walter Bean is another of those teachers who talk to us as though we are schoolkids. He had with him a Samsung VIK346 VCR. Before addressing us he undid his jacket button, slipped a hand into his trouser pocket and presented us with a good view of the underside of his chin.

"This machine ah hisses in ah standby and ah blinks off when ah switched on" he said.

"We'll have ah look at ah it" I said.

The cause of the trouble was in the power supply of course. Yet another case of electrolytic capacitor trouble. When we had replaced C38 (1,000μF, 10V) all was well.

But there was nothing we could do for Bean. He's spent too long wielding power over those unfortunate children.

### Miss Drudge - 3

Just then poor Miss Drudge crept in. Her severe and ancient mother treats her like a lackey. I feel sorry for Miss Drudge, but daren't tell her so.

"It's mother's set again, Mr Bullock. I'm ever so sorry, but it

keeps going wrong. It's the Ferguson, the one you call a TX100. There's no picture. Could you repair it, Mr Bullock, er... without too much delay, if it's possible? Only mother doesn't like being without her television. Mr Bullock... She doesn't like..."

The truth, and we knew it, is that for poor Miss Drudge living with her mother was hell. Living with her when the set failed was purgatory extended. So Paul and I bowled round to look at it.

There was just a raster. But where was the aerial flylead and its coaxial plug? The old woman's fat cat was asleep in the shaft of sunlight behind the set. I rolled it over - ever so gently! - to reveal the plug. As the cat raced away frantically I restored the picture.

"Thank you Mr Bullock" cackled the old woman as Miss Drudge arrived, all hot and bothered. Then she barked at Miss Drudge. "Where have you been? Pay Mr Bullock at once."

"No need" I said as we made our exit, "have this one on us." I gave Miss Drudge a secret wink as we departed.

### Bodmin Business

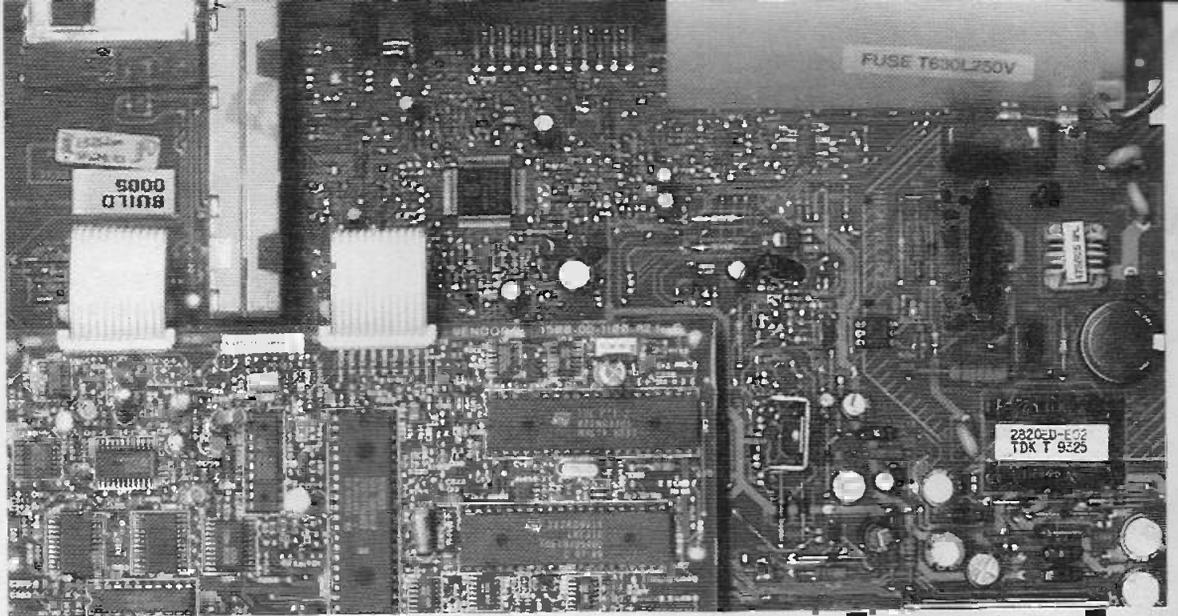
I had a note from Vic Rummery a while back. He and his wife Marjorie run a TV servicing business in Bodmin, Cornwall. He'd enjoyed what he called Rebecca's "libellous" article (September '96) and told us about a couple of recent customer experiences.

One chap had called and asked for a suitable aerial system for the locality. Vic advised him on what was required and supplied the correct type. A few days later the chap's wife rang. She said they'd erected the aerial but it hadn't cured the trouble, which must be due to something else. Could they return the aerial and have their money back?

Another card phoned late one Saturday night to say that the set he'd just bought from a shop in Plymouth had failed. Could Vic call and fix it?

Vic was about to go to bed. He was asked whether he could call next day, a Sunday, but declined and offered to call first thing on Monday. The offer was turned down. "The people from the shop can do that."

Keep your chin up, Vic! I've had to, for years and years.



# Satellite Notebook

**Reports from  
Pete Haylor  
Pete Gurney  
and  
Hugh Cocks**

## Obscure Faults

A collection of obscure faults started with a Pace MSS100 receiver I'd installed about six months previously, along with a new LNB. The Cartoon Network and Sky Sports 3 were among several channels that were intermittent. So a spectrum analyser was connected. When the channel polarisation was changed the signals didn't. Only the vertically polarised signals could be obtained. A new LNB was fitted under guarantee.

A Pace clone (PRD800) worked with a scart connection but there was no picture with a UHF connection. After a few minutes the graphics displayed with the scart connection became distorted. The cause was the graphics chip U10. I replaced crystal X2 for good measure.

One call actually had me thinking! All the programmes were wrong, though the displayed frequencies were correct for the programme names. The LNB, fitted by the customer, was 90° out!

When removing the F connector from a receiver, check the connections carefully. One I had made contact when removed, but the last few strands of the braid broke when it was refitted to the receiver.

A call I had to an old customer led to a stand-alone decoder's card reader being replaced. Next day I was surprised to be told that the horizontal channels were now all missing. The system was based on an old Salora 5902 receiver: the small connector at the back is usually the cause of this fault. This one was intact however, but a short was recorded when a meter was connected across the plug. The short was traced to the back of a chair, where

the cable was chewed up. A pet rabbit had been allowed to run loose in the room! P.H.

## Pace PRD800/900

If the problem with one of these receivers (or their various clones) is no decryption of the scrambled channels along with absence of the "please insert card" message, one of the more common causes is a faulty AD or DA converter chip. There's a check, which is not included in the manual, for the correct operation of this circuitry.

Tune the receiver to a non-encrypted channel – Eurosport is my usual choice, but any such channel except a Sky one will do – then locate test pin TST2 which is next to IC U19, near pin 9. Connect it to chassis (0V). This has the effect of routing the video first through the A-to-D process then the reverse. If this has no effect on the picture, other than a slight degradation because of the conversion processes, the converter chips are OK and the cause of the fault lies elsewhere. If the picture disappears, the fault lies in either the AD converter U20 or the DA converter U24. Also check L20, which is at the front of the PCB, next to LED3: it can fracture, removing the supply to U20.

A further source of trouble is the 503kHz resonator X7, which is connected to pin 17 of the sync separator chip U18. When this item is faulty the symptoms range from outright failure to decode to extremely intermittent decryption. To confirm correct operation, check for a field sync output at pin 15 of U18 and a line sync output at pin 17. P.G.

## Amstrad SRD510

There was sound but no picture,

either via the modulator or the scart connector. In this event the first thing to check is R80 (10kΩ), which is either on the board or glued beneath it. On this occasion it was OK. Scope checks brought me to TR2, where there was no signal or bias at its base – there was a healthy signal at the collector of TR10.

Things can get a little complicated here, as some parts are fitted only in 320 series receivers but they are all shown on the circuit diagram. In the SRD510 the bias is developed by the potential divider R5/R4 and is fed to pin 4 of the 4053 switch IC1. It should exit at pin 3 and pass via the parallel network L1/R167 to the base of TR2. There was voltage at pin 4 of IC1 but not at pin 3. A new 4053 chip restored normal operation.

IC1 also switches the left and right audio channels. P.G.

## Pace MSS100

This receiver was brought in dead. The mains fuse had died and so had the TOP200 chopper chip U1 which, unusually, had a crack across its body. While I was replacing this device I noticed that R3, a 47Ω surface-mounted resistor in the feedback path to U1, had vanished, leaving only a black mark on the PCB. I also find it wise to check the mains rectifier's reservoir capacitor C3 (47μF) and replace it if it's the original one – an early batch was inclined to go open-circuit. In this case C3 checked OK, but I nevertheless replaced it.

The power supply in these receivers is one of the most reliable I've come across in recent times. Why had it failed? I came to the conclusion that a nearby lightning

strike was the most likely cause, though there had been no storms for some months.

When the receiver was powered up there were still no results. A scope check showed that the power supply was operating in the trip mode. Tests on the secondary side of the power supply then revealed a near short-circuit across the 5V rail. This is tricky, as the supply goes just about everywhere. Fortunately there are plenty of links that can be removed for test purposes. When LK107 was removed the tuner proclaimed its guilt, with a reading of about 4Ω to chassis.

A new tuner restored normal operation. It transpired that the unit had been out of use for some three months, which tied in very nicely with our last storm. P.G.

### Diplexer Trouble

I recently reinstalled a Pace PRD800 receiver that had been repaired because of power supply trouble. It worked all right, but when the terrestrial TV aerial lead was plugged into the receiver's loop-through socket there was noticeable grain on the picture. This is often the case when a mast-head amplifier is in use, the amplifier adding noise (plus patterning/cross-modulation as often as not!). But in this case there was no mast-head amplifier.

The answer soon became clear. The signals from the dish and the UHF aerial were fed to an outdoor diplexer of Far East origin so that a common downlead could be used. Downstairs, two cables emerged from a recessed box in the wall – it housed a similar diplexer unit (see Fig. 1). The Pace receiver's modulator had been set to ch. 62 (800MHz), and the diplexers were passing some out-of-band IF noise from the LNB, though they should have cut off such noise at least 100MHz higher up the band. Fortunately an Astra 1D LNB was in use. Had an old LNB (10.6GHz local oscillator) been in use there would have been a lot of patterning from Astra 1D signals as low as ch. 50 or so.

Terrestrial UHF reception was in the group A spectrum, and the diplexers had managed to roll-off the LNB noise by the 600MHz point. I moved the Pace receiver's modulator output to ch. 28. There was then no increase in snow when the UHF aerial was reconnected.

Diplexers are useful with an installation where only one cable can be fitted into an existing pipe.

But allow for slightly lower amplitude terrestrial signals than before – compensation is often possible by replacing the original downlead cable with satellite-quality coaxial cable. If the local channels are at the top of group C/D, proceed with caution! H.C.

### Pace MSS260

This MAC receiver (my own!) had no front panel display and produced only a blank raster with some patterning. The culprit was soon found: the 5V supply's 2,200μF reservoir capacitor C15 had gone open-circuit between one day and the next.

I've come across several similar cases recently. If an electrolytic capacitor is coloured light blue, it may be a good idea to change it on sight. This includes the HT one. They seem to be used in receivers manufactured during the second half of 1995 and very early into 1996. So far the capacitors have always looked innocent, with no bulging or any signs of discharge.

When connecting an external VideoCrypt decoder to the MSS260, note that there's an eight-level 'PAL contrast' adjustment in each channel's tuning menu. If this is set too high, the result can be flicker and intermittent decoding with peak white scenes. H.C.

### A Sight to Behold

I often come across a strange satellite system bodge when paying a first visit to a customer's house after a call for help to restore pictures. The oddest of things greeted me recently, attached to a 1.2m prime-focus dish on a flat roof. A five-litre paint can lid had been bent and tied to two of the support legs, just in front of the LNB.

The 'technician' had told the customer that this would 'improve' the signals. I couldn't see what it was supposed to be screening – it was vaguely in the direction of a waterlogged four-way IF splitter. Unfortunately I didn't have a camera to hand to record this installation for posterity! H.C.

### Drake ESR4240E

This elderly motorised system's dish had ceased to move, and the picture looked weak and streaky. The dish positioner is independent of the receiver – communication takes place via the IF cable, at a fairly low frequency. The positioner box also supplies power to the LNB (when the system is a fixed one, this box isn't needed and the IF signal goes straight to the receiver, which then

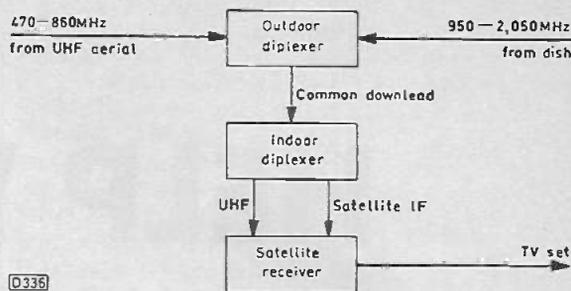


Fig. 1: When a common downlead is used with diplexers and the satellite receiver's modulator is set at the top of the UHF band, IF noise from the LNB may be seen because of poor diplexer response.

powers the LNB). The receiver dates from 1988-1990 – it was superseded by the ESR250S. Construction is rugged, and an Astra 1D converter can easily be made automatically switchable via one of the rear terminals.

The cause of the problem turned out to be poor cable contact between the positioner box and the receiver. A new coaxial cable cured the fault. Weak signals had been received from the dish, but the much lower frequency data link between the two boxes had been lost. H.C.

### Pace MSS100

New receivers now come with a remote control unit that won't operate earlier ones. It's labelled RC10 in small print at the bottom. Don't muddle up remote control units, otherwise you could waste lots of time chasing non-existent faults.

Operation of the receiver is exactly the same, but a third option is now available in the 'hidden menu' that's obtained via "function, menu, radio and store" with the remote control unit. It self-aligns the audio PLL offset. The receiver helpfully asks you to "please wait" while it carries out this operation. H.C.

### Corrosion Problem

The owner of a large, elderly dish complained of weak Astra signals, which is definitely not normal here. The dish was correctly aligned, but when the plastic cap at the front of the feedhorn was removed (it was a prime-focus dish) a lot of white aluminium oxide powder poured out.

I removed and cleaned the feedhorn/LNB and made a couple of holes in the plastic cap to provide an exit for any moisture. For good measure I put a cover over the feedhorn/LNB to prevent rain entering directly. Microwave signals are greatly attenuated by any corrosion in a waveguide. H.C.

# 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.*

**For disposal:** Service manuals/diagrams, all makes, over 1,800 in total. For details phone Sarah Burton, Circuit Services, on 01526 833 023. Address 31a High Street North, Ruskington, Sleaford, Lincs NG34 9DY. We also have a Tektronix 2215 60MHz scope for sale. Any offers?

**Wanted:** Circuit diagram for the BT Rapport 20 answering machine. Photocopy or whatever OK. Reg Oliver, G4SFM, 18B Rostrevor Road, Fulham, London SW6 5AD. 0171 731 5673.

**Wanted:** Service manual for the Sony SLF30, also a VCR for spares. Alan Stubbings, 7 Church Road, Saxilby, Lincoln LN1 2HH. 01522 702 601 (evenings).

**Wanted:** NTSC VCR and an NTSC to PAL system converter. Also a TDA3586 and an AN239 chip. Nixie Bolton, 17 Longueville Court, Lumbertubs Estate, Northampton NN3 8HJ. 01604 407 375.

**Wanted:** Access to a service manual for the Sony CCDTR75E camcorder to enable me to fit a new mode switch. A photocopy of the relevant information would be OK. Robert Millard, 15 Meadowgate Drive, Lofthouse, Wakefield. W. Yorkshire WF3 3SR. 01924 870 599.

**Wanted:** Service manual or circuit diagram for the Brenell Mini L8 reel-to-reel multi-track recorder. Also a scrap Ferguson Videostar FC06/JVC GRC9 camcorder. V. Smith, 175 Lyon Park Avenue, Wembley, Middx HA0 4HD. 0181 902 5447.

**For disposal:** Newnes *Radio and Television Servicing* vols. I-V and 1955-1968, also a quantity of *Trader* servicing sheets for the same period. Free to anyone interested. Must be collected. J.H. Felton, 28 Chelmerton Avenue, Gt Baddow, Chelmsford, Essex CM2 9RF. 01245 471 984.

**Wanted:** Philips VR2324, 2334,

2340, 2350 or 2840 VCR or video head. Also Philips N1700 workshop manual. John Norman, 19 Farm Close, Priestwood, Bracknell, Berks RG42 1SD. 01491 671 200 day, 01344 640 368 evenings.

**Wanted:** Luma/chroma board for the Saisho VXL12X/Matsui VX765 VCR. Also front membrane switch control panel for the Ferguson 51K3 TV set. Mike Haslam, 477

Warrington Road, Abram, Wigan, Lancs WN2 5XY. 01942 865 766.

**Wanted:** Technical information from a technician fully conversant with late models using the British Nicam system. Generous reward for services rendered. Please e-mail [aquasurf@ozemail.com.au](mailto:aquasurf@ozemail.com.au) or write to PO Box 830, Canning Bridge PO, Canning Bridge, WA, Australia.

**Wanted:** A cable-mounted mains socket to mate with the mains input plug fitted to a range of Telequipment oscilloscopes made about twenty years ago. It contains three connectors and the plastic moulding is T-shaped. Malcolm George, 42 Butt Lane, Manuden, Nr Bishops Stortford, Herts CM23 1DL. 01279 813 727.

**Wanted:** Jockey wheel for a Dansai record player, SII125H audio amplifier chip for the B & O 2422, and an S-40W or S-60W audio amplifier chip. Keith Docwra, DTV Service, Manston Green Industries, Preston Road, Manston, Ramsgate, Kent CT12 5BA. 01843 822 911.

**Wanted:** Head preamplifier for the Hitachi VT150 VCR. Andrew Beer, 30 Cawkwell Close, Chelmer Village, Chelmsford, Essex CM2 6SG. 01245 468 958.

**Wanted:** Can someone supply deck timing set-up information for the Mitsubishi B30, as no timing marks seem to be visible? A photocopy of instructions or any tips on how to align the deck would be welcome. Also require a circuit (photocopy OK) for the power supply in the

Akai VSX470EG. S. Akers, 8 Farm Road, Lakeside, Redditch, Worcs B98 8LB. 01527 456 313.

**Wanted:** Regular and super 8mm cine film for servicing and testing cine projectors prior to transferring home movies to VHS tape. Any unwanted, exposed film is suitable. Victor Thompson, 2 Mount Avenue, Barton-upon-Humber, North Lincs DN18 5DW. 01652 633 155.

**Wanted:** Exploded view, parts list and/or complete cassette mechanism for the Marantz cassette deck Model SD3510. W.E. Milton, Styche House, Hemyock, Devon EX15 3QZ. 01823 680 777.

**Wanted:** Perspex cover for the Ferguson Studio 25D music centre; Model 3923, released in about 1977. Does anyone know of a source of the stylus for the Goldring G850 Garrard turntable pickup? Tandy says this is obsolete. F.C. Bailey, 53 Peile Grove, Taunton, Somerset TA2 7SZ. 01823 253 905.

**Wanted:** Tuner/IF panel for the Susumu XR1 VCR. Mike Withers, 3 Main Street, Sorbie, Newton Stewart, Wigtownshire DG8 8EG. 01988 850 378.

**Wanted:** The flap that covers the audio and video input sockets on the front panel of the Akai VSF600EK VCR. Also a remote control handset (Model RC-V602A or similar) that will operate this machine. Dan Kenney, 45 Bicton Avenue, St. Peters, Worcs WR5 3TF. 01905 351 905.

**Wanted:** Power supply for the Sony Profeel KX27 TV set. Ray Standley, Tachbrook Hill Farm, Bishops Tachbrook, Leamington Spa, Warwickshire CV33 9QG. 01926 492 277.

**Wanted:** Circuit diagrams and specifications for WW2 equipment: R109 and R1147 receivers; Bendix rec/trans rack FT-244-A; US army/rack 5009UK AM. Also video heads for the Toshiba 8600. Ken

Domminney, 7 Chestnut Close, Eastbourne, E. Sussex BN22 0SZ. 01323 500 174.

**Wanted:** Circuit information for the System Video Ltd. 1204A TV waveform monitor. Also any information on the System Video Ltd. 1205 vectorscope. Failing that, does anyone have an address for System Video Ltd.? The one on the back of the units doesn't work. Tony Jaques, 88 Sandy Lane, Stretford, Manchester M32 9BX. 0161 865 9398.

**Wanted:** Working power supply panel for the Toshiba 150R6B TV receiver. Please ring Steve on 0181 537 6631.

**Wanted:** Two sets of type DSE1422BL scan coils for the Matsui Model 1440A. P.J. Herring, Eastern TV Services, 99a Rotterdam Road, Lowestoft, Suffolk NR32 2EY. 01502 565 427.

**Wanted:** Full cassette housing or carriage for the Proline 5000XR VCR. Reasonable price paid. Mike Adye, 114 Norwood High Street, West Norwood, London SE27 9NH. 0181 670 2303 (9am to 7pm).

**Wanted:** Circuit diagram (photocopy OK) for the Ferguson amplifier Model 3939. M. Till, 6 Oakwood

Close, Walsall Road, Walsall, W. Midlands WS9 9BP. 01543 371 383.

**Wanted:** Circuit diagram and/or handbook for the SatTel satellite receiver type PRK6. It's an English-manufactured analogue receiver, one rack unit in height, with two single-channel receivers fitted. Ross Weir, Technician at Christchurch Polytechnic, PO Box 22-095, Christchurch, New Zealand.

**Wanted:** ICs to repair a no sound output fault with a Thorn Model CT514TN Nicam stereo receiver (CP-365 chassis). Or a complete set with sound working. T. Milverton, 121 Borrowdale Road, Northfield, Birmingham B31 5QL. 0121 477 2044 (evenings).

**For sale:** Philips PM5509 pattern generator £80 and Grundig 100MHz 4CH TB delay oscilloscope £600. F. Willing, 12 Littlebury Court, Kelvedon, Hatch, Brentwood CM15 0XQ. 01277 374 166 (after midday).

**For sale:** Hewlett-Packard power module 1 for Paintjet, Quietjet etc., £25. Computer dust cover 57 x 57 x 47cm (base unit/monitor) and 50 x 21 x 4cm (keyboard), antistatic, midnight blue, unused (not for

tower case) £4. GEM font editor for Amstrad or any IBM-compatible PC, to embellish existing GEM fonts or create new ones, £10. Tektronix 5110 oscilloscope for spares (case, power supply and tube, no control board) £30. Tamron MF28-200mm f3.8-5.6 aspherical zoom lens as new, with Pentax Program A, UV and polarising filters, case, in mint condition (lens of the year 1994) £330. Interpet Convertagear control unit for aquarium, fluorescent tubes, doubles light into the tank to save cost and energy, suit Triton, GroLux, UV etc., 1/1-5in. diameter tubes £5. Contact 22 two-line pricing gun £15. Julian Bohan, 30 Stanley Street, Lincoln LN5 8NG. 01522 871 926.

**Wanted:** V board (teletext) for the Sony Model KV27XR(TJU). Part no. is A-1325-023-A; board legend is 1-617-643-11. D. Benyon, Marshland View, St Annes Hill, Bude, Cornwall EX23 0LT. 01288 353 373.

**Wanted:** Service manual or circuit diagram for the Dell SVGA monitor Model VC5EN. Martin Abbott, Flat 7, The Highlands, Ludlow Road, Leominster, Herefordshire HR6 0DH. 01568 614 725.

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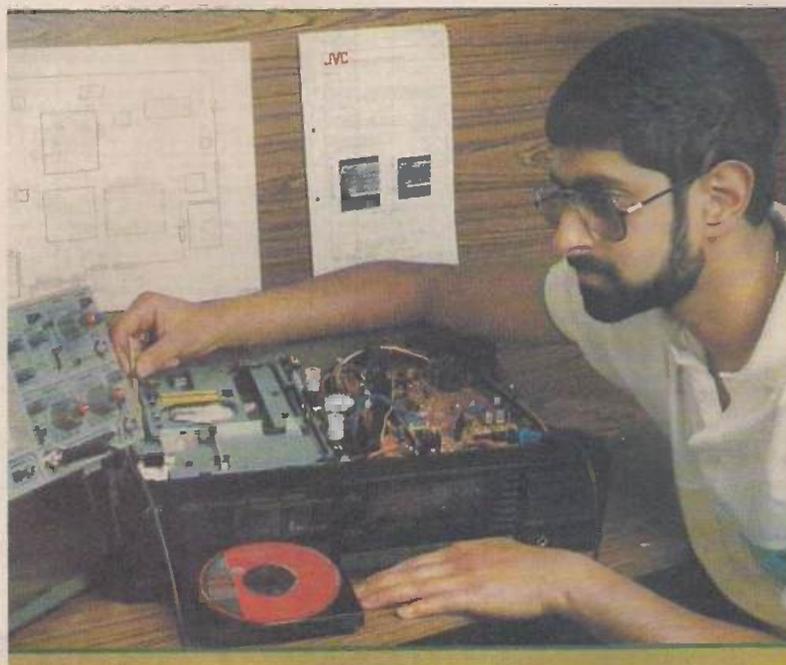
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# Strictly for Youngsters



Despite the mixed feelings amongst old-timers in the TV/video trade, many youngsters have a keen interest in electronics and want to enter the profession. **Richard Newman** provides some hints and tips for those anxious to get started

**W**hat you want to do in life is often related to an early interest. If there is a particular subject that you think could lead to an interesting and worthwhile job, it's a good idea to find out as much as you can about it.

My first interest in electronics developed at the age of about eight or nine – when I found out how to wire up a bulb, battery and switch for a Lego house I'd just built! I then went and borrowed a library book which took me through basic circuits, and after that I had an overwhelming desire to make a radio receiver.

With help from my brother, who was a qualified TV engineer, I got the bits and pieces for a crystal set together. Then, having taught myself to solder, I made the thing up on hardboard. It was an untidy lump, but when I tuned in the BBC Light Programme the feeling of achievement was amazing. The receiver was my pride and joy for weeks.

I steamed ahead and gained much knowledge and experience by building valve and transistor radio sets and buying old radio and TV sets from jumble sales to get them going. By the time I entered the trade at seventeen I had a good working knowledge, and signed on at the local technical college to get my qualifications.

Now, nearly thirty years on, I wouldn't be in any other trade.

## Fixing Tellys

If you are thinking of becoming a TV/video engineer you need proper qualifications. This is only to be expected in any profession. If you are a school leaver, it may be best to try to get a job with one of the larger rental companies to start with. Very often they will send you on training courses – and may even pay for you to attend college. Whatever you do, aim to get at least City and Guilds finals or whatever equivalent it is nowadays. There are unfortunately a lot of cowboys who give the trade a bad name. I've seen some horrendous examples of the work of "Mr Fixit", who is really a plumber but knows a bit about tellys. Get proper qualifications and you will start off on the right foot.

## Basics

If electronics is also your hobby, a good way to gain valuable experience is to get hold of some old radio and TV sets. It's great to get them working, but if you do make a mess of things at least you will probably be left with some useful spares and will have gained some

knowledge of circuit operation in the process.

One thing it is essential to observe is safety. When working on mains-powered equipment you should have a proper bench and use an isolating transformer rated at 250W at the very least. The bench should be wooden, and a rubber floor mat is advisable. If you are working for a company, the workshop should already comply with current safety standards.

**Early days**

When I started out I worked for a small private company that took in for repair almost anything that ran off the mains or batteries! Back then, in 1970, it was mainly older monochrome TV sets and a variety of radio receivers. I didn't care what it was - the experience I gained was tremendous.

When I started doing colour TV theory at the local Tech I was eager to get stuck in. By this time I was working for a major manufacturer, and the first colour TV set I repaired without any assistance, using a scope to trace the cause of a colour fault, was a 14in. portable. The fault was caused by a leaky capacitor in the reference oscillator circuit. When colour appeared on the screen, my feelings were probably about the same as when I tuned in the first station on that crystal set.

**How far to go?**

The sky is the limit. If, like me, you just do up to C & G finals, that's fine. You will have gained a good grounding with which to work. You can go far beyond this by continuing up to HNC or HND. As you progress, you will discover your weak points. It's then up to you to find out more by attending courses or reading up on it.

After passing my finals at the Tech I was, during subsequent years, sent on VCR, teletext and microprocessor courses. But remember that there is no substitute for experience. I have met so-called engineers with qualifications up to their eyeballs who are about as much use in the workshop as a chocolate teapot! Their theory was fine, but they didn't know how to go about fault finding. In other words, they had no practical experience.

**Current Scene**

Nowadays there is a far greater variety of equipment than when I started out. Most of it relies on microprocessors or microcontrollers of one sort or another. You have to keep up to date with developments. A subscription to this magazine is a good start! Most of the articles are written by people who have been in the trade for some years, and they are able to pass on their valuable experience to the reader.

There is a great deal going on at the moment, and you should never become complacent. Digital technology is taking over in many situations. We'll soon have digital TV broadcasting, with all the differences this will bring, also flat plasma displays instead of CRTs, digital VCRs and more. Your interest won't be allowed to flag!

Never be afraid to ask questions or seek advice wherever possible. Worst of all, don't become like the cowboys mentioned earlier. Have confidence in your work, and don't feign knowledge - you'll only come unstuck. No matter how good you are, you cannot be expected to know everything.

We'll need some good engineers to keep all this new technology going. So, if you are thinking of joining us - go for it!

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# Pace PRD Series Upgrades

**Pace PRD800 Series satellite receivers lend themselves to various upgrades. Martin Pickering, B.Eng., describes a couple – to give the PRD800 199-channel capability and to provide the PRD800/900 with J17 wideband audio in menu**

**T**his article describes a couple of modifications that can be carried out to extend the capabilities of Pace PRD series receivers. Note that the modifications described here are not Pace approved.

The initial steps to take are as follows:

- (1) Test the receiver to ensure that all existing functions work correctly.
- (2) Disconnect the receiver from the mains supply.
- (3) Remove the five cover screws and lift off the cover.
- (4) Remove all screws and tuner nuts at the rear.
- (5) Using a pair of side cutters, gently lift each plastic rivet head from the PCB. Remove the two-part rivets.
- (6) Using a pair of fine-nosed pliers, speeze together the tips of the two white plastic support pillars and lift the PCB up and forwards.

Take great care not to bend the PCB, as this can crack the components underneath.

## 199-channels with the PRD800

Model PRD800 has a smaller capacity EEPROM chip than the PRD900. It can therefore store only 120 channels – some clones are limited to 99 channels. Provided the receiver is fitted with a microcontroller chip (U2) version later than the 809-8661001 it should be possible to upgrade to 199-channel capability. This is handy if you have a motorised dish system, a Hot Bird/Astra system – or simply want to store all those radio stations.

As a bonus, the following functions are activated:

- (1) Favourite channels.
- (2) Selection of menu background colour.
- (3) Radio blanking option.

The steps to take are as follows. Add a 4.7k $\Omega$  (472) surface-mounted resistor (R550) on the underside of the PCB, next to pin 7 of U4 – see Fig. 1. This should be the only resistor beneath U4. Remove any other resistors. On the top side of the PCB, replace U6 with a blank 24C16 EEPROM chip. Be sure to insert it with the notch or dot next to the notch indication on the PCB.

Reassemble the receiver and connect it to the mains supply. You will see “-E2” in the display (if there is a display). Wait about twenty seconds. The receiver will now operate normally, but with 199 channels. Note that all original customised settings will be lost.

If the receiver is not a true PRD800, with channel number display, this conversion could result in the front panel LEDs working incorrectly. The receiver itself should work perfectly however.

If the receiver is fitted with an 809-8661001 microcontroller chip this will have to be replaced with a later type. The recommended microcontroller upgrade kit is listed by Pace as part number 808-866032. It includes a later microcontroller chip which provides menu options for various LNBs, including enhanced 9.75GHz types. The kit is suitable for all PRD (not PRD Plus) models.

A 199-channel EEPROM with resistor and three power supply capacitors (C5, C7 and C8) is available from SatCure (see address at end) for £9.95. The 808-866032 enhanced microcontroller kit is available from the same source for £22.95. Please add £2.50 post and packing per order.

## J17 Wideband Audio with the PRD800/900

Although audio bandwidth selection is a feature in Pace PRD Plus models. It was not included in earlier PRD series receivers. The PCB is designed to take the additional components required however, so that receiver upgrading is possible. This modification is useful with some non-English programmes, whose audio bandwidth can be as wide as 400kHz. Note that the components to be added are mostly tiny surface-mounted devices. The modification is thus not suitable for those without experience.



# Long-distance Television

Terrestrial DX-TV reception, satellite sightings and news from abroad. The HS Publications' 49MHz notch filter reviewed. Roger Bunney reports

July 1997 was an unusual month for DX reception. Sporadic E signals were about on most days, though they were of lesser duration than in June. There were no reports of double-hop Band I signals from North America, though there were numerous sightings of TV from transmitters in the Middle East. When I checked Band I prior to 0900 hours I often found that low-level signals were present: they remained frustratingly low-level, thus making identification impossible. Early morning, very low-level ch. E4 signals from the SE, of long duration and slow fading, were present on August 4th and 5th – not unlike tropospheric propagation, but a



*If you know where to look and have a digital receiver, pay per view offerings intended for the UK may be found elsewhere in the Clarke belt – though you might have to put up with an Arabic commentary! This BSkyB PPV offering came courtesy of Antenna 2 via Eutelsat at 13°E.*

really long single-hop Band I signal.

The following log summarises the more interesting – or strong – signals received during the month:

- 9/7/97 An unidentified Arabic ch. E2 signal at 1400.
- 10/7/97 Syria and Iran ch. E2, both prior to 0900; SVT (Sweden) chs. E2-4; YT1 (Ukraine) ch. R2.
- 12/7/97 SVT E2, 3.
- 13/7/97 Dubai ch. E2 at 1600; RAI (Italy) ch. IB.
- 14/7/97 YT1 R2; TVE E3, 4; RAI IB.
- 15/7/97 Arabic colour bars at 0840 on ch. E2; Iran ch. E2 at 1015; RAI IA, B; TVA (Italy) IA; TVE E4.
- 16/7/97 Unidentified Russian ch. R2 (not quite, actually 57.75MHz) signal at 1605; TVE E2-4.
- 17/7/97 Syria chs. E2-4 (0730-0900); RAI IA.
- 24/7/97 Syria chs. E2-4 (0730-1130).
- 25/7/97 HRT (Croatia) E4.

Reception seemed to be concentrated in the middle two weeks of the month. The increased reception from the Middle East was marked, though there was no known sighting of the usual Jordan ch. E3.

Those who know about meteor matters suggest that Leonids activity in mid-November could be intense. So make a note to keep a careful check on Band I over the period November 15-20th, in particular the 17th at 1600 GMT – just in case of

spectacular reception across Band I – if this occurs, remember to check the low end of Band III as well.

## Satellite TV Reception

Last month I mentioned the visit by our local council's planning enforcement officer after he'd discovered a second, 'illegal' dish in my garden. A chat with the DOE about proposed changes to dish ownership legislation revealed that the maximum dish size without planning permission will rise to 90cm wherever you are, but that use of a second dish will still require planning permission from the local authority. I've sent in my application for "retention of satellite dish on post in rear garden", and the committee is likely to consider this during the coming month. Five complete copies of everything were required – forms, area and local plans and photographs, also a cheque for £90. The local paper has run a piece on the application.

Bandula Gunasekera (Sri Lanka) reports reception of several new channels: an Egyptian TV channel in extended C band and an Iranian TV channel at 4.034GHz (horizontal), both from PAS-4 (68.5°E); and Secam TV from Madagascar at 3.825GHz (RHS polarisation) via Gorizont 19 (96.5°E). Another C band enthusiast, Julian Redwood (Christchurch), mentions reception of many 4GHz news feeds such as MIR via Gorizont at 40°E, and reports on the Montserrat volcano via Intelsat at 21 and 25°W. Julian has recently

invested in a modified Nokia d-box (English menus): we look forward to hearing about the results obtained.

There is at present considerable interest in acquiring digital receivers. Some care is required. Many Nokia d-boxes are 'grey' imports, with menus in languages other than English. This could cause confusion – unless you are proficient with German technical phrases. The going price for imported MPEG digital receivers is at present well above £400, approaching £500, which is more than you would expect to pay for enthusiast DX purposes. I hope to obtain a receiver this autumn, and will report on my and others' experiences. Meanwhile analogue satellite TV is still alive and well!

Clive Manning (Northampton) has been using digital receivers for a year. He started with a Nokia d-box which included a CAM (conditional access module) for the Multichoice package. Once it had been set up, which took time because of the German-language menus, it worked well until Multichoice altered its encryption so that only Dutch receivers could decode the channels. A Dutch-market Pace DVR500 receiver was then brought into use to regain the signals. This works all right, but does not have the flexibility to resolve alternative digital package parameters without the necessary CAMs and smart cards.

I've noticed that considerable use is being made of Telecom 2C at 3°E for local TV programme inserts in the UK. Ulster TV used an analogue uplink on July 21st to relay Milk Cup '97 events for its early evening magazine programme slot at around 1815. The BBC has regional magazines from 1830: Orion-1 at 37.5°W is a favourite analogue slot when the Corporation's South West TV truck UKI-231 Plymouth is on duty – last month in Jersey, and on July 17th at a clay pit near Newton Abbot. During the same week the BBC Wales counterpart UKI-116 ventured out to report from various locations in South Wales, above a river at Haverfordwest on the 15th. The BBC always terminates a transmission with a colour-bar pattern that carries location details etc.

The shooting of Gianni Versace in Miami on the 15th took up much live transponder bandwidth aboard PAS-3R, Orion-1 and

Intelsat K (43, 37.5 and 21.5°W respectively), with street reports, 'locked-off' shots of the area etc.

Other analogue sightings during the month included President Clinton's visit to Romania, which was reported live via Orion-1 for the "US TV Pool, Uplink Bucharest" news feed back to the states, using the NTSC standard. Orion-1 also provided live street coverage of the Madrid riots for Antena 3 Television on the 14th. Sat zappers who are sports fans couldn't have missed the numerous feeds from Silverstone for International Racing from the 11th onwards, also golf which seems to be a permanent feature with Intelsat K!

### Terrestrial News

Digital Audio Broadcasting: Ch. E12 is now being used for DAB transmissions across Germany: they are likely to spread into ch. E11, i.e. across 217-230MHz. The UK DAB allocation at the top end of Band III uses largely chs. E11/12, and will be divided into seven main DAB blocks within the 217.25-230MHz band.

A new financial data service is being transmitted across London via DAB radio test transmissions. BT Broadcast and Classic FM are co-operating to provide the new service, mixing the financial data with the normal DAB broadcast programme. The data is provided by City information service TenFore, which in turn obtains it via satellite distribution. Classic FM recently demonstrated the service in Birmingham, during its Radio Festival week, mixing the data with the normal DAB broadcast transmission.

Italy: SBS (the Scandinavian Broadcasting System) has bought five per cent of SEI TV of Milan: its stake will be increased to ten per cent by the end of the year. SEI TV provides a round-the-clock news service. It may join the DSTV digital satellite package later this year.

Norway: SBS hopes to increase the coverage of its TV Norge channel from 75 per cent to 90 per cent by the end of next year, following relaxation of the country's networking regulations.

Germany: The authorities want PRO7, SAT-1 and RTL to introduce more information and cultural programming now that

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these services have achieved over ten per cent coverage.

Cellphones: Orange and One 2 One have both been provided with an extra 5MHz of RF spectrum for the expansion of their mobile data services, giving each an operational bandwidth of 30MHz.

### Satellite News

Intelsat has awarded a contract to

**A digital Star TV (Hong Kong) test signal for BSkyB, received by John Locker from Eutelsat at 16°E.**

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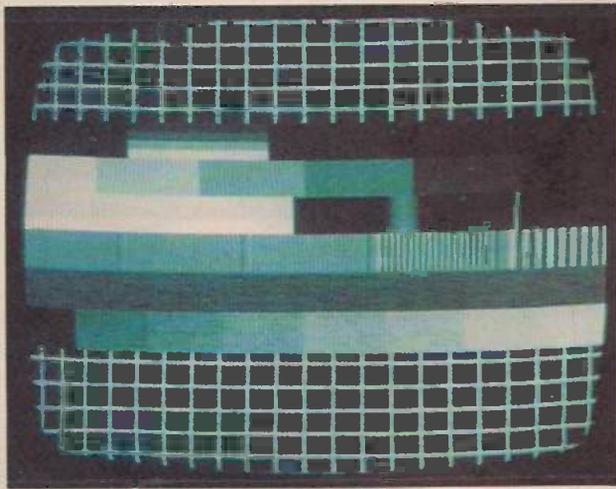
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Aerial Techniques







An unidentified analogue test card received via Intelsat K at 21.5°W.

Matra Marconi Space to launch the K-TV satellite at 95°E in the spring of 1999. This will provide more high-power Ku-band capacity in the Asia/Pacific region. The satellite will have thirty transponders, with two fixed and two steerable beams covering S and SE Asia. There are options for a further three K-TV craft in the series, which will provide both digital and analogue transmissions.

Intelsat's improved series IX satellites are now in the design

stage. They are due to enter service in mid-2000, providing TV and general communications transmissions and links. The first IX series craft will replace two IV series satellites over the Indian Ocean.

Successful worldwide, multipath test transmissions with internet/multimedia data incorporated within a TV signal have been carried out by news agency AP-TV. Set-top decoders were used to separate the data and TV information at the receiving end. One test consisted of transmitting a complete issue of the *Sunday Times* at speeds of up to 6Mbits/sec. The originating company NDS claims that the throughput capacity is up to 30Mbits/sec, enabling a complete CD-ROM to be transmitted in under three minutes.

Hard porn has arrived in the South Pacific via Intelsat 702 (centre spot E. Australia): dishes as small as 1m can be used to receive the Exxtasy channel's digital MPEG programming. The programme package starts off in Taiwan, with a C-band uplink via

180°E to the Brewster, Washington earth station where Exxtasy is added. A further C-band uplink via 177°E supplies two Ku-band spot beams to Asia and Australia. Satellite dealers in Australia are uncertain about the legal situation.

Italian state broadcaster RAI has formed a partnership with telecommunications company STET to offer six digital channels in the Telepiu package. The first will be available, under the RAISAT banner, on September 29th. Initially the channels will be Raisat-1 (culture/history/arts), Raisat-2 (mainly children's programmes plus Nickelodeon) and Raisat-3 (educational). Raisat channels 4, 5 and 6 will follow in mid-1998, offering news, sports and multinational culture respectively. Canal Plus is to take a 35 per cent stake in Telepiu, which will also offer a travel channel (Marco Polo) and various film and music programmes.

Finally, NTL can now provide a 24-hour occasional feed service at the Crawley Court, Winchester teleport.

### Band I Notch Filter

Nowadays the main problem with Band I DX-TV reception is the RF dustbin around the 49MHz band – baby alarms, garage doors, pagers, kids' walkie-talkies, model cars and all sorts of other items. For those who live in a built-up area ch. R1 (49.75MHz vision) is for most purposes swamped. The interference spreads down to ch. E2 (48.25MHz vision), perhaps touching ch. 1A (53.75MHz vision). For ch. E2 reception, a sharp notch filter tuned to the 49MHz sash should remove the worst problem and attenuate

interference on adjacent frequencies.

So to the good news. HS Publications (7 Epping close, Mackworth Estate, Derby DE3 4HR, telephone 01332 381 699 during reasonable hours) is marketing a suitable notch filter. It comes in a metal box with an input socket and an output plug – the arrangement is similar to that used by the common, Taiwan-sourced type of signal splitter. There are two adjustment holes, one for basic tuning and the other, which leads to a carbon preset, to enable the notch depth to be fine tuned, maximising signal rejection. Fig. 1 shows the response and circuit.

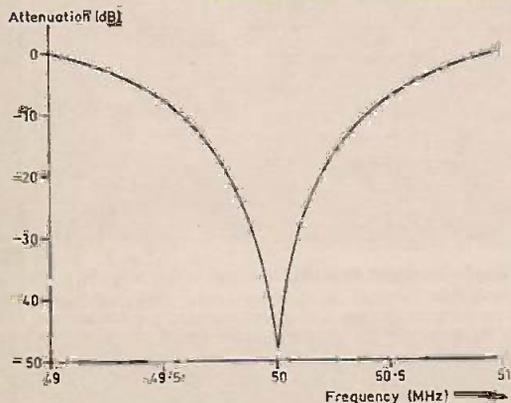
The filter is extremely critical to adjust. Once the rotary capacitor (red hole) has been tuned to the correct frequency (it's easy to pass over this), the notch depth and ultimate attenuation are set by the equally critical carbon

potentiometer (blue hole). The filter is not intended to be retuned. Tune it to a specific frequency then hide it away in your aerial system, prior to any amplifier. HS Publications tell us that a varicap notch filter for operator use is under development – watch this space.

Tests show that the filter has great potential for DX-TV reception when you are plagued by 49MHz interference. Using a 50MHz spot frequency, I measured the performance as follows: insertion loss at 1MHz and wider -1dB; maximum notch depth -48dB; attenuation at ±125kHz -21dB, at ±250kHz -17dB, at ±500kHz -7dB, at ±750kHz -3dB and at ±1MHz and above/below -1dB.

A notch of -48dB makes the interfering signal all but invisible. An impressive performance. The filter may provide a little help with ch. R1 reception but will certainly remove the sash from ch. E2. I feel that this notch filter is an essential addition to the DXer's range of equipment. It costs £14.95 including post and packing (in the UK).

Fig. 1: Measured response (left) and circuit (right) of the HS Publications' Band I notch filter.



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### Transmission Fault

One Saturday afternoon we were called to look at an Hitachi C2118T receiver with a sound problem. We found that there was poor, low sound on BBC-1 only. As retuning only made matters worse, we took the receiver back to the workshop for investigation. After spending about an hour on it we still hadn't found the cause of the problem, so we put the set to one side and turned our attention to a Sony set fitted with the AE1 chassis. It had just been brought in with the complaint that the picture and sound were being cyclically blanked out. Again we failed to find the cause of the problem, and by now it was closing time.

Monday morning came and brought with it a flood of calls from customers complaining about flashing pictures, no teletext, no sound and, guess what, this was all on BBC-1 only. The penny then dropped: there was a transmitter fault. A scope check on the video signal showed that on BBC-1 the sync pulses were of much lower amplitude.

At this point we phoned the BBC to report the problem. An engineering team was sent to sort it out. Here at Buxton we receive our signals from a relay transmitter. Just after lunch the signal was back to normal.

It seems that only sets which use the sync pulses for tuning control, muting etc. were affected. Several

# Letters

old TV sets we'd tried in the workshop had no problems at all. How do you explain to a customer to whom you have sold nice new TV set that the transmission is at fault when he says that the fifteen-year old set in the next room isn't flashing and is being fed from the same aerial?!

*Michael Dranfield,  
Buxton, Derbyshire.*

### Channel 5 and Cable TV

I was interested to read Mike Harris's letter in the August issue. With the steady increase in multi-channel cable TV services and the use of single, fixed output-channel cable TV converter boxes I was wondering when the issue of TV tuner image- and adjacent-channel rejection performance would raise its ugly head. Mike's problem with reception of weak Channel 5 signals in the presence of high adjacent-channel signals and an  $n + 9$  image channel is probably quite common now, what with VCRs, games consoles and Channel 5 all fighting for use of the spare buttons on TV sets.

One way of ensuring optimum reception is to use a good-quality receiver. Modern TV sets for the UK market are fitted with tuners whose image- and adjacent-channel rejection is better than  $-50\text{dB}$ . The performance of tuners for mainland Europe and the Irish Republic, where multichannel distribution with no guard channels and images has been an issue for many years, is closer to  $-60\text{dB}$ . Cable TV has no guard channels: double-conversion tuners are used to achieve the best image-rejection performance from cable TV boxes (as do high-quality radio receivers and multistandard TV sets). Modern TV tuner design can easily achieve such figures, with varactor diode input filtering at the front end for good image rejection.

Taking into account all the correct engineering information documented by Mike, he has a very good case for his local cable opera-

tor to activate an alternative output channel for the cable converters in his area. It is a relatively simple CATV headend task, because the cable converters are individually addressable. It would save the cable operator costly, wasted trouble visits (truck rolls) to other viewers in the future.

*Stephen Webster, 1.Eng., MIEIE,  
Shotts, Lanarkshire.*

### ITT Monoprint BNN Chassis

I read with interest Ray Porter's fault report on one of these sets (September, page 796). The most likely cause of the fault is the  $47\mu\text{F}$  reservoir capacitor for the 8V supply, C722. When there is ripple on this line, D1429 will conduct on negative-going excursions below 8V, robbing T1406 of its base drive. By reducing the value of R1427 the voltage at the anode of D1429 is lowered, altering its conduction point. As C722 deteriorates, I think the fault will return.

*Barry Gibbons, B.Sc.,  
Wigan, Lancs.*

### Electrolytics in Pace Sat Boxes

In reply to John Woodgate's letter (August), which referred to my earlier comments (Satellite Notebook, July) about bulging 63V electrolytics in Pace satellite receiver power supplies, the failure does not occur with 35V capacitors of the same make. I've seen the 63V type budge in both the SS9200 receiver (C9) and in PRD series receivers (C7, C8 and C9) after a relatively short period of time. As both types come from the same manufacturer and are subject to the same operating conditions, one tends to conclude that the failure is related to the working voltage, though 63V capacitors from other sources may work happily enough.

The recent problem of some HT electrolytic capacitors failing within a short time scale has been put down to contamination from phosphorous. Maybe the cause of the

problem I've come across is something similar.

*Hugh Cocks, Algarve Ltd., Algarve, Portugal.*

### Service Manuals

In reply to your request (July letters page) for views on service manuals/supplements, I would comment as follows. Manuals are expensive and are ordered as a last resort. Thus any delay because the manual is not complete is particularly frustrating. Here are some examples.

- (1) A TV manual didn't cover the teletext/remote control module, for which a supplement was required.
- (2) A TV manual showed a power supply which was nothing like that in the set. Again a supplement was required.
- (3) The mechanical side of a VCR was covered in a separate manual.
- (4) The redesigned PCB in a CD player was covered in a supplement.

I appreciate that manufacturers introduce modifications that require supplements to the original manual. But they, their distributors and the manual specialists should ensure that all manuals/supplements are cross-referenced. These are after all older sets, so there has been plenty of time to update the lists!

*D.P. Bunker, Berkhamstead, Herts.*

I recently required a service manual for a Kodak Photo-CD player, Model PCD265. Kodak has ceased production of Photo-CD players. I phoned Kodak at Hemel Hempstead and a nice lady took my order. The manual would be posted right away at no charge. Great! Two days later, a large brown envelope plopped through my letterbox. But when I opened it I found a user's instruction guide.

Back to the phone. I explained the situation and was referred to the Components Division. Eventually I was put through to the manager, who told me that there was no stock and one would have to be ordered. Fine, but at what cost? The manager consulted his list and, I kid you not, said £250. Speechless, I rang off.

Somewhat miffed by this experience, I decided to go right to the top and sent a letter to Kodak's head office in Rochester, New York. Three weeks later, at 7.30 p.m., the phone rang. A voice told me that Kodak Hemel Hempstead was calling me to let me know that the ser-

vice manual I has ordered was in the post.

Two days later I received a large brown box. Inside were the service manuals for every Photo-CD model made by Kodak. All beautifully laid out and bound in loose-leaf jackets, with a mine of information in every one. Quite the best manuals I've come across in many years. Full marks to Kodak USA.

The moral of this tale is "Go West young service man"! *Thomas MacDougall, B.Sc., Falkirk, Central Scotland.*

### Thanks

I would like to thank all those who responded to my request for information on the RCA 40379 thyristor in the Help Wanted column. I will eventually write to everyone individually. It is gratifying to find that in an ever increasingly difficult industry we can help one another. If only the majority of manufacturers were as helpful.

*Michael Brett, Watford, Herts.*

### Minimum Order Charges

I am concerned about a policy adopted by HRS of Birmingham. As is usual in this trade, the company has a minimum order policy: with an order below £30, you pay a carriage charge. No problem here: most companies have a similar policy, though the amount varies from firm to firm. When you use a view-data terminal some companies, notably WVE, have a lower limit.

When the HRS Truedata service is used between noon and 3pm however the minimum order becomes £50. Watch this point, and make sure that the goods are in stock. If an item has to be put on 'back order', this will reduce the value of your order and a carriage charge may be incurred. The charge is also applied with any item(s) that have to be supplied on back order.

The same back-order policy applies with the £30 limit, and with the use of the Truedata service at other times when the minimum order is £25.

So you could run up quite a lot of carriage charges. Unless, that is, you order at least £5,000 worth of components per annum, when HRS will relax these rules. This seems a bit unfair. I doubt whether many small businesses order that amount of small spare parts in the course of a year.

*L. Jones, Abatron Electronic Services, Slough, Berks.*

## Book Review

***Servicing TV, Satellite and Video Equipment, 2nd Edition, by Eugene Trundle. Published by Butterworth-Heinemann, Linacre House, Jordan Hill, Oxford OX2 8DP. 312 pages, price £30.***

The first edition of this unique book, then without "satellite" in its title, was published in 1989. It was reprinted no fewer than nine times. That says as much as anything about its success as a practical guide to the techniques of video and TV equipment servicing. It managed to cover a very wide range of equipment in its 209 pages, and the emphasis throughout was on practical matters, especially in the opening chapters which dealt with basic diagnostic techniques, test and servicing equipment and then, naturally, straight on to power supplies. The author had many years of bench and field servicing experience to call upon in preparing the book.

There have been major changes in the domestic TV and video field since 1989. So it was time for a thorough revision. Not only a revision: a substantial increase, of over fifty per cent, in the number of pages, now 312. Much of the original material has been scrapped, so we have a virtually new publication. Yet the price has increased by only £5, from £25 to £30. Value indeed. Chapters have been added on satellite receivers, digital TV and video, interfacing and hook-ups, and video disc players. The camera section has been expanded to cover camcorders.

As before, the emphasis is on the practical nuts-and-bolts business of fault diagnosis and repair. But there has to be a starting point for diagnosis. So throughout the book there are excellent equipment/system block diagrams and well-chosen representative circuits. These are briefly discussed to provide reference points for the diagnostic advice. There are also fifty five off-screen photographs to help with symptom identification, and a number of fault-finding trees. A very helpful chapter is devoted to that bane of servicing, the intermittent fault.

As the author says, a "book can guide and advise you, but it cannot do the job for you". Nevertheless, without guidance and advice you won't get very far. This is an essential book for those starting out on a servicing career, and will also be helpful to those seeking to widen the range of their servicing skills. Nothing of importance is overlooked - there are sections on workshop organisation and safety for example. And the index is a symptoms one. What more could you want?!

The book is available at £30 from Paul Richards Books, 28 Boscobel Road North, St. Leonards-on-Sea, East Sussex TN38 0NZ. The credit-card hotline is 01424 434 874. J.A.R.

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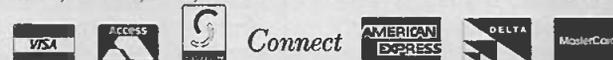
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## Answer to Test Case 418

- see page 867 -

Elusive faults, domino failures, demanding customers – such is the TV servicing scene. It's no surprise that very little money is made in the brown-goods repair trade. Usually, as in this example, it is no one's fault when a bounce occurs. But, unlike other professions, it's the repair shop that always has to pick up the tab . . .

The Panasonic TV set required three repairs, two collections and two deliveries before it was finally fixed. With each failure it destroyed an expensive 2SD1441RL line output transistor from Panasonic. The line driver transformer's dry-joints may or may not have been responsible for the demise of the first two transistors. Plainly something else was the cause of transistor number three going.

The root cause of the problem was finally found in the power supply, after application of freezer from an aerosol, heat from a hairdryer and many expletives being mouthed. It was C808, a 10µF, 50V electrolytic capacitor that forms part of the regulation circuit. When it played up, the voltage outputs provided by the power supply rose to the point where the line output transistor gave up the struggle.

Whenever we see an Alpha 2W chassis in future we'll replace C808 and resolder the legs of T531. Meanwhile Mr Wicks watches and waits . . .

## NEXT MONTH IN TELEVISION

### Digital TV – Receivers

The second instalment in J. LeJeune's series looks at a typical digital TV decoder arrangement and the associated control system.

### Adding CCTV Sound

Bargain-price CCTV cameras are available from one of our regular advertisers. Eugene Trundle describes the addition of a sound facility.

### At the Berlin Show

George Cole reports on the developments and equipment presented at Europe's premier consumer electronics show.

### Cable Head-end Digital Receivers

Hugh Allison offers some tips on these MPEG receivers, some of which are becoming available on the second-hand market.

### DiSEqC

Wazzat? Digital Satellite Equipment Control, actually. K. Rutherford describes the system, which is based on modulating the 22kHz tone signal.

### Toshiba Service Briefs

More fault-finding know-how from Toshiba Technical.

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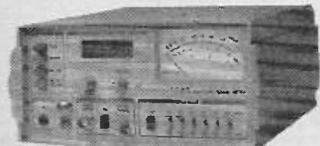
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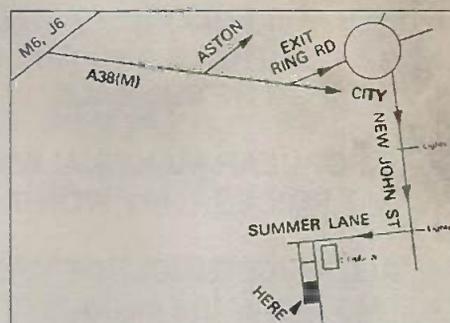
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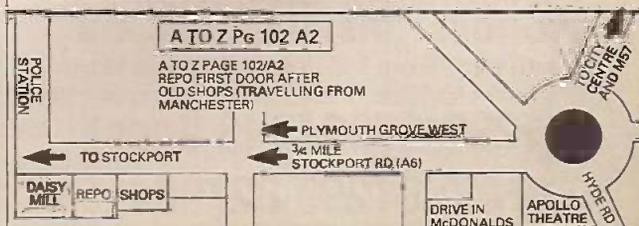
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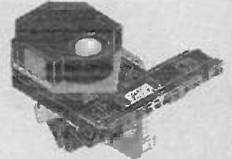
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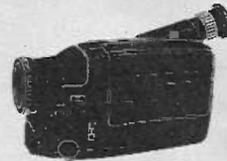
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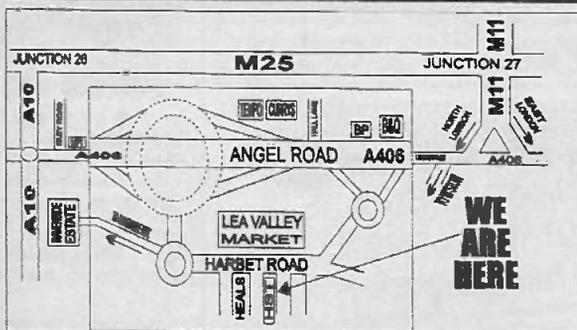
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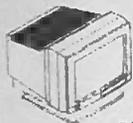
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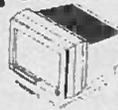
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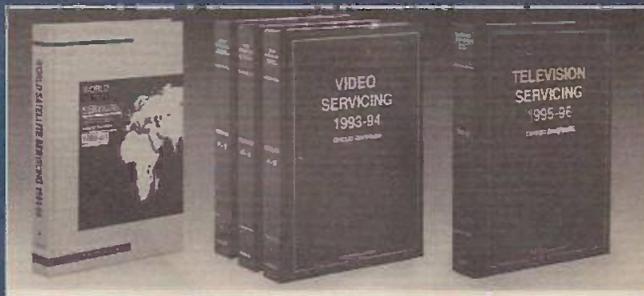


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BURGLAR ALARM KIT ... send for data ... MAIN CONTROL PANEL	£12.50
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PANEL-CVC80-POWER	£5.00
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POSITOR-2322 662 98012	50p
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