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TELEVISION

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chassis technology

The Onwa
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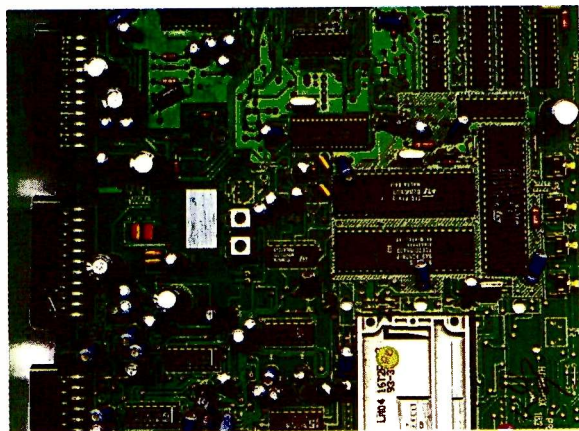
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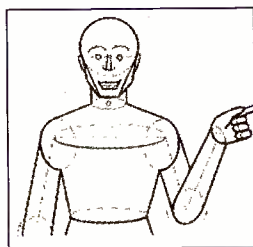
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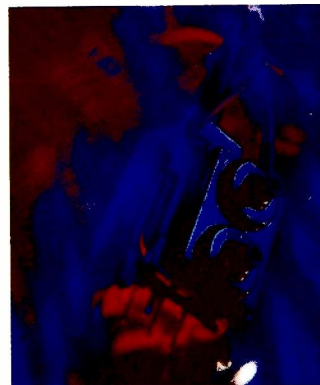


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Editor

John A. Reddihough

Production Editor

Tessa Winford

Consultant Editor

Martin Eccles

Publisher

Mick Elliott

Advertisement

Manager

Kate Hale
0181-652 3076

Advertisement Sales

Executive

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The day that changed the world

Just over fifty years ago, on December 16th 1947, Drs Walter Brattain and John Bardeen, working at the Bell Telephone Laboratories, made a discovery that was to change the world as we know it. They were investigating the properties of the semiconductor material germanium, in particular surface potentials under various conditions, using two very closely spaced (one or two thousandths of an inch) metal probes, when it was noticed that a change of current flowing via one contact influenced the current flowing via the other one. In particular they discovered that when one metal-to-semiconductor contact was forward biased and the other one was reverse biased there was a power gain. For the first time, amplification had been achieved with a solid-state device. How did they come to be carrying out these experiments? Although they had discovered the basis of the bipolar transistor, that had not been their aim. They had discovered the transistor effect by accident!

The use of semiconductor material for various electrical/electronic purposes preceded the thermionic valve era. Electrical non-linearity in metal sulphides such as galena (lead sulphide) and pyrites (iron/copper sulphides) was demonstrated by Ferdinand Braun in 1874. This led to the development of metal rectifiers and crystal detector diodes. The most common device for radio work was the catswhisker, which consisted of a springy metal wire that pressed against the surface of a piece of galena. It was not an ideal arrangement: you often had to adjust the contact for optimum performance by varying its pressure and position. But it worked, and was successful to the extent that crystal sets outnumbered valve sets until 1927.

So the semiconductor rectifier/detector had long been known. In the early Twenties a Russian experimenter, Lossev, described a device using zincite (zinc oxide) and two catswhiskers. How far he got with his experiments is uncertain. In 1925 Dr Julius Lilienfeld, in New York, came up with the idea of using an electric field to alter the conductivity within a block of semiconductor material – what we now know as the field-effect transistor. Although he filed a patent, neither he nor anyone else at the time was able to produce such a device. What Bardeen and Brattain, with Dr William Shockley, were trying to do in 1947 was to create a field-effect device. They couldn't understand their failure, which John Bardeen suggested was because surface states prevented the field penetrating the block. Hence the experiments with surface conductivity, which led to the discovery not of the FET but the point-contact germanium transistor.

Most books quote 1948 as the date of the discovery of the transistor effect, for which Brattain, Bardeen and Shockley received the Nobel Prize in Physics in 1956. This is because Bell didn't make a public announcement – and demonstration – until June 30th 1948. They had been working

out the theory and getting the patent situation sorted out. Shockley had established the theory by the end of January 1948, and on the basis of this proposed the junction transistor, with pn junctions within a block of semiconductor material. The first junction transistor, again a laboratory device, followed in February 1948. It proved that bulk rather than surface effects were the basis of the bipolar transistor effect.

The announcement of the transistor in mid 1948 produced little public response. It was, after all, still a laboratory device. But the technology rapidly evolved, and it wasn't long before transistors started to be used in hearing aids. Transistor radios first appeared in 1954/5. The Regency in the USA in 1954, produced by collaboration between the IDEA Corporation and Texas Instruments, and a Sony set in 1955. The transistor radio came to the UK in 1957, with models from Corsor and Perdio.

The devices then in use were all germanium ones. They suffered from various limitations – temperature stability, voltage restrictions etc. It was hoped that more robust devices would be possible if silicon could be used as the semiconductor material. But purifying silicon was more difficult. Texas Instruments solved this and announced the production of the first practical silicon transistor in 1954. A further major step came with the advent of the silicon planar transistor, which protected the collector-base junction from contamination during manufacture.

From the late Fifties on the transistor gradually took over from the thermionic valve as yields increased and prices fell – with early production methods you'd be lucky to get ten per cent of usable devices (yield) from a semiconductor wafer. The valve market peaked in 1955 (by volume) and in 1957 (by value). In the consumer electronics market the transistor, in its original and subsequently its IC form, has made it possible to produce smaller and smaller products and to pack more and more features into such items as TV sets and VCRs. But perhaps the most significant impact of the transistor was in the computer field. Computers started to do far more and to cost far less as more and more transistors were packed in. The ubiquitous PC, on which we all now rely, would have been an impossibility in the thermionic valve era.

It is doubtful whether Drs Bardeen, Brattain and Shockley could have foreseen what lay ahead when they made their discoveries. But what they came across was to do more than anything else to change the world in which we live, making modern electronics and all the things that rely on it possible. What about the field-effect transistor they were after? The first commercial FET, a junction device, appeared in 1958, at roughly the same time that Texas Instruments produced the first IC. The metal-oxide silicon transistor (MOSFET), which was to give a further major impetus to semiconductor technology, appeared in the early Sixties.

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2SB892	0.35	2SD468	0.28	BC327	0.10	BF423	0.14	BYD33D	0.12	LA4282	5.11	STK5421	9.52	TD42582	3.85	TL072CP	1.03
2SC1008	0.24	2SD667	0.38	BC328	0.14	BF459	0.43	BYD33M	0.16	LA4445	3.45	STK5481	8.12	TD42593	1.12	TMP47C432AP8189	15.19
2SC124	0.48	2SD669A	0.64	BC337	0.14	BF471	0.37	BYD33M	0.26	LA4460	2.50	STK7253	7.69	TD42600	7.69	TMP47C434N3537	15.19
2SC1318	0.19	2SD718	1.90	BC338	0.06	BF487	0.57	BYV1040	2.55	LA4700	4.27	STK7308	6.41	TD42611A	0.84	TMP47C434N3555	15.22
2SC1473	0.21	2SD756	0.47	BC368	0.18	BF491	0.41	BYV95B	0.21	LA6324	2.05	STK7348	5.74	TD42653A	1.32		
2SC1573	0.52	2SD837B	1.12	BC369	0.18	BF494	0.12	BYV95C	0.28	LA6510	2.94	STR11006	7.37	TD43190	4.70		
2SC1675	0.14	2SD856	0.79	BC372	0.53	BF759	0.38	BYV96D	0.27	LA7830	1.88	STR4211	9.40	TD43190	2.05		
2SC1685	0.21	2SD882	0.43	BC546A	0.11	BF859	0.38	BYV96E	0.53	LA7832	2.40	STR50020	9.38	TD43330	14.21	TPU2732	10.05
2SC1740	0.16	2SD898B	6.41	BC546B	0.12	BF871	0.41	BYW56	0.31	LA7835	2.99	STR50103	4.48	TD43305	2.40	U2829B	3.40
2SC1815Y	0.11	2SD965	0.67	BC547	0.11	BF871	0.41	BYW56	0.31	LA7835	2.99	STR50103A	5.56	TD43560	6.13	UC3842	1.46
2SC2001	0.23	2SD965R	1.05	BC547A	0.04	BF960	0.30	BYW95C	0.21	LA7837	4.19	STR50103A	5.56	TD43561A	3.85	UC3844	1.20
2SC2023	3.18	2SK1117	3.40	BC547B	0.11	BF970	0.43	BYX55600	0.23	LC7132	4.70	STR54041	5.15	TD43562A	4.62	UC3844N	

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TELETOPICS

DVD Marketing Developments

The DVD Steering Committee has voted to make Dolby Digital audio (AC3) one of the mandatory audio specifications for PAL DVD discs. As a result, disc producers can encode PAL DVD discs with either Dolby Digital or MPEG-2 audio. The previous version of the DVD specification stated that discs for PAL territories would use MPEG-2 audio, other formats such as Dolby Digital being optional.

According to Dolby over 600 DVD titles have been launched, most encoded with Dolby Digital audio, while almost all the 600,000 DVD players that have now been sold worldwide have Dolby Digital. Over 250,000 5.1-channel

Dolby Digital decoders have been sold worldwide, 45,000 in Europe.

Many manufacturers plan to launch PAL DVD players with dual Dolby Digital/MPEG-2 audio decoders. Despite this agreement it now looks as if an autumn instead of a spring launch for DVD is Europe is more likely, because of lack of software (discs to play). The Hollywood studios have in turn put the blame on failure to provide MPEG-2 audio encoders and the problem of having to produce different versions of discs for different countries.

Nimbus Manufacturing (UK) plans to invest almost £3m on manufacturing DVD discs in Europe. The company has installed DVD production equipment plant at Cwbran in Wales. This is expected to become operational in March.

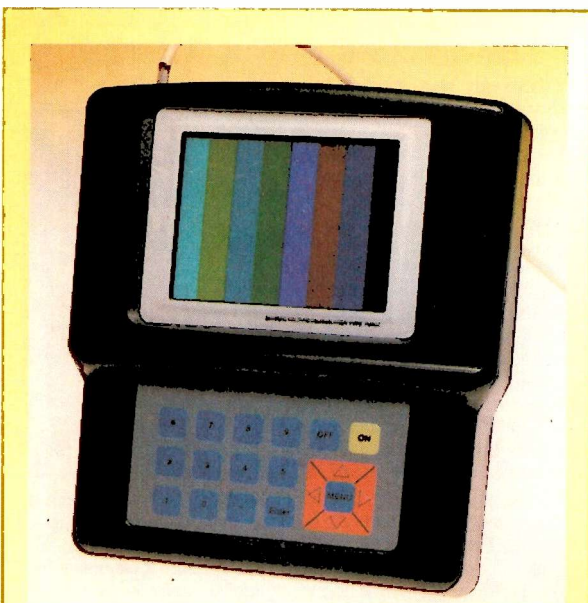
Microsoft and Toshiba are working together to make DVD and the Windows 98 PC operating system compatible. Toshiba is helping

Microsoft develop support for DVD navigation.

The US company Hide and Seek Technology has developed an alternative play-and-dispose DVD system. Discs are coated with a photosensitive polymer that darkens over time, making the disc unplayable. The previously announced Divx system uses a clock-controlled encryption system.

DVD's take-off in Japan has been slower than anticipated. To try to stimulate the market, Matsushita, Toshiba and Japan's largest video and CD rental group, Culture Convenience Club, have formed an alliance. CCC will rent software and players while Matsushita and Toshiba will each take a 19.9 per cent stake in a CCC subsidiary which owns software publishing rights.

There is still disagreement over the DVD-Audio specification. Launch of the format will be late this year at best.



Swires Research has introduced the TVA97 TV analyser. It's a portable spectrum analyser with built-in terrestrial and satellite TV demodulators. Designed specifically for cable and satellite TV installation and testing, the redesigned Swires' spectrum analyser provides increased versatility and can offer customer confidence by displaying the picture as it will be seen.

The TVA97 weighs less than 4kg. It provides three hours' continuous operation and a complete set of digital and analogue functions.

For further information call Jason Kaplan on 01268 417 584 or fax 01268 419 083.

More Monitors

Acer, Taiwan's largest PC manufacturer, is investing £25m in a plant at Wentlooge near Cardiff to produce computer monitors and peripheral equipment. Production is expected to begin in August, and the plant will have a 2m a year monitor production capacity when

complete. Computer assembly is also under consideration.

ADI Manufacturing UK, another Taiwanese-owned company, is to establish a computer monitor plant at Cramlington near Newcastle upon Tyne. The investment will amount to some £10.5m.

Cable TV

The latest figures from the ITC show that broadband cable services are now available to well over ten million homes in the UK – there was an increase of almost three quarters of a million home passes during the third quarter of 1997, the largest increase in the history of the UK cable industry. Over three and a quarter million homes are now connected, the national connection rate being 32.4 per cent,

the highest ever. The total number of telephone lines installed by cable operators has also risen above the three million mark. A consortium of cable companies – Telwest, Diamond Cable, NTL and General Cable – has formed Front Row. This movies-on-demand service is due to be launched in the present quarter. Agreements have been reached with Warner Brothers and Columbia Tristar.

FireWire

You will probably come across the term FireWire increasingly often in the coming months. It's a high-speed serial data link that uses the IEEE1394-1995 standard. This was originally designed – in 1994 – for linking multimedia peripherals.

The first products to use the system are due to start appearing shortly. Intel is understood to be delivering prototype motherboards with the FireWire-1995 interface, using software by Microsoft. Sony has announced a digital colour camera, Model DFW-V300, with a FireWire port so that, for example, video data can be fed into a PC for processing. Sony hopes to launch another six image-sensing products with the FireWire facility later this year.

Texas Instruments has just introduced new chips (see photograph) that conform to IEEE1394-1995 and its enhancement 1394.a. These are an Open Host Controller Interface

(OHCI) and a new family of 400Mbps/sec physical layer interface chips. They will form part of digital signal processing applications in DVD players, digital VCRs and TV sets, and similar equipment.

The OHCI (an industry standard specification) interface controller, to be called OHCI-Lynx, co-ordinates reception, transmission and routing of data over the 1394 bus and manages bus interfacing with memory. The physical layer interface chips perform the transceiver functions of initialising the 1394 communications link, arbitrating access to the channel and placing data packets.

Texas Instruments can be reached on 01604 663 399.

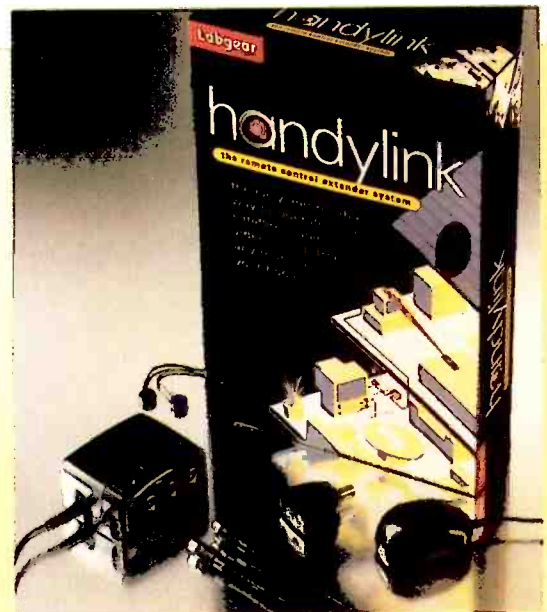
We will be publishing an article on FireWire shortly. A more advanced specification, IEEE1394-1998 or -2000, is being discussed by industry and the standardisation bodies.

The IEEMIE

Earlier last year members of The Institution of Electronics and Electrical Incorporated Engineers (IEEIE) and The Institution of Mechanical Incorporated Engineers voted in favour of combining to form The Institution of Incorporated Engineers in electronic, electrical and mechanical engi-

neering. Since then The Institute of Engineers and Technicians has decided to join the combined Institution, creating a total membership of some 38,000.

The official launch of The Institution of Incorporated Engineers in electronic, electrical and mechanical engineering will be held on April 2nd, in London.



The Labgear Handylink remote-control extender system enables households with several TV sets connected to a distribution amplifier to control equipment from another room in the house. Satellite, video and hi-fi equipment can be controlled without having to point the handset at it. The system works by receiving the remote-control command then sending it via the distribution amplifier to a base unit, and from there to sender buttons attached to the VCR, satellite receiver etc. under control. These buttons retransmit the control signal, operating the equipment as if the handset had been pointed at it directly.

Handylink is compatible with most TV and standard IR remote-control systems. Only an existing coaxial link between the equipment to be controlled and the extra control site is required. Since the system uses existing coaxial cable, it's quick and easy to install and there is no risk of interference to other equipment. Some three million UK homes have coaxial distribution systems in place.

DVB Latest

The ITC has granted British Digital Broadcasting (BDB) Multiplex Service Licences B, C and D to provide digital terrestrial TV (DTT) services. There are several conditions to the licences, including agreement with programme supply companies to be limited to five years, a requirement to support non-exclusive technical standards for receiving equipment, and that Granada's equity stake in BSkyB doesn't affect competition between BDB and BSkyB. The granting of the licences follows discussions with the European Commission's competition authorities. This seems to mean that the EC has given its approval, though it won't say so formally.

The first DTT services are expected to be launched this autumn. BDB plans to offer fifteen channels initially, including three Pay-TV channels sourced from BSkyB. It is expected that BDB will shortly

announce the names of the companies which have been given licences to manufacture DTT set-top decoder boxes. The front runners are believed to be Philips, Panasonic, Pace, Toshiba and Amstrad.

BDB has also announced its commitment to the inclusion of interactive features with its services. The company has been negotiating terms with internet television providers such as Web TV (Microsoft) and Navio (Oracle) for the inclusion of internet-based services.

The DVB Steering Board has reached agreement on a set of functional requirements for running applications on advanced set-top boxes, TV sets and multimedia PCs. This is the first step in developing open technical specifications for what is referred to as a Multimedia Home Platform (MHP). The specifications are expected to be complete by June this year. DVB says the goal is to provide an

"open solution" so that multiple service providers will be able to operate with compatible, cost-effective domestic receivers while recognising the investments already made by broadcasters and consumers in existing equipment. The DVB specification will include a receiver application program interface (API) and download mechanisms for applications, software and related functions.

The French Pay-TV company Canal Plus has demonstrated to members of the European Parliament and the CEC a new generation of digital decoders. The decoders, based on a new set of international standards, will give viewers access to digital services from various providers without having to worry about compatibility between different CA systems. The new boxes will also help in the development of interactive services and internet access.

The Onwa TV Power Supply

Philip Blundell, AMIEEIE, and Stephen Brushforth on the operation of a power supply that has been causing a lot of problems

Chassis produced by the Chinese Onwa company have been imported in large quantities and sold under a wide range of brand names including Akai, Alba, Amstrad, Bush, Goodmans, Hinari, JVC, Matsui and Perdio. There are several slightly different chassis, with either 14, 20 or 21in. tubes. What they all have in common is the same basic power supply, which has been giving service engineers a fair amount of trouble in recent times.

Fig. 1 shows a typical example. Although the circuit remains basically the same in all the chassis, the component reference numbers tend to differ. For example, C911 is C910 in some sets. It has also been C909 and C410, and there are sets that use 500 series numbers in the power supply.

Circuit Operation

It is worth considering the circuit's operation, since this may not be too clear at first sight – we've done our best to draw out the circuit logically however. We will use the component reference numbers shown in Fig. 1.

A conventional bridge rectifier, BR901 with its reservoir capacitor C906, produces some 320V at pin 7 of the chopper transformer T901. Q904 is the chopper transistor. When the set is first powered, Q904 receives forward bias at its base via R913 and thus switches on. Since its collector load is inductive, the current build up is gradual. Q904's current flows via its emitter resistor R914 and, a key component in the circuit's operation, R902. A sawtooth voltage waveform is therefore generated across R902.

Q902/903 form a pulse-width modulator/switch whose function is to switch Q904 off. A positive bias from the junction of R907 and R908 is applied to the base of Q902. As it's a pnp device this is reverse bias,

which holds Q902 in the cut-off state. The negative-going sawtooth developed across R902 when Q904 conducts is also applied to the base of Q902 however, via C908 and R909. At some point this sawtooth voltage will drive the base of Q902 negatively and it will switch on. Q903 is then forward biased via R910 and the two transistors momentarily lock on, placing an AC short-circuit across Q904's base-emitter junction, via C911. The negative plate of this capacitor receives a negative charge and Q904 switches off. There is now no voltage across R902, so Q902/903 switch off.

When Q904 switches off, the rectifier diodes on the secondary side of the circuit, D905 and D904, conduct. In this way energy is transferred from the transformer to the secondary side of the circuit. As a result of the current reversal in the transformer, a positive pulse appears at pin 10. This is applied to the base of Q904 via D901 and C911. Q904 switches on again, and the cycle is repeated.

D902, C910 and R912 provide pulse shaping. C912 and R915 form a simple snubber network.

Regulation

The bias for Q902 is controlled by Q901. This is the basis of the output voltage regulation. D903 produces across C909 a supply for Q901. This voltage is obviously proportional to the other output voltages produced by the chopper power supply. It is monitored at the base of Q901, whose emitter is held at a constant voltage by zener diode ZD901. As the conduction of Q901 varies with changes in the output voltages, so does the voltage across R906 and the bias at the base of Q902. Thus the point at which Q902 switches on during the sawtooth via C908/R909 is varied. The net result is pulse-width modulation at the base of Q904,

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CX34	£15.00	59P, 59H3, 59H5	£16.65	CPT1444	£15.00	Contur T28, T24	£16.80	CB340	£24.00
ALBA		59J7	£16.65	CPT1446	£15.00	Prof T28	£16.80	CB389	£24.00
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CTV742	£13.00	66H3	£19.50	CPT2036, CPT2038, CPT2046, CPT2048	£15.00	1422	£15.00	CI514	£15.00
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3114T	£15.00	68M9	£18.90	CT2500/2	£17.80	PLASADONIC		KV2090, 2092, 2096	£16.20
AT207910	£13.00	68M9	£18.90	CT2512	£15.00	TLF14520P	£20.00	KV21XRTU, H.R.	£22.80
CROWN		68M9	£18.90	CT2600	£14.00	TLF14521F	£20.00	KV21XRTU, H.R.	£16.60
CTV-1487R	£15.00	68M9	£18.90	CT3306	£15.00	TLF14567F	£20.00	KV2252, 2256, PE3, H.R.	£18.00
CTV-2037VR	£15.00	68M9	£18.90	CT3326, 3327	£15.00	TLF14585F	£20.00	KV2252, 2256, RX	£15.00
CTV-B5063	£18.00	68M9	£18.90	CT3335	£15.00	TLF14585F	£20.00	KV27XRTU	£16.50
CTV-B5070	£18.00	68M9	£18.90	CT3337	£15.90	TLF14586F	£20.00	KV2704	£15.00
CTV-B7270	£18.00	68M9	£18.90	CT3335	£15.90	TLF14586F	£20.00	KV2705	£16.20
CTV-H3790DK	£17.50	68M9	£18.90	CT6320	£17.50	PERDIO		KV2752, 2756, RX	£16.50
DTV-9254	£15.00	68M9	£18.90	CVC1100	£15.00	P1408	£13.00	KV2752, 2756, PE3	£23.80
DAEWOO		68M9	£18.90	CVC1150	£17.80	P2005	£13.00	KVE2522	£23.80
DCS-1634	£15.80	68M9	£18.90	CVC1175	£15.00	P2102	£13.00	KVE2922	£23.80
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Chassis-145, 146, 147	£15.00	68M9	£18.90	CVC1204	£15.00	Anubis A/B	£16.50	KVX21TU	£23.80
Chassis-160, 161, 165, 166	£18.90	68M9	£18.90	CVC1210	£14.00	Anubis A/AC	£16.50	KVX2321	£23.80
85-3876-6	£15.00	68M9	£18.90	CVC1212, 1215	£14.00	Anubis B/A/A	£25.50	KVX2529	£23.80
85-9835-5	£18.90	68M9	£18.90	CVC1222	£14.00	Anubis B/B/A	£25.50	1-439-416-11/12/21/41	£23.80
FERGUSON		68M9	£18.90	CVC1201	£14.00	CF1	£15.00	1-439-423-11/21	£23.80
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20G1, 20G2, 20G3	£14.50	68M9	£18.90	FX3448	£15.90	Pico 1	£15.00	TCT2100	£15.00
20H4, 20H2, 20H3	£14.50	68M9	£18.90	FX3548	£17.20	Pico 1 ST2	£17.80	TCT362	£15.00
22B1-22B4	£13.50	68M9	£18.90	FX6320	£17.50	Pico 3	£15.00	TOSHIBA	
22D1-22D4	£13.50	68M9	£18.90	FX6330	£17.50	SPN578	£15.00	1400RB	£15.00
22G1-22G3	£13.50	68M9	£18.90	FX6348	£17.50	SFN3878	£15.90	150RB	£15.00
22H1, 22H3	£13.50	68M9	£18.90	FX6348	£17.50	SFN5550	£15.90	1589B	£17.20
2323, 2343, 2353, 2373	£13.50	68M9	£18.90	FX6348	£17.50	SFN5581	£16.80	1597B	£17.20
2423	£14.00	68M9	£18.90	FX6348	£17.50	SFN5880	£17.20	175RB	£15.00
2445, 2452	£14.50	68M9	£18.90	FX6348	£17.50	SFX3578	£17.20	175T9B	£15.80
2453	£16.65	68M9	£18.90	FX6348	£17.50	SFX3598	£17.20	2100RB	£20.00
2463	£14.50	68M9	£18.90	FX6348	£17.50	ST3467	£16.00	215RB	£15.80
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26D2, 26D3, T6033L	£13.50	68M9	£18.90	FX6348	£17.50	TX3325	£15.00	AT207909	£15.00
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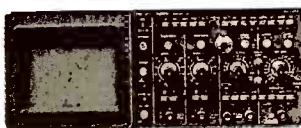
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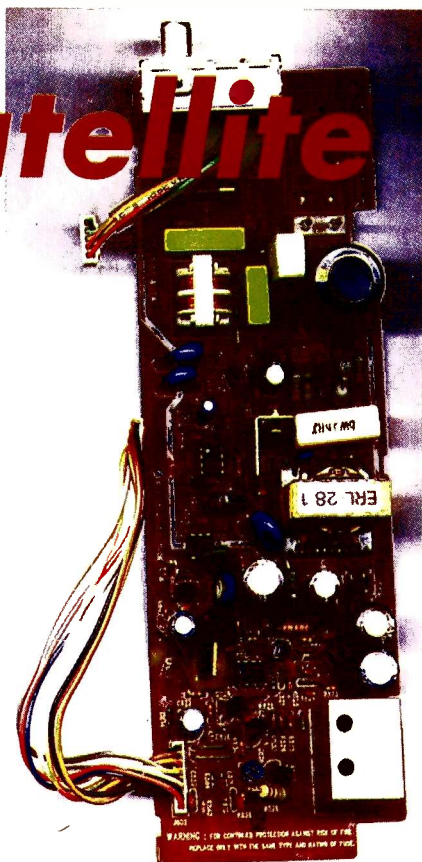
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Satellite

WORKSHOP



Jack Armstrong

BT SVS300

This receiver had been pizzafied. If you've ever left a pizza in the oven for slightly too long you'll know exactly what I mean!

I spent some time scraping away from the PCB what looked like burnt, melted cheese, then fitted the power supply repair kit. The receiver remained stubbornly dead – until I discovered two cracked tracks near the fuse. To remove the power supply PCB, which is wedged tightly in place, you have to wiggle and twist it. But I don't think I had been particularly heavy handed and assume that someone else had had a go before me.

With the receiver now working and producing pictures, I found that there were no decoder messages. Another half an hour passed while I replaced the decoder capacitors and other bits supplied in the kit. These kits usually save me a lot of time, but on this occasion the board didn't seem to work until it was heated with my hairdryer. My impression was that the board was damp. So I scrubbed it with isopropanol and then dried it thoroughly with hot air. Finally, since the area around the PTV111 chip seemed to be the most sensitive to moisture, I dripped hot beeswax around it, the bench and my trousers, leaving nice white

stains. My wife gave me a funny look later. I can't imagine why – after all they were very old trousers . . .

Next morning was cold and damp. But the receiver worked perfectly.

Ferguson SRD6

You may recall that I repaired an SRD6 for Tom in the next town. The symptom had been low video level and no decoder messages. The cause was transistor TV04, which is connected to what I had thought was the video level adjuster PV01. In fact PV01 controls the de-emphasis, as I discovered once I had replaced TV04.

Two weeks later the same receiver bounced back with a fault report that said, unhelpfully, "same fault again". It wasn't. This time the pictures were washed out while the decoder messages, though present, were heavily distorted. The decoder was working perfectly.

Scope checks showed that the video level was correct until the signal emerged at pin 8 of the graphics generator chip IV02, where there should have been a 2V peak-to-peak composite video waveform superimposed on 1.5V DC. In fact the DC bias was 3V, and the video waveform was being clipped by TV22 on its way to the TV scart socket and the UHF modulator. Now the graphics generator is a TCE10117180 and, curiously, I didn't have one in stock. My solution to this problem was an empirically-contrived 'bodge': I soldered a 330kΩ resistor between pin 8 of IV02 and chassis. That fixed it!

According to Tom the customer indicated his gratitude, as customers do, by whining about being charged twice and muttering about "trading standards". I really must try this myself. Next time I get an engine fault I'll take my car to the garage which replaced my exhaust pipe. "It's the same fault" I'll say, "it makes a noise again." I wonder if they'll fix it free of charge?

BT SVS250

I bought ten 'scrap' SVS250 receivers recently for spares. I won't end up with many spares however, having mended the first two dead ones (fuse melted) and jumped up and down on the third one in frustra-

tion – well, they *are* frustrating machines!

The other day I had a letter from Peter Thomeycroft, a dealer in Telford, describing the problems he had had with a customer's SVS250. "The original problem was caused by a faulty EEPROM, the symptoms being out-of-range bars on the display and an LNB offset reading of 25.38 which, after correction, could not be stored. When I'd replaced the 24C04 chip with a used one and fitted the SatCure upgrade kit Relkit 17 (phone 01270 753 311 for details) the receiver was OK and the customer left happy. An hour later he phoned to say that the receiver was the same as before. It transpired that he had used the receiver for about two years with a UHF connection, and had now decided to try a scart connection instead. As soon as he fitted the scart connector the receiver went feet up. I had already checked it with our TV scart socket and found that it was OK. When I checked his TV set I discovered that there was 12V at pin 10 of the scart socket! The LNB offset read 25.38, indicating that the EEPROM had once again died. I had to cut the relevant wire before reinstallation. Incidentally the TV is a Beko one."

So the moral is: beware of scart connectors! I've come across similar problems with decoder scart connections in Amstrad receivers, but never with a TV scart. It seems that in the SVS250 a data line from the 24C04 chip is connected to pin 10 of the TV scart socket.

Pace MSS1000

Left to themselves these Pace receivers will give trouble-free use for years. But the designers failed to take into account the ingenuity of the average customer, who believes that equipment should be kept hot! And, in my experience, the more money the less common sense they have.

This particular receiver belonged to a gentleman I'll call, to save him from any embarrassment, Lord Potts. He designs clothing – or rather he employs others who design it for him. He thus has, so he tells me, "a feel for quality".

The MSS1000 had been squeezed into a custom-built brick fireplace arrangement, together with a 28in. TV set, two VCRs and a hi-fi audio

system. To ensure that there was absolutely no possibility of nasty drafts, or 'ventilation' as we call it in the trade, the chimney stack had been blocked and the whole affair was hidden behind velvet drapes.

The fault symptoms were obvious: the audio from both the left and the right channels was very faint and extremely distorted, and the vacuum fluorescent display flickered in time with the audio. Very pretty.

Back in the workshop I discovered that the fault vanished when the Dolby board was disconnected. Before I plunged in head first however I tried another Dolby board. The distortion returned. Hmm.

I decided to replace all the power supply electrolytics, as they looked decidedly black – there seems to me to be little point in trying to trace the cause of an obscure fault when such an obvious clue is present. Relkit 10 from SatCure (01270 753 311) contains all the high-reliability capacitors required, except for the 100µF, 400V one that seldom fails. I replaced the capacitors in turn, reassembling and testing after fitting each one. Since the symptom was new to me, I wanted to establish which part or parts contributed to the fault. In fact the culprit was C10 (100µF, 35V), the reservoir capacitor for the -21V sup-

ply, but I fitted the complete kit as a precaution. In addition I installed a miniature fan kit, as Lord Potts insisted that the receiver should be returned to its original oven.

The net result was an excellent picture and sound for Lord Potts and a nice big check for me!

Pace SS9200

This receiver lit up when it was plugged in, but the fault report from a local dealer simply said "dead". As I could get nothing but snow on most channels, my first impression was that the tuner might have died. Tuning was tricky, because the menus didn't appear on the screen. Clearly there was more than one fault.

I fitted a second-hand tuner. This made no difference, and I scratched my head in confusion. A few pictures appeared when I flicked through the channels, but only on the horizontally-polarised stations. Aha! Power supply noise was switching my universal LNB to high-band operation. I have seen this before, the cure being to replace all the electrolytic capacitors in the power supply. I did so, but the fault remained.

Looking at the circuit diagram, I traced the LNB supply path to the tuner and noticed that at this point a

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

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

100µF electrolytic (C128) is used to decouple the supply. Replacement of this capacitor solved one problem – the vertically-polarised channels could now be received. But there were still no decoder messages, channel identifications or menus. I guessed that there were no sync pulses. I should have used my scope, but a guess is sometimes quicker – when you are right! I was right this time: a new TEA2029C sync separator chip restored normal operation.

Finally, for good measure, I upgraded C125 to 1,000µF to remove some horizontal streaking on decoded pictures. Sometimes a lot more capacitors need to be replaced to cure the problem, but this time I was lucky.

Test Case 422

It was just before Christmas. Sage had taken a day off sick, which is very unusual for him. The rest of the staff put it down to a surfeit of the wine he's so fond of, and this was not too wide of the mark.

As is usually the case in the run-up to the big day, there was a lot of equipment in the workshop awaiting repair, especially VCRs. The other members of the workshop team, mostly TV specialists, were having to get to grips with motors and mode switches, rollers and reels as Sage, alone in his bedroom, rolled his eyes and reeled across the landing to the loo, his system control in deep trouble.

The scratch video repair team managed all right until a Toshiba V411 came along. This machine had been throbbing away for six or so years without giving any trouble. It had then developed a 'nasty'. At first the problem didn't seem to be too bad: during playback the VCR would intermittently flick between the SP and the LP modes. It's a common enough fault, the cause usually being to do with poor signal pick-up at the control-track head. So for starters the CTL head was cleaned. There had been no visible deposit on the head however, and the treatment didn't make any difference. Next, the path of the tape across the face of the ACE head-stack was carefully checked while the fault was present. The tape was seen to be a fraction too high, so the worn pinch roller (no surprise about this after six years' service) was discarded and a new one was fitted.

This seemed to cure the problem. But as the fault had been intermittent the machine was left to run for a while, using the customer's tape – which had not been crinkled by the worn roller. No doubt Sage would have gone through the same

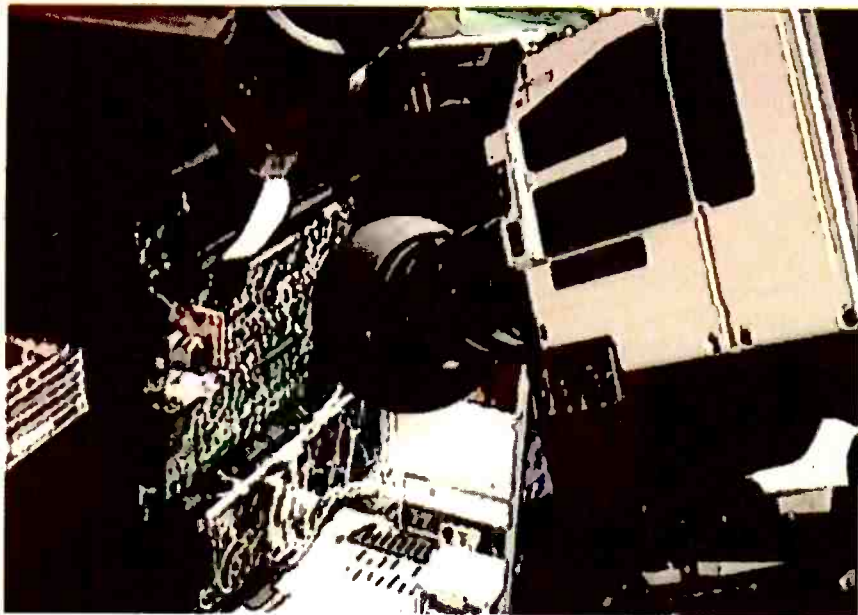
motions had he been there. But at that moment he was concerned about different motions altogether.

After a while the sound track of the Teletubbies recording went funny and the Tosh's front panel indicator once more flickered between SP and LP. Uh-oh! Examination of the tape path showed that the tape was running straight and true across the face of the still clean ACE head. Maybe poor head alignment was affecting the control-pulse transfer? The tilt screw behind the head was tweaked to make the head lean back a little. Its height was readjusted to compensate. But the fault had not been cured.

What next? The technicians were so engrossed with thoughts of head and pulse-readout faults that they didn't make any oscilloscope checks before coming to the conclusion that the head had to be faulty. A new one was ordered and the VCR was put to one side awaiting the parcel. The customer was provided with a loan machine.

Sage had recovered and returned by the time the new head arrived. He fitted and aligned it himself. At first the results were fine, but within half an hour of the start of a soak test the playback sound and picture became wobbly. The fault was back again! Well, the ACE head was not responsible anyway. Would Sage have condemned it without carrying out further checks? We can't answer that one. Certainly he had to do some further checking now. With his scope triggered by head flip-flop pulses and its probe in amongst the servo chips, Sage soon found and rectified the cause of the problem. Was it to do with the ACE head? Were any further components required to put matters right? For the solution to the problem, turn to page 291.

Test Report



Eugene Trundle
reports on the current range
of training tapes available
from Visions Video
Productions

Service Training Tapes

In the November 1994 issue of *Television* I reviewed an instructional video tape that had just been released by the then-new company Visions Video Productions. It covered the Akai VCRs of the period and I found it very good.

Since then Visions Video has produced a wide range of training and instructional cassettes for the benefit of bench technicians in the brown-goods servicing trade. There are now ten of them, and more are to come. They cover TV sets, VCRs, satellite receivers and camcorders from several manufacturers, who have all given their approval and co-operated in the production of the tapes.

Current List

The cassettes currently available are as follows:

VIS001. This was the original one previously reviewed, covering Akai VCRs of the period.

VIS002. Covers the Ferguson/Thomson ICC5 TV chassis.

VIS003. Deals with the Panasonic G deck, which is also used in Grundig, Philips and Sony VCRs.

VIS004. On Pace PRD-series satellite receivers.

VIS005. Covers Akai AX-GX series domestic VHS decks, which were produced from early 1994.

VIS006. Covers the Nokia M digital TV chassis, which was also used in Granada, Hitachi, ITT, Luxor and Salora models.

VIS007. On the GoldStar/LG D27 VCR deck.

VIS008. On the GoldStar/LG PC53A TV chassis.

VIS009. On the LG D17 VCR deck.

VIS101. This, the longest-running tape, deals with Akai 8mm camcorder models in the PV-M series.

Quite a selection! Ten hours and thirty-six minutes of viewing for me, but many hundreds of hours of painstaking work for those who designed and produced these training guides.

Content

A common thread runs through the design and production of these visual servicing courses: they are all practically based and tailored to meet the needs of a technician with a faulty piece of equipment on the bench in front of him – and perhaps a puzzled look on his face!

The tapes that deal with deck mechanisms take you through the entire dismantling and reassembly processes, with close-up shots of the work actually being done. The friendly running commentary mentions pitfalls as well as describing what is being done and the techniques involved. Phasing of the mechanics and for example the mode switch is described in detail. The beauty of this method of presentation is that you can freeze any frame on the tape while your repairwork is in progress, so that you can match what you are doing with what is shown on the screen. The tape path and head alignment procedures are very well done, with a view of the screwdriver adjustment in the main picture and an insert (PIP) section that shows its effect on an oscilloscope display or the running tape ribbon as appropriate.

The TV, particularly satellite, courses contain some



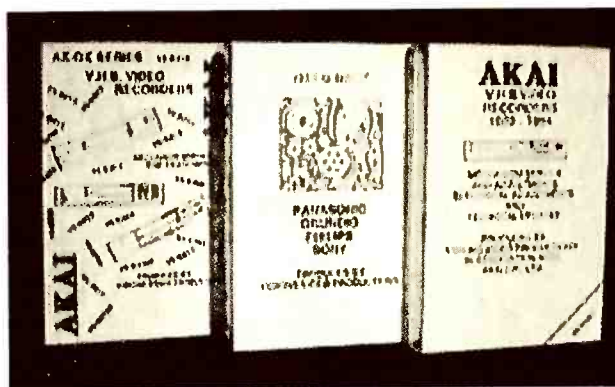
circuit description where this is relevant to diagnosis and repair. They are primarily concerned with what goes wrong in practice, with getting to the root of the trouble, then the repair and setting up. Once again a picture-in-picture technique is used, with scope traces and meter/counter readouts as insets to views of the main PCB and its preset controls. There are also off TV-screen shots to show menus, fault conditions and the effects of adjustments as relevant.

For the individual pieces of equipment we are shown such things as getting into the service mode, software addresses and the operation of VCR decks outside their cabinets. Many of the tapes have a 'hints and tips' section in which common faults, quirks, modifications and service/repair kit availability are covered.

All the tapes are indexed with time-counter readings per topic, so that for example we see that in the ICC5 programme EW problems are dealt with at 46 minutes in while the Akai camcorder tape explains the AF tracking adjustment at the 2 hour 26 minutes mark. All this is well thought out and quite accurate.

Verdict

It is increasingly difficult to find the time to attend conventional technical training courses, while with every year the number of friendly TLOs available for workshop visits diminishes. Even when you can take advantage of these facilities, the knowledge gained tends to fade with time. These on-tape guides have the advantage that they can sit on the shelf for use as and when necessary, then wound to and fro, frozen and released as required – unlike the human memory or printed notes!



A selection of the Visions Video Productions tapes.

And what conventional courses come complete to you on the workshop bench at a cost of typically £20?

My opinion of these training tapes is very high, but I will leave you to decide for yourselves about the background music with some of them!

Price and Availability

Most of the cassettes are priced at £19.95 plus VAT. But prices range from £15.95 plus VAT for VIS008 to £45 plus VAT for the two-and-a-half hour camcorder tape VIS101. The cassettes are available from leading component/spares suppliers and from Visions Video Productions themselves, who can also provide information on distributors in the Irish Republic and Australasia. The address of Visions Video Productions is 41 Sherwood Road, Addiscombe, Croydon, Surrey CR0 7DL, phone no. 0181 654 5773, fax 0181 656 7183.

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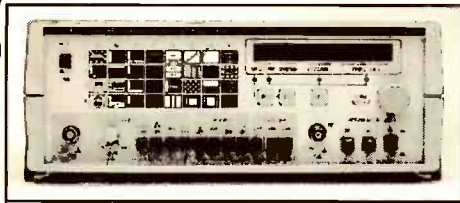


PROMAX

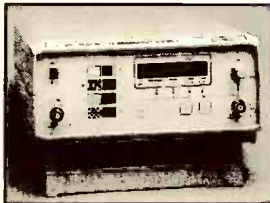
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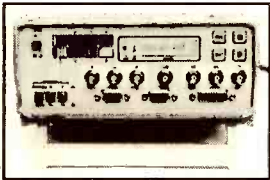
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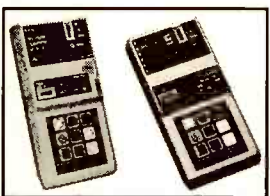
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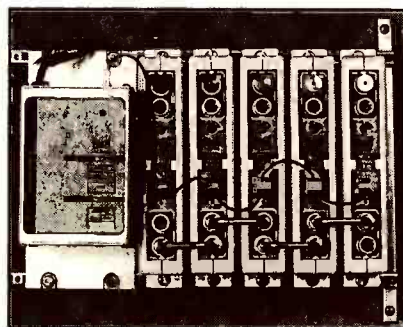
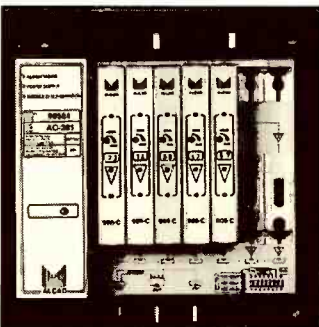
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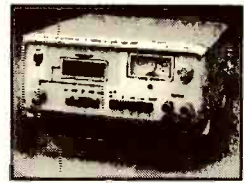
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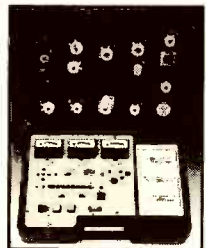
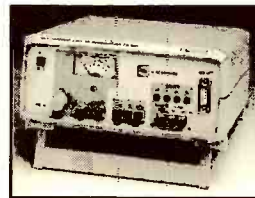
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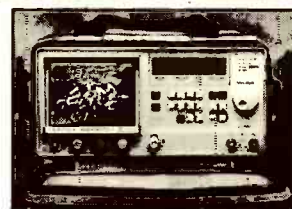
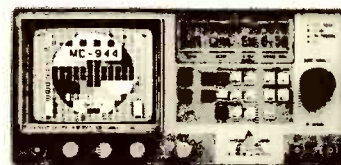
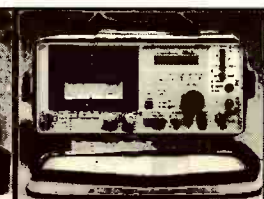
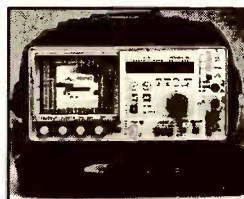
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A Pace PRD800/900 Modification

An unused microcontroller option in these satellite receivers can be used to control an external device such as an ADX channel expander. Martin Pickering, B.Eng., describes the modifications required

The simple modification described in this article should do the trick if you have one of these receivers and want to control say an external 22kHz tone inserter box on a 'per channel' basis.

There is, hidden in the microcontroller chip (U2) used in these receivers, an option to control a dual-bandwidth tuner. Since the PRD series receivers don't have a dual-bandwidth tuner, the option can be used for our own purpose.

The modification is simple: you don't even need to remove the PCB!

Components required

The following components and items are required to carry out the modification:

Three 0.25W resistors with values 1k Ω , 4.7k Ω and 100 Ω .

A 150mm length of insulated wire.

Thin solder and a fine-tipped soldering iron.

Procedure

Refer to Fig. 1 which shows where the extra resistors are to be added. Proceed as follows:

- (1) Tin the relevant IC legs with solder - pin 1 of U2, pin 2 of U4, pin 14 of U3 and pin 5 of U18.
- (2) Tin the resistor leadout wires with solder.
- (3) Solder the 4.7k Ω resistor between pin 1 of U2 and pin 2 of U4.
- (4) Solder the 1k Ω resistor between pin 5 of U18 and pin 14 of U3.
- (5) Solder the 100 Ω resistor to the junction of the added 1k Ω resistor and pin 14 of U3.

(6) Solder the 150mm length of insulated wire to the free end of the 100 Ω resistor, then solder the other end of the length of wire to pin 14 of the decoder scart socket (on the top row, count four from the top sharpest corner of the socket).

Pin 14 of the socket has no connection to the circuitry beneath the board. It is therefore free for use - but, if you use a decoder, it is essential to cut the wire to pin 14.

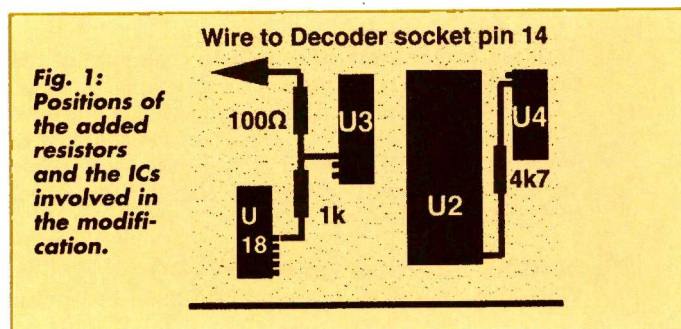
(7) You will now see a new feature, "IF BANDWIDTH: NORMAL", in the tuning menu for each individual channel.

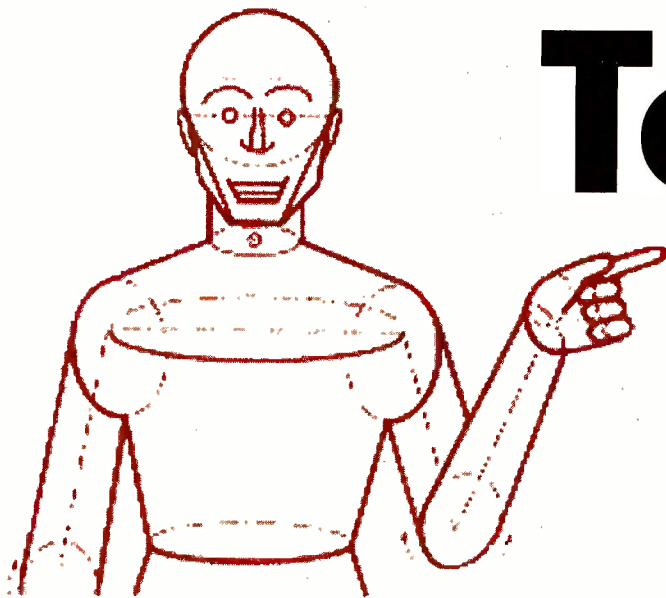
If you change this to "IF BANDWIDTH: NARROW" the modification will apply 12V to pin 14 of the decoder scart socket.

This 12V supply can be used to control an external device such as an ADX channel expander unit, a 22kHz tone inserter or an LNB switching box.

SatCure

For details of various satellite receiver modification and repair/upgrade kits, send two first class stamps to SatCure, PO Box 12, Sandbach, Cheshire CW11 1XA (01270 753 311). Be sure to state the make and model number of the receiver concerned.





Toshiba

Service Briefs

More know-how from Toshiba, based on Technical Bulletins CDH68 and CDH69

Televisions

Model 2163DB (C6S Chassis)

Poor character width in the teletext mix mode: Cause is poor performance of the TV/text switch in the TB1229N video/colour/timebase generator chip Q501. Replace the chip with the improved type TB1229AN, part no. B0102070.

Models 2512DB and 2812DB (C91SB Chassis)

Lack of width with corrugated effect to side of picture: The value of C424 (4.7 μ F) on the DPC PCB has decreased. Replace C424, part no. 24676479.

Models 2527DB, 2539DB, 2927DB, 2939DB, 3327DB and 3339DB (C2D Chassis)

Field bounce on channel change: Replace R329 (22k Ω , 1/6W).

Reduced height from cold or field cramping at the top: Either C321 or C322 has probably fallen in value. C321 (18nF, 50V plastic film) is connected to pin 14 of IC302. C322 (2.2 μ F, 50V electrolytic) is connected to pin 15 of IC302. If capacitor replacement doesn't cure the fault, replace the TA8859P EW chip IC302, part no. B0384680.

Models 32W6DB and 32W6DG

When using the service park position the chassis must

be secured to the cabinet top using a back fixing screw – tighten over the slot in the plastic frame. The addition of a washer is recommended to provide more secure fixing: it will give greater surface contact at this point.

Note that the line output transformer part no. quoted in the service manual is incorrect: the correct part no. is 23236517.

Spares

The IR receiver (K901) used in Model 1752TB is incorrectly specified in the schematic diagram. It should be shown as type TFMS5380, part no. 23904750A.

To avoid PCB damage in transit, the power/deflection PCBs used in Models 2557DB, 2577DB, 2857DB, 2877DB, 3357DB and 3377DB are now supplied without the chopper transformer T803 (for the same reason they also come without the LOPT). The original or a replacement chopper transformer will therefore have to be fitted as appropriate.

Projection TV

Safety note: Do not attempt to operate a projection TV with the X-ray protection plate at the front removed – the plate is under the front plastic cover beneath the speaker grill. A safety interlock lead, which has to be disconnected to gain access to the CRTs, is attached to the protection plate. When this lead is open the power supply is disabled. Overriding this connector and removing the plate will expose you to harmful X-rays from the CRTs.

Models 48PJ6DB/DG and 55PJ6DB/DG (C5SS Chassis)

Convergence errors appear gradually with use. May

be corrected with digicon adjustment but reappear: Replace resistors R7716, R7721 and R7711 which are connected to the STK392 vertical convergence output IC Q751, or R7726, R7731 and R7736 which are connected to the STK392 horizontal convergence output IC Q752. These resistors tend to increase in value. The correct value is 2.2Ω, rating 2W. Part no. is 24323229.

If either of these output ICs has overheated and failed, the relevant three resistors specified above must be replaced in addition to the IC.

If the power 2/digicon chassis (left-hand side looking from the rear) has been removed during service it is easy to fit the two 4-pin plugs P621 and P712 in the wrong sockets at the rear edge of the PCB, especially as the shorter lead goes to the farther socket. The symptoms will be the power LED flashing green at six-second intervals and no sound or picture. No damage will be done.

Rubber grommets (inserts) for the speaker grill plastic location pins are not listed in the service manual: they are available under part no. 23451853.

Satellite TV

Model TS540

Dead, fuse FS1 (1A fast-blow) open-circuit: The usual causes are as follows.

- (1) One of the 1N4007 (part no. 1200400701) bridge rectifier diodes D1-4 short-circuit.
- (2) D55 (type BAS16, part no. 9120001651) leaky.
- (3) The STP4N90F1 MOS chopper transistor Q1 (part no. 1104910000) short-circuit and the 10Ω, 2W anti-surge resistor R1 (part no. 1431007821) open-circuit.

No sound, distorted sound or only one sound channel working: Replace the MSP3400 sound processor chip U18 (part no. 1090340000).

No signal. The tuning voltage at pin 15 of the tuner does not vary with channel-change operation: Two likely causes are as follows.

- (1) The 4MHz clock signal at pin 12 of the Nicky chip U26 is missing because the 74LS74 oscillator chip U31 (part no. 1010007400) is faulty.
- (2) The Nicky chip U26 (part no. 1090960103) is faulty with no tuning voltage output at pin 16.

Grid of dots flashes on the screen, over the picture: The M550555 display chip U7 (part no. 1090505551) is faulty.

Test signal and text box are permanently displayed in the centre of the screen: This occurs when test point TST1 in the VideoCrypt decoder, between ICs U8 and U9, is dry-jointed or the track is broken. Resolder/repair as necessary.

VCRs

V3 Cat 1 and Cat 2 Chassis

These chassis are used in Models V205B, V215B,

V226B, V255B, V425B, V426B, V705B, V726B, V727B, V856B and V857B.

Dim clock display: CP041 (220μF, 25V) has fallen in value. Replace capacitor.

Dead, or pulsing outputs from the power supply: Two likely causes are as follows.

- (1) CP007 (10μF, 50V) or CP008 (100μF, 25V) has fallen in value. Replace both capacitors.
- (2) The U4614B chopper control chip IP001 (part no. 70011972) has failed.

While the above notes will help speed diagnosis and repair, the power unit is available from Toshiba spares at typically less than £30 trade. It may therefore be more cost effective to replace than repair the unit.

Crushed whites with playback via the RF modulator only: The 2SC2236-Y 12V regulator transistor TW003 is faulty with low output (11V). Replace the transistor, part no. A6325549.

Intermittent video and audio mute with both E-E and playback: The 17.7MHz crystal QT102 (QT001 in Cat 2 Hi-Fi models) is faulty. Replace the crystal, part no. 70012188.

Models V205B, V215B and V255B (V3 Cat 1 Chassis)

No E-E or playback picture or OSD, with no supply to the RF modulator: Check capacitor CW001 (100μF) in TW001's base circuit by substitution.

Models V226B and V426B

The main microcontroller chip IT001 in these models has been changed from the original type TMP90CS74DF part no. 70012656 to part no. 70012801. The only difference is that the new chip has additional software for a full-band modulator. This may automatically upgrade some early versions of these VCRs.

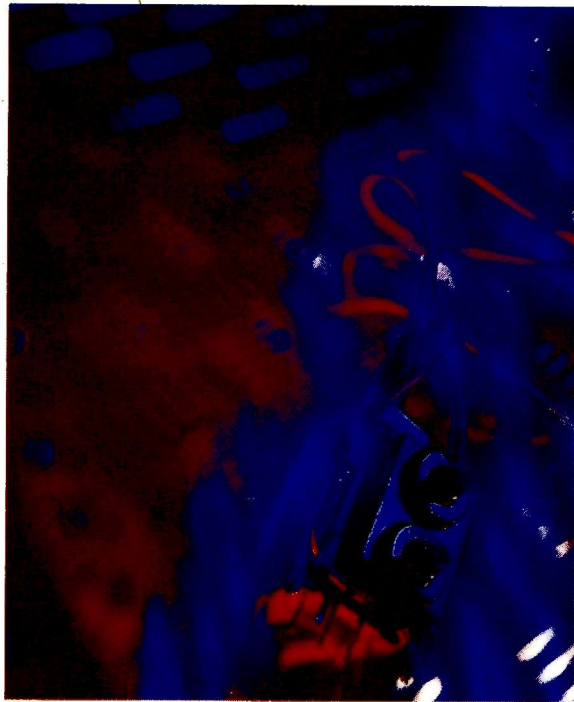
Ribbon Cables

Following requests Toshiba can now supply the following ribbon cables for V3 type VCRs.

Models V204B, V205B, V215B, V226B, V254B, V255B, V404B, V425B, V426B, V454B, V705B, V726B, V804B, V825B, V854B, V855B and V856B: 6-pin FFC from the main PCB to the loading motor and cam switch, part no. 70011821.

Models V204B, V205B, V215B, V226B, V254B, V255B, V404B, V425B, V426B, V454B, V705B, V726B and V856B: 14-pin FFC from the main PCB to the KDB PCB (key display), part no. 70011980.

Models V804V, V825B, V854B and V855B: 12-pin FFC from the main PCB to the KDB PCB (key display), part no. 70011818.



It's very helpful to have a means of testing line output transformers. This tester design by Charles Ritchie is based on a TBA920 line generator chip

LOPT Tester

You decide that the cause of the trouble just has to be the line output transformer. But when you order and fit a replacement it transpires that the original one had been OK. This has happened to me umpteen times, and no doubt has to most other readers as well. The last time it happened to me I swore "never again, there has to be a cheaper way of doing things". Then I remembered Ian Rees's LOPT tester design published in the September 1993 issue of *Television*.

In his circuit Ian used a CD4001 IC as the oscillator. As I didn't have one in stock, and neither did my supplier, I decided to use a TBA920 IC instead. Many older engineers will recall the use of this chip as the line generator in sets produced during the Seventies.

I also decided that it would be handier if I could use a multimeter rather than tying up an oscilloscope. And because of circuit differences, the ringing method devised by Ian was out. In addition there is no need to be able to alter the tuning capacitance since my circuit uses feedback.

Circuit Description

The circuit I devised is shown in Fig. 1. IC1, with VR1, R1, R2, R3, R4 and C2, acts as a free-running oscillator. It produces a 10V peak-to-peak output at pin 2. Q1 is the switching transistor, which drives the primary winding of the transformer being tested. C4 tunes this winding and C3 applies feedback to pin 13 of IC1.

D1 and C5 rectify the pulses generated at the collector of Q1, providing a feed to the multimeter. R6 and R7 give a 10:1 reduction: this is the oscilloscope output.

The unit's power consumption is about 100mA.

A fixed potential divider (see Fig. 2) could be used instead of VR1, but the control should be retained if you intend to use an oscilloscope – it helps with triggering.

Testing and Use

To test a transformer out of circuit, connect its primary winding across C4 as shown in Fig. 1. Connect your multimeter, switched to its 200V DC range, to the junction of D1/C5. Switch on the 12V supply. The circuit should then oscillate. A faulty transformer usually produces a reading of less than 50V.

For an in-circuit test, first make sure that the receiver's HT reservoir capacitor is discharged. Then either disconnect the line output transistor's collector or the HT feed to the transformer. Proceed as above. If you get a low reading, try reversing the connections. If you still get a low reading it may be necessary to unsolder all the transformer pins.

When testing a transformer, keep your hands clear – you can get a nasty shock (guess how I found out!).

Fig. 3 shows a typical waveform produced by a good transformer. Scope settings are 20µsec/cm and 2V/cm.

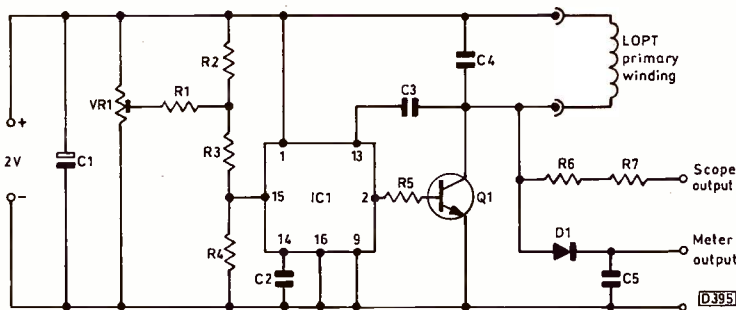


Fig. 1: The LOPT tester circuit. There are no connections to pins 3-8 and 10-12 of IC1.

Fig. 2 (left): Fixed potential divider alternative to VR1.

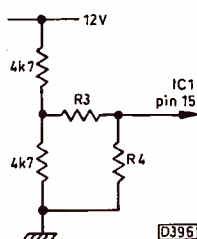
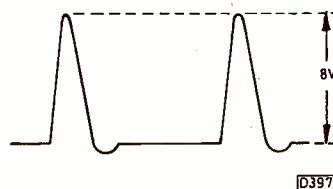


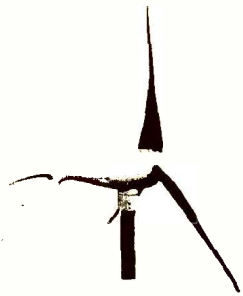
Fig. 3 (right): Typical waveform produced by a good transformer. See text.



Components required

C1	1,000µF, 16V	R1	27kΩ
C2	10nF, 400V	R2	27kΩ
C3	560pF, 1kV	R3	15kΩ
C4	10nF, 400V	R4	2.7kΩ
C5	0.1µF, 400V	R5	2.2kΩ, 0.5W
D1	BYD33	R6	2.2MΩ
IC1	TBA920	R7	6.8MΩ
Q1	BUT11AF	VR1	10kΩ linear

Also two miniature crocodile clips. Except for R5 the resistors are rated at 0.25W.



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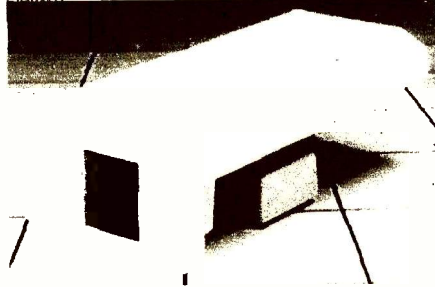
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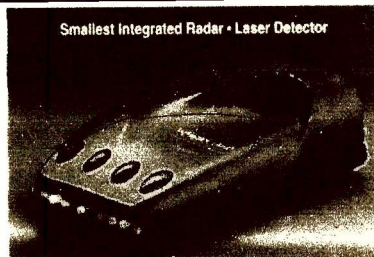
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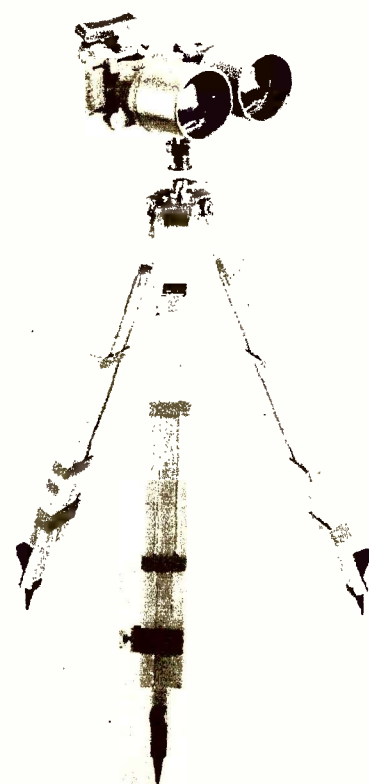
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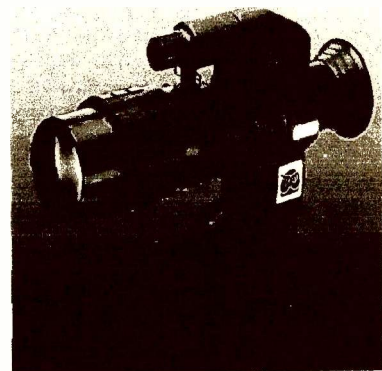


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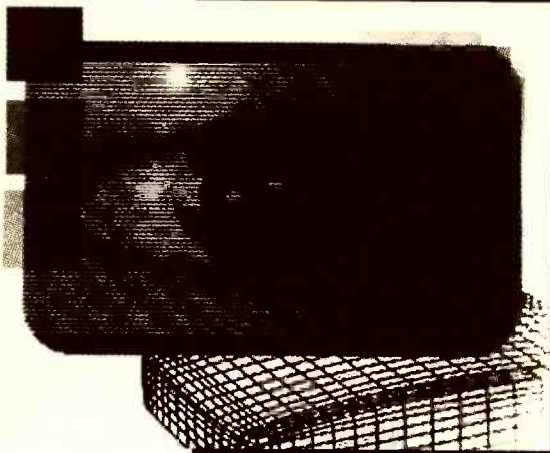
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Monitors



Reports from
I. Field
Philip Blundell, AMIEEIE
Chris Watton
John Edwards
Roger Burchett and
Adrian Spridell

Wyse 60

These elderly ASCII terminals remain popular and are sturdy. We get two faults from time to time however. One is gate array failure, the other is failure of the 3.3 μ F, 50V non-polarised electrolytic line scan coupling capacitor C205. When C205 fails, R214 (10 Ω) in the dynamic focus circuit usually catches fire, burning a hole in the side of C206 (0.22 μ F, 100V).

File away the carbonised PCB carefully and fit a replacement resistor flat across the aperture, using its leads to repair the damaged print by bending them to the required shape. Replace C206 and clean the soot off the focus potentiometer. With regard to C205, an alternative to an electrolytic should prevent a recurrence of the trouble. I suggest a 4.7 μ F polycarbonate type, or possibly a polyester capacitor. These should be available from Farnell Electronic Components (phone no. 01132 636 311). Fit the capacitor on end, with a wire link from the top end to the other PCB hole. Secure with hot melt or silicone rubber. **I.F.**

Gateway 2000 Model CS1572FS

The problem here was a dull, milky raster. As normal checks revealed nothing amiss, I looked at the CRT's pins. They were well covered with oxide scale. You get this with all CRTs, and it occasionally causes problems. I find that using a glass-fibre pencil to brush around the accessible part of the pins, then

pushing the CRT base on and pulling it off a few times, will remove the oxide where the contacts rest on the pins. The fibre particles must be completely removed, using compressed air. The result is better than new! **I.F.**

Peacock/Nytec Model MN14P37

There was line collapse – a vertical line down the centre of the screen. I found that one of the solder connections to L401 had arced away. This magnetically-polarised inductor is in series with the line scan coils, at the earthy side. When refitting it after scraping the leads, note that the line mark on the body of the inductor lines up with the dot on the PCB screen-print symbol. **I.F.**

Philips 4CM2799/00T

If one of these colour monitors is dead with a clicking relay, check whether transistor Tr7605 or Tr7615 is short-circuit. If either transistor, or diode D6608, has failed replace all three components, also coil L5604. In addition, check that the value of C2609 is 5.6nF (part no. 4822 121 43677). **P.B.**

IPC VDVGA14#55N1

This monitor was dead. There was 320V at the output from the mains bridge rectifier circuit and at the collector of the chopper transistor. As usual, I didn't have a circuit diagram. What I do in such a case is to check for heavy loads across the outputs from the power supply. If none are present I check for a start-up supply of some sort on the primary side of the circuit. In this case the search brought me to R531 (560k Ω) which had failed. It's connected between the 320V supply and the junction of a zener diode and the base of a series regulator transistor. The latter provides power for the primary control stage. **C.W.**

Mitec L1450PD

This budget VGA-type monitor was

dead with no power supply operation. The PC engineer who had brought it in pleaded for a quick job and I was happy to oblige. One of the two 47k Ω start-up resistors R904/905 was open-circuit. **J.E.**

Capetronic CDS438K

The frame scanning would intermittently become distorted at the top and bottom, eventually collapsing to a height of less than half an inch. A tap anywhere would clear the fault – which wouldn't appear once the monitor had been dismantled! Only by flexing the board could any disturbance be seen. Resoldering the pins of the μ PC1498H frame output chip IC201 didn't seem to have any effect. When the solder was removed from the IC's heatsink tag however the metal was seen to be eroded. Resoldering, with an added wire link, cleared the fault. **R.B.**

Chuntex 1565D

These monitors often have badly soldered joints at the pins of the line output transformer. In one case there was no HT supply at the collector of the line output transistor because of a solder 'blob' that failed to make contact with the print. **R.B.**

AST SVGA LR14

The symptom was line cramping at the sides of the screen. I found that C350 was leaky. **A.S.**

Taxan MV789LR

This monitor was dead. The BU2527A line output transistor and the FET Q808 were both short-circuit. The cause of the trouble was that the HT output from the power supply had risen from 84V to over 200V. Feedback resistor R820 (150k Ω) was the cause: it had gone open-circuit.

If you get this type of fault, check D406 before you switch on again. It's under the LOP heatsink. If D406 is leaky, Q808 will blow immediately when power is reapplied. **A.S.**

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The Language of Digital TV

With TV going digital, there are many new terms and abbreviations we'll have to get used to. **Mark Paul** has compiled the following list as a handy reference

Digital technology will involve a new way of thinking about TV. We have already seen some use of digital techniques in the world of TV, with remote control, teletext, Nicam and, in a few chassis, signal processing, but we are now on the brink of something altogether different. There is to be a major design shift from the analogue to the digital approach, and this will require a new understanding – we are not just concerned with a bit of add-on technology.

The change has been compared with that from monochrome to colour, but is in fact more radical. It will bring with it new servicing techniques, a new set of fault conditions, new test equipment, new features, new product awareness, new customer education and a new language: Digispeak! The following is your guide to digital TV Digispeak. We'll start with abbreviations, then provide definitions for the new terms you'll be encountering.

Abbreviations

AC3 A multi-channel audio system developed by Dolby Laboratories.

ADC Analogue-to-Digital Converter. Device for converting an analogue voltage waveform into a series of digital numbers.

AF Adaption Field. A data field used for adapting the PES (see later) to data transport packet length.

ADPCM Adaptive Differential Pulse Code Modulation.

ASK Amplitude Shift Keying. A digital amplitude modulation system with two states.

AU Access Unit. MPEG coded picture, sound or data frame.

B Bidirectional. Use of preceding and succeeding MPEG frames to derive a further frame (by interpolation).

B When used to refer to an MPEG video frame, the type that is derived from I and P frames.

BAT Bouquet Association Table. A table that relates DVB-SI services.

BER Bit Error Rate. Ratio of the number of erroneous bits to the total number of bits transmitted.

BIT Binary Digit, i.e. a logic one or zero. Binary means two-state, either one or zero.

BUS A group of conductors forming a circuit or route along which data or power can be sent between several ICs, circuits or pieces of equipment.

BYTE Digital 'word' consisting of eight bits – the standard size of a binary number.

CA Conditional Access. The means of restricting access to Pay-TV programmes.

CAM Conditional Access Message. Specific messages for conditional access, i.e. ECM and EMM.

CAT Conditional Access Table. A DVB MPEG-2 transmission table that identifies conditional access packets.

CAZAC/M Constant Amplitude Zero Auto Correlation. A reference symbol for terrestrial DVB.

CCIR Comité Consultatif International de Radiodiffusion. Organisation that controls international standards, frequencies etc. Now known as ITU-R.

CCIR-601 Recommended standard form of video signal digitalisation, with a sampling frequency of 13.5MHz and YUV signals in 4:2:2 format. Now known as ITU-R 601.

CCIR-656 Recommended way of interfacing CCIR-

601 signals. The most common arrangement is 8 bits parallel multiplexed YUV.

CCITT Comité Consultatif International de Télégraphe et du Téléphone. Now known as ITU-T.

CIF Common Intermediate Format. A compromise between the European and American SIF (see later) formats. The spatial resolution is taken from the 625-line SIF (360 x 288 pixels) and the temporal resolution from the 525-line SIF (30Hz). This compromise is the basis of video conferencing.

C/N or CNR Carrier to Noise Ratio. Received carrier power to noise power in the channel bandwidth expressed in dB.

COFDM Coded Orthogonal Frequency Division Multiplex. See OFDM. Modulation technique to be used for digital terrestrial TV transmissions.

CRC Cyclic Redundancy Check. Used to check the correctness of data.

CSA Common Scrambling Algorithm. The scrambling algorithm specified for DVB.

CVBS Composite Video Baseband Signal. This relates to analogue TV – it's the composite luminance, colour and sync PAL, NTSC or Secam signal.

DAB Digital Audio Broadcasting. The new European digital audio broadcasting standard.

DAC Digital-to-Analogue Converter. Device for converting a series of digital numbers into an analogue signal waveform.

DAVIC Digital Audio Visual Council. The council, based in Geneva, has members from all the industries involved in the application of digital technologies to audio and video. It aims to define and specify interfaces to provide maximum interoperation between countries, applications and services.

DBS Direct Broadcasting by Satellite, i.e. from a satellite to individual dishes. The original DBS band reserved for TV broadcasting was 11.7-12.5GHz. Other sections of the Ku band have come into use for DBS, i.e. 10.95-11.7GHz and 12.5-12.75GHz.

DC Direct Current, also refers to the null-frequency coefficient in DCT (see below).

DCT Discrete Cosine Transform. JPEG/MPEG technique in which a pixel data block is converted from temporal to frequency form.

DiSeqC Digital Satellite Equipment Control. Method of modulating a 22kHz tone to provide control of LNB etc. switching.

DPCM Differential Pulse Code Modulation. Method of coding a value in terms of its difference from the previous value.

DRAM Dynamic Random Access Memory. A read/write memory whose stored data requires periodic 'refreshment'. The most common type of memory, because of its low cost.

DSM Digital Storage Medium. Term given to such mass storage devices as a hard disc, tape or CD/DVD.

DSP Digital Signal Processor. Chip used for processing digitalised analogue signals.

DTS Digital Time Stamp. Indicator of the decoding time of an MPEG access unit.

DVB Digital Video Broadcasting. In Europe there are three variants, DVB-C (cable), DVB-S (satellite) and DVB-T (terrestrial off-air).

DVB-CI Digital Video Broadcasting Common Interface. Used for conditional access modules in the PCMCIA format.

DVB-SI Digital Video Broadcasting System Information. A group of tables with specifications additional to MPEG-2 programme specific information (see PSI).

Eb/No Ratio between the average bit energy E_b and the noise density N_0 . It's related to C/N.

EBU European Broadcast Union. An organisation that brings together the main European broadcasters and, amongst other things, works on new standards which then require ETSI approval.

ECM Entitlement Control Message. The first type of conditional access message with the DVB standard.

EEPROM Electrically Erasable Programmable Read-Only Memory. ROM that can be both read from and written into. It's not suitable for use as a RAM as the write process takes considerable time. Also known as an EAROM – Electrically Alterable ROM.

EIT Event Information Table. A DVB-SI table that indicates a new event.

EMM Entitlement Management Message. The second type of conditional access message with the DVB standard.

EPG Electronic Programme Guide. A graphical user interface giving easy access to DVB programmes.

EPROM Erasable Programmable Read-Only Memory. A ROM that can be programmed/reprogrammed. Erasure is by UV light, programming by a device that supplies pulses to determine the state of individual memory cells. This device is software controlled.

ES Elementary Stream. The data output from an MPEG audio or video encoder.

ETSI European Telecommunications Standards Institute. The organisation that confirms European standards in the telecommunications field. Such a standard is called an ETS.

FEC Forward Error Correction, also known as Channel Coding. This is the addition of coding to the MPEG signal to enable errors to be detected and corrected at the receiving end of the transmission path.

FFT Fast Fourier Transform. Method of processing a digital signal.

FIFO First In First Out. Refers to the flow of information into and out of a type of memory used as a buffer.

FSK Frequency Shift Keying. Modulation technique that uses a frequency shift to indicate the change of state of a digital signal from zero to one or vice versa.

GOP Group of Pictures. An MPEG video 'layer', i.e. a group of twelve MPEG video frames (pictures) starting with an I (intraframe-coded) picture.

I In-phase or Intra. The first relates to QAM (quadrature amplitude modulation), indicating the carrier on the 0° axis. The second relates to a complete MPEG frame (the first in a series of twelve) which is used on its own and then as a reference for further frames in the group.

IC Inter Integrated Circuits. IC interconnection system via a serial bus. Originally developed by Philips.

IS Inter Integrated Sound. System for interconnecting digital sound ICs via a serial bus, developed by Philips.

IEC International Electrotechnical Commission. International organisation for standardisation in the field of electrotechnics, electricity and electronics.

IEEE 1284 Bidirectional high-speed parallel data interface (an enhanced Centronics Interface).

IEEE 1394 High-speed (up to 400Mbps/sec) serial data interface. Is likely to become the standard for digital AV links with consumer electronic equipment.

IRD Integrated Receiver Decoder.

ISI Inter Symbol Interference. Interference between successive symbols in a digital data transmission.

ISO International Standards Organisation. The international standards organisation within UNO.

ITU International Telecommunications Union – the world regulatory organisation for telecommunications. Previously CCIR/CCITT.

JPEG Joint Photographic Experts Group. The group that set the standard for video compression with still pictures.

MP@ML Main Profile at Main Level. The main DVB standard video format.

MPEG Motion Picture Experts Group. The group that has established video compression standards for moving pictures. There have been four standards to date. MPEG-1 is designed for CD-ROM and CD-I applications. MPEG-2, providing higher quality, is designed for broadcast and DVD use. MPEG-3 was to be used for digital HD-TV but has been abandoned – the requirement is now catered for by upper levels added to the MPEG-2 standard. MPEG-4 is still being developed and is not expected until the year 2000. It will be used for low bit rate audio/video compression (10kbits/sec-1Mbits/sec for moving pictures, 2-64kbits/sec for the associated sound).

MUSICAM Masking Universal Sub-band Integrated Coding And Multiplexing. Coding process for MPEG-1 audio, layer 2, used for DAB and DVB.

NICAM Near Instantaneous Companded Audio Multiplexing. Digital sound system used with analogue TV. Employs QPSK modulation with two carriers at 6MHz and 6.552MHz (UK standard I).

NIT Network Information Table. DVB-SI table included in a transmission to provide information such as channel numbers and frequencies.

OFDM Orthogonal Frequency Division Multiplex. Modulation system in which the signal modulates a large number of carriers within the channel bandwidth. The carriers are all spaced apart by 90°, i.e. they are orthogonally related. There is therefore no interference between them.

P Predictive: refers to every fourth frame in an MPEG GOP. These frames are derived from the I frames and are in turn used to derive the B frames.

PAT Programme Allocation Table. A DVB table which indicates the PID of the data packets that comprise a programme.

PCM Pulse Code Modulation. Pulse modulation to convey information.

PCMCIA Personal Computer Memory Card International Association. Since renamed **PC-CARD**. The format used for PC extension modules and proposed by DVB for detachable CA modules using the DVB-CI (common interface).

PCR Programme Clock Reference. Information sent at regular intervals with an MPEG-2 transmission to synchronise the receiver's decoder clock with the clock of the programme being received.

PES Packetized Elementary Stream. MPEG data streams (elementary streams) when arranged in packets for transmission as part of a multiplex.

PID Packet IDentifier. Number used to identify packets in a DVB transmission (MPEG-2 multiplex).

PMT Programme Map Table. A DVB table which enables all the programmes in an MPEG transmission multiplex to be identified.

PRBS Pseudo Random Binary Sequence. A signal scrambling technique.

PSI Programme Specific Information. Information, such as CAT, NIT, PAT and PMT, included in a DVB MPEG transmission to keep track of the data in the multiplex.

PTS Presentation Time Stamp. Data that marks the timing of a presentation unit.

PU Presentation Unit. A decoded MPEG audio or video frame.

Q Quadrature. The relationship between two signals/carriers with a phase difference of 90°. In relation to QAM, the carrier on the 90° axis.

QAM Quadrature Amplitude Modulation. Amplitude and phase modulation of two carriers at the same frequency but with a 90° phase difference.

QEF Quasi Error Free. A channel in which the BET is less than 10^{-10} .

QPSK Quadrature Phase Shift Keying. Modulation of one or both of two orthogonal (90° phase difference) carriers to obtain four possible signal conditions (phasors) at 45° , 135° , 225° and 315° .

RISC Reduced Instruction Set – Computer. System used to achieve more efficient use of computer ROM.

RLC Run Length Coding. Data compression system that exploits data repetition.

RSC Reed-Solomon Code. An abbreviated version of this error-correction technique is used for DVB transmission.

RS232 An asynchronous serial data interfacing standard. Data transfer is relatively slow.

RST Running Status Table. An optional DVB-SI table that provides information on the current transmission status.

SCR System Clock Reference. Sync signal sent at regular intervals with MPEG-1 compressed information to synchronise an MPEG decoder's clock with the system clock.

SDRAM Synchronous Dynamic Random Access Memory. Memory used in MPEG decoders as a high-

speed RAM. The memory is 16- instead of 8-bit organised.

SRAM Static Random Access Memory. RAM that does not require data refreshment.

SDT Service Description Table. A DVB-SI table that provides information on the services in a transmission.

SIF Source Intermediate Format. The basis of MPEG-1 compression.

ST Stuffing Table. An optional DVB-SI table.

TDT Time and Date Table. A DVB-SI table used to update a receiver's real-time clock.

TPS Transmission Parameter Signalling. Use of pilot carriers with DVB-T to indicate modulation and channel coding in the OFD multiplex.

VLC Variable Length Coding. Compression technique in which fewer bits are used to code frequently than less frequently occurring data patterns.

VLIW Very Long Instruction Word. A new method of microprocessor operation.

Next Month

So much for abbreviations and their meanings. We will continue next month with definitions of commonly used terms.


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What a Life!

Reminiscences of earlier times, then back to today's dud TVs and other matters. Donald Bullock's commentary

As I sat nursing an after-dinner whiskey over Christmas I found myself reflecting on the changes that have occurred in our trade over the years.

There was a time when the family TV set took pride of place in the nation's sitting rooms. When it went on the blink there was consternation all round. The relief was obvious if we could get it going in the house. Dark expressions turned to smiles, and we were often given something, from the garden, say, in addition to our payment.

When the set had to be taken off, as was often the case, it was a different story. We would get suspicious looks, there would be dark mutterings about honesty and expense, and urgent entreaties about how long it would take.

TV engineers had to learn how to cope with such situations. Many who had entered the trade because of technical interest found that dealing with personal problems was part of the job – also backbreaking weight lifting. All this for very limited reward.

Silent Sydney

Many customers would resort to threats, bribes and various tricks to get their sets back quickly. When I was at a local GEC branch with a workshop at the back there was a character we called Silent Sydney. He would drive up to the front gates with a pocketful of silver half-crowns. The gateman would be tipped to let him through, after which he would tip everyone else he came across until he reached the workshop. My half-crown came when I had lifted the set from the car. The resident engineer, who usually cleared his bench at once, got the jackpot.

Sydney was a tense and expectant man, but once his set came to life a gentle smile of relief would appear

on his face. He communicated mainly with his eyes: I never heard him speak.

Workshop Conditions

The workshop conditions usually reflected the poverty of the job. One of my earliest jobs was as a bench engineer at a city branch of J & M Stone, a well-known multiple of that era. Most of the floorspace was taken up by a cheerful, brightly-lit showroom. At the back there was a tiny and basic lavatory – and my workshop, which was scarcely larger. It had a short, wide shelf, and a stool whose top had long since disappeared. The floor consisted of a couple of uneven flagstones. It was here that I learnt the cruelty of a mains-to-earth shock. But I was told that they keep you free from rheumatism for life, and my experience seems to bear this out.

Reuben and the Philips

An even earlier job was as an assistant to Reuben, an enthusiastic but small-minded electronic wizard. This was just after the war, when decent wireless sets were rare. One day a pre-war Philips radio was brought in for a complete overhaul. Now Reuben knew and respected Philips sets, as I came to do, and he tackled it as if it was some sort of vocation.

First he dismantled and thoroughly dusted it. Then he took out the dial glass and washed it. In went new valves, a new magic-eye indicator, a new tuning gang, a new dial-drive cord, pilot lights and many smaller items. Next came realignment, RF and IF, using a signal generator. Finally the cabinet was cleaned and polished. When he'd finished, the set shone and produced unbelievable sound quality. Reuben radiated contentment.

When the customer came to collect it, Reuben proudly demonstrated its quality on several programmes.

He then presented the bill. The customer complained that it was far too high. Reuben told him about the hours of dedicated work involved. There was an awful row, which ended when the customer ordered Reuben to unrepair the set. "I'll take it to Weatherby's" he shouted, "they'll do it cheaper."

Reuben unrepaid the set then some. He misaligned it, drilled tiny holes through the capacitors, pulled the speaker cone off-centre and, amongst other things, opened the huge IF transformers and painted their windings with battery acid. Next day the customer returned, full of apologies. "I've come to pay for your excellent work" he announced, "it was unforgivable of me. You'd worked wonders on the set."

Reuben sagged, then tottered out to the King's Head. The customer looked at me. "What's up with him?" he asked.

A Goodmans 2875

I could fill a book with such reminiscences – if it wasn't for the likes of Fanny Trotter. She came in and colared Steven.

"My set ain't half funny Mr Snodd, er, Bullhead" she said. "Can you be a dear and get him from the car?"

Steven looked outside. It was raining, hard.

"Where's the car?" he asked.

"Just across the road" she replied.

He followed her out. There was a parked car twenty yards up the road. Gritting his teeth, he followed her towards it. But she walked past, to another car thirty yards farther on.

When he came back he was soaked and puffing. It was the biggest set I'd ever seen. A 28in. Goodmans 2875.

"It's a funny sort of fault" she chortled, but we waved her out.

I got the set on the bench. There was no green content to the on-

screen graphics but there was green in the picture, which was wishy-washy and flared. "One for you, Steven" I said, "er, I'll make the tea."

A Vacuum Cleaner

As I put the kettle on Steven called me to see Mrs Noggs. She was clutching a modern, upright Electrolux vacuum cleaner.

"I just done me rubber plant when he went 'fuzz' and cut out" she said, "he ain't all that old."

I don't like vacuum cleaners, especially Electroluxes with their clamped up motor-cum-fan units. This one was no exception, though I did manage to get to the motor brushes. To my surprise one was almost worn away while the other one seemed as good as new. But I was wasting my time. Enquiries proved that there are no motor spares for this model, just the complete motor/fan unit.

Mr Dewey

Just then an ancient but brisk man walked in. "Name's Dewey" he said, "of Dewey, Squeezam and Howe, solicitors." He flicked at his watery eye. "My set's old, same as me. But don't you tell me to change it. It's got push-buttons and knobs, and I can work it. And it looks like a television set, not a storage bin."

It was a Ferguson Model 3792, which uses the TX9 chassis, and was dead. I found that the plugtop fuse was open-circuit in addition to the 1-6AT mains fuse in the set, FS1. Then I saw that the BU508A chopper transistor TR62 had blown its front off. Steven was busy with the Goodmans set, so I went to look for the circuit diagram. Steven noticed.

"There are about forty TX9 circuits, all different" he said, "aren't you lucky?"

The set was actually fitted with the 1044 non-remote control version of the chassis, the later version that has a chopper power supply. I eventually found the right circuit.

As R164 (27 Ω) and D104 (1N4001GP) in TR62's base circuit had both died violently I decided to check the windings of the chopper transformer T1. They were short-circuit. We've had trouble obtaining these transformers in the past, so I fitted one from a scrap chassis. In addition to the blown devices it seemed logical to replace the TDA4600 chopper control chip IC57. Then I started the set up, gingerly, using the variac.

There were no shorts, but there was no HT output from the chopper

circuit either. "Check R165 (300k Ω) in the current-simulation network" rapped Steven authoritatively. It was virtually open-circuit. A replacement completed the repair, and the results were excellent.

Meanwhile Steven had been working on the CRT base panel in the Goodmans 2875 – where the TEA5101A RGB output chip lives. He found that R28 (68k Ω) in the green channel was open-circuit. In addition its counterparts in the red and blue channels, R26 and R29, had risen in value to about 75k Ω . Replacing all three restored correct displays.

Return of Mr Dewey

When Mr Dewey returned to collect his set he brought two more with him, a Sony KVM2121 (BE1 chassis) and an Hitachi fitted with the G7P Mk 2 chassis. "These belong to my two partners" he announced.

The Sony set was dead with the standby light pulsing. A check on the BU506DF line output transistor Q802 showed that it was leaky. After fitting a new one we discovered that circuit protector PS802 in the supply to the line driver and output stages was open-circuit. It's rated at 0-6A. A new one completed the repair.

Then Steven pulled up the Hitachi set. It was dead with the BUT11AF chopper transistor Q901 open-circuit. This is another TDA4600-type power supply (TDA4601 actually). The resistors in the current-simulation circuit are R932 (120k Ω) and R931 (150k Ω). They were both high in value at some 180k Ω . After replacing these items he started the set up via the variac. All was well.

Later, over a cup of tea, Steven pointed out that Mr Dewey, an intelligent man, refused to consider buying a new set because they are full of gimmicks and are unpleasant, if not impossible, for normal folk to operate. In addition they look so black and awful.

"I'm finding that more and more people, especially the mature ones, feel the same about modern sets. They don't like them and won't have them. When their existing sets need to be replaced they ask whether we can supply an older, reconditioned one. Since the population is rapidly ageing, there must be a fortune waiting for the first manufacturer sensible enough to produce a basic set that anyone can operate" he concluded.

Rippling Picture

Just then a thin, sharp-faced character hustled in carrying a Matsui 1436



"It was here that I learnt the cruelty of a mains-to-earth shock."

portable. He put it on the counter, had a fight with his duffle coat, pulled out a red-spotted handkerchief and gave his nose a good blowing.

"Shall I ask him for an encore?" I asked Steven.

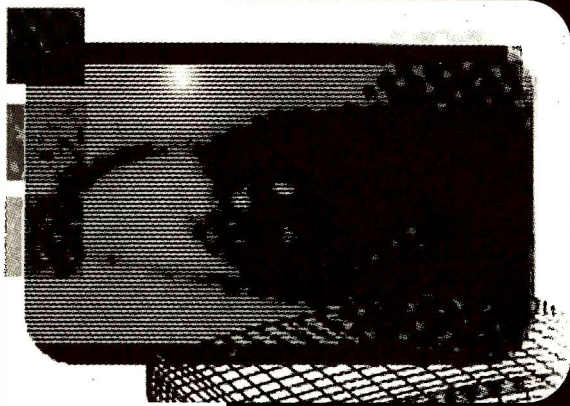
"This set, now" rang out the Modern Man. "It's never been *really* right since you last tried to do it, but I thought I'd give it time to settle down. I think it must be the valve or the transformer. Perhaps you fitted new ones last time. You'll have it in your records, I daresay. We were watching 'Are you being served' when it failed. My dog likes to watch that."

"When did we last do it?" Steven asked, reaching for our tray of cards.

"It was just before that last Cassius Clay fight" he said. "I wanted to watch it, the wife didn't and didn't we have a row. Well, wives are all the same, aren't they? Er, are you married Mr Duffer?"

"No" said Steven, "I've just got toothache."

Once he'd departed we pulled his set on to the bench. The entire right-hand side of the picture was rippling. This suggested an open-circuit or low-capacitance electrolytic in the power supply. But we found that the print at the positive side of the HT reservoir capacitor C666 (150 μ F, 160V) was cracked. Resoldering it cured the set's trouble, but there was still the customer . . .



Reports from
John C. Priest
Pete Gurney, LCGI
Blair McEwan
Chris Avis
Chris Watton
Michael Dranfield
Graham Colebourn and
Stephen Leatherbarrow

Beon CTV1403T

These sets tend to have problems with their power supply start-up circuit. First examine the PCB, above and below, for brown glue on and around components in the power supply and line output area. The glue will have become brittle and hard and needs to be removed. Once the board has been cleaned up you may find that the set works all right. If not, replace the start-up resistors – R508/9 (150kΩ, 0.5W) and R107/8 (270kΩ, 0.5W). This should restore normal operation, but I have had one case where the CNX82A optocoupler D111 had to be replaced.

Check the long wire link between the microcontroller chip and the transistor that drives the optocoupler if the set sometimes fails to come out of the standby mode. **J.C.P.**

Memorex 1400

These sets were sold through Tandy outlets. The chassis is very similar to that in the Matsui Models 1455/1465 and the same service manual can be used. If a replacement remote control unit is required, the Konig HS00004 will operate all functions with the Matsui 1465 and these Memorex sets. There may be some buttons for functions not provided with the Memorex sets. **J.C.P.**

Panasonic Alpha 3 Chassis

There was severe EW bowing and none of the relevant controls had any effect. It's not an uncommon

TV Fault Finding

fault with this chassis, the usual cause being the TDA8145 chip IC701, with R708 and/or L701 also failing. In this case R708 and L701 were OK. A new TDA8145 chip restored some operation of the width and parabola controls, but a full, linear scan could not be obtained and the trapezium control still had no effect. Further checks revealed that there was no voltage at pin 1 of IC701 because the associated 0.01μF, 50V disc decoupling capacitor had an internal resistance of 55Ω. A new capacitor finally cured the problem. **J.C.P.**

Philips NC3 Chassis

If there is intermittent loss of the picture – it fades off and on as the CRT heaters go out then come on again – check for faint haloes (dry-joints) at the base of the line output transformer. You may need a magnifier to see them. Don't just resolder the transformer's legs. Remove the transformer, as you will probably find that the legs are quite black above the PCB level. Scrape and retin them before refitting the transformer to the PCB. Also check the connections to the CRT's base panel. **J.C.P.**

Nikkai Tara 10

I've had a number of these sets with intermittent loss of luminance – a dark red/purple display. You usually find that the PCB is sensitive to tapping. The brightness, contrast and colour controls are part of a single assembly. Remove it, treat the tracks with a little contact cleaner, then clean off the print before refitting the assembly.

If this doesn't clear the problem, look at the print in the general area of the TDA3566 colour decoder chip. I've had several sets where the solder pad drilling has been well off centre – sometimes barely on the pad at all. It pays to remove the IC then clean up the whole area with desoldering braid and PCB cleaner

before refitting it. Take great care to ensure good connections to the solder pads.

The soldering in these sets leaves a lot to be desired: there is far too much solder on most of the connections and dry-joints abound. **J.C.P.**

Mitsubishi CT25A2 (Euro 12 Chassis)

The complaint was of intermittent Nicam crackling, more when the set had warmed up. On test it was obvious that the set was drifting off tune. Eventually the text was corrupted as well. This is becoming quite a common problem, the cause being bad joints in the IF unit, particularly around the two ICs, the SAW filters and the coils. When it's faulty the unit is not always sensitive to tapping. Resoldering cured the problem. **P.G.**

Huanya 37C-2

This set came from another dealer, the complaint being no luminance. The D7193 colour decoder chip IC501 had been replaced, also several transistors in this area. A scope check at the base of the luminance delay line driver transistor Q302 displayed a suitable waveform, but voltage checks showed that the transistor was saturated – there was 9V at its collector instead of 4.5V. This in turn cut off the luminance emitter-follower transistor Q303.

The cause of the trouble was in the pedestal clamp stage. Transistor Q304 should have 10V at its emitter. This supply comes from the sub-brightness control, via D306 (type 1S2076). Only 8V was present here. The cause of the fault was D306. It checked OK out of circuit, but a replacement restored the luminance and correct voltages. **P.G.**

Toshiba 219T9

This set took a progressively longer time to start up. Eventually it died altogether – the power supply sat there with most of its voltages pre-

sent though it wasn't working. I've had a few dried-up capacitor problems with this model. Replacing C818 (22 μ F, 100V), C814 (100 μ F, 50V) and C823 (10 μ F, 16V) on the primary side of the chopper power supply usually gets things going, and did in this case. It's also wise to check the capacitors on the secondary side of the circuit, using a scope, and to replace them as necessary. P.G.

Mitsubishi CT25A4STX (Euro 12 Chassis)

There was intermittent loss of sound and sometimes no picture. In most cases of this sort a good tap on the VIF module will produce results. When the module was removed I found that there were bad joints at both ICs and most of the capacitors. Resoldering all the joints and earths cured the fault. P.G.

Sharp DV5103H

This set came in dead with a blackened mains fuse and the surge-limiter resistor R700 (8-2 Ω) open-circuit. The short-circuit was still present when the chopper transistor had been removed. I subsequently found that the transformer was the culprit, with all the pins on the primary side shorted together. P.G.

Daewoo T200

This set wouldn't come out of standby. You switch it to on by pressing the programme buttons at the front. In this case the relay clicked but not much else happened. While preparing to take some voltage measurements I noticed that C410 (1nF, 2kV) in the line output stage was puffing away merrily. The transistor proved to be OK, and a new capacitor restored the set to life. B.McE.

Grundig GT1401

There was no sound or picture. The supplies were OK except for the 5V rail. D114's cathode connection wasn't through the print. Soldering it properly cured the problem. B.McE.

Beon CTV1412R

If the sound blares intermittently, check for dry-joints at R140. This is, anyway, what it's marked on the PCB – it is actually a wire link. B.McE.

Minoka MK1491A

There was a greenish raster with no video. A check on the RGB outputs from the TA8718 timebase generator/colour decoder chip IC201 showed that the red was OK but

there was no green or blue. A new chip cured the fault. B.McE.

JVC C141EK

The problem was an intermittently bright raster with lack of height and width. The 1k Ω HT preset VR901 had bad tracking. A replacement cured the problem – the HT should be set for 112.5V. B.McE.

Sharp DV5161H

This set wouldn't come out of standby. Checks revealed that the 12V supply was missing. D602 (1N4936) was open-circuit. B.McE.

Finlux 5025C26

There was either no sound via the scart socket or low, distorted sound would break through. The 0.68 Ω fusible resistor RL74 on the back panel was open-circuit. It's in series with the 12V supply. B.McE.

Hitachi CPT2808 (G7P Mk II Chassis)

There was a green raster with fly-back lines. I found that the green output transistor's 22k Ω , 0.25W load resistor R808 was open-circuit – so there was no voltage at the collector of Q802. B.McE.

Sony KM2171U (BE4A Chassis)

The picture had become a wide pincushion and there was no response to the relevant service mode commands. Pincushion/width control originates at pin 8 of IC301, where there should be 0.6V. The voltage had risen to 1.4V and there was no sign of a parabolic waveform. It seemed logical to replace the chip (type MC44007P), which turned out to be the correct action. I then spent far too long playing with the digital picture adjustments in the service menu, something that's still a novelty here. C.A.

Akura CX12

The on-screen display and the sound were OK but the screen was otherwise blacked out. This can simply mean that the contrast is at minimum and not memorised. Adjust the contrast to a suitable level then memorise the setting by holding down switch S002, by the tuner, and putting the set into standby. C.A.

Boots CTV1414R

Why do people buy TV sets from a chemist? Perhaps I should open a pharmacy in the corner of my shop! Anyway, a channel number could be selected and tuned in, but the set would then memorise it on all

channel positions. The 32V tuning voltage via IC102 had risen to 38V. A replacement μ PC574J chip cleared this bizarre fault.

The set is the same as the Matsui 1450/Saisho CT147R. C.A.

Mitsubishi CT2155STX (Euro 4Z Chassis)

There was intermittent loss of sound. The cause was eventually traced to the muting switch transistor Q706, a weird JA101QR – fortunately I was able to find one on a scrap board!

Other sets fitted with this chassis include the CT2153 and CT2553. C.A.

Samsung CI5013T (P58S Chassis)

Channels could be tuned in but not stored. This fault is usually caused by a defective EEPROM chip, but not this time. I found that the data signal between the microcontroller chip and the EEPROM was very poor. The cause was an increase in the value of the pull-up resistor RR53 – the correct value is 3.3k Ω . Does anyone know why LOPT failure is so rare with Samsung TV sets? C.A.

B & O LS5500 (also LX/MX/L etc)

Snowy pictures, no sound and erratic colour suggested a possible tuner fault. But a high-tech investigation with a can of freezer showed that the severity of the symptoms was reduced when the TDA8120 chip IC6, which includes the IF section, was cooled. This chip also contains two voltage regulators and tends to run hot, demonstrated by the darkened board beneath it. A replacement chip restored the top-quality B & O performance. C.A.

Nokia 9291 Cinescreen

These large sets, which are fitted with the Euro-digital chassis, have an Ipsalo type power supply/line output circuit similar to that used in the Salora J, K, L and M chassis. This set was dead.

I usually find that the best way to check the power supply is to disconnect the collector of the line output transistor then force the set into the standby mode. Do this by switching the set on then connecting the mains supply. This will give you a clue. Check the \pm 15V supplies, which are marked on the PCB. The readings are usually around \pm 12V. If so, the power supply is probably OK and the line output stage components should be checked, i.e. transistor

T525, diode D523 and the associated components.

In this particular case the $\pm 15V$ supplies were OK but the Ipsalo transformer was faulty. This may sound odd, but with these sets standby is achieved by effectively shorting out the line output transistor. The cost of the transformer is related to screen size, so the repair is an expensive one.

Incidentally a Jabco type tester can be used to check the transformer. Check between pins 14 and 15 for the line output primary winding and pins 1 and 2 for the power supply primary winding. C.W.

Sony KV27XRTU (SX Chassis)

This set was dead. Checks in the power supply showed that the 135V HT supply was missing while all the other outputs were low. The cause was simply that L651 was open-circuit, but in this set it turned out to be an N38 type ICP. C.W.

Nokia Euro Stereo 2BF110NN

If there's a screaming chopper transformer and ragged verticals from cold, replace C787 (10 μ F, 50V). As this capacitor sits right next to a very hot running 220 Ω wire-wound resistor the replacement should be rated at 105°C.

C787 should also be replaced when you find that the line output transistor is faulty, as it will almost certainly have been the root cause of the problem – assuming that you have already attended to the dry-joints. M.Dr.

Toshiba 2927DB

Excessive EHT was the problem with this Dolby Pro-Logic set – the anode cavity was sparking. The HT was also high, at 180V instead of 125V. The cause of the trouble turned out to be the TLP721 optocoupler IC826 in the power supply.

Why hadn't the overvoltage trip shut the power supply down? Because transistor Q841 (2SA1015) in the trip circuit was leaky. Fortunately no other damage had been done. M.Dr.

Philips CF1 Chassis

This set had a very unusual fault. There was a three-inch band of very faint patterning about two inches from the left-hand side of the screen. When the aerial was disconnected the problem showed up as a dark patch through the snow. As the problem was worse at switch on, a tin of freezer was brought into

action. The cause of the fault was eventually traced to C2484 (4.7 μ F), which is connected to the emitter of the E-W modulator driver transistor. Tests showed that it had fallen to a very low value. A replacement rated at 105°C was fitted. M.Dr.

Sharp DV3760

This set would trip back to standby after two seconds. Various items were disconnected from the power supply to establish the source of the trouble. This revealed that there was a heavy load in the line output stage. In fact the line output transformer was faulty. A genuine replacement from Willow Vale was priced at less than £12 plus VAT, a bargain. The cheapest genuine line output transformer we've ever bought was obtained from Philips recently – it cost £9.11 plus VAT. Could it be that the major manufacturers are trying to stamp out dubious-quality pattern parts? M.Dr.

GoldStar CIT9325

If there is sound and EHT but no picture, and the cause of the fault is not field collapse, connect the collector of one of the RGB output transistors to chassis via a 10k Ω resistor. If the picture returns and remains on until the set is switched off, replace the TDA3562A colour decoder chip. It's on a stand-up sub-panel. M.Dr.

Salora K Chassis

If the set is dead with a faint whistle coming from the Ipsalo transformer, check whether D603 (type PE2D) is short-circuit. M.Dr.

Matsui 2091

If the power supply is working but the line output stage remains inactive, replace diode D401 (1N4007) in the line driver stage. It provides the start-up supply for the collector of the line driver transistor – when the set is up and running this stage obtains its supply from the line output transformer. A word of warning: D401 can become intermittent, so it's worth fitting a replacement whenever one of these sets comes into the workshop.

Incidentally the set is fitted with a GoldStar chassis. M.Dr.

Hitachi C2118, C2119

If one of these sets appears to be completely dead apart from the standby light showing, or fails in this way intermittently, check the connections to the 9V regulator IC703. They may well be cracked, especially if the regulator has been

fixed with a blob of hot glue to steady it. This method of component fixing often results in premature failure of the soldered joints. So look out for this as a matter of routine. G.C.

Goodmans 2875

This 28in. set produced no sound or picture because the line output stage had failed. The soldered joint at one end of the E-W capacitor C134 had burnt out. Although the capacitor itself was unharmed, the S2055AF line output transistor had been destroyed. A replacement transistor and repair to the PCB restored normal operation. G.C.

Panasonic TX21V1 (Alpha 2 Chassis)

The picture would disappear intermittently, leaving a blank, dark grey raster. I found that the soldered joints at all three pins of connector B4 had cracked. This connector is right at the front of the chassis, under the CRT's rim. It's on the IF panel, which is beside the tuner. G.C.

Hitachi C2509 (G7PS Chassis)

The field scanning was very non-linear: the bottom of the picture was cramped while the top was stretched. The cure was to replace two electrolytic capacitors: C712 (2,200 μ F, 50V) which is the reservoir capacitor for the 28V supply used by the field output stage; and C606 (680 μ F, 16V) which is the field scan coupling capacitor. G.C.

Ferguson 51J7 (TX99 Chassis)

The owner of this set said that although it had not changed the programme number to which it was set, the station displayed changed randomly. When I checked there were no signals at all. The tuning control voltage was almost zero and resisted all attempts to increase it, so attention was turned to the TACS control panel on the left-hand side.

There was no voltage at the tuning supply stabiliser IC243 because one of the 2k Ω resistors in the feed chain (R234 and R254-8) was open-circuit. I replaced all six of them, using 1W types, to prevent further failures. Care is required to prevent the larger resistors clashing with the plastic frame when the board is refitted. G.C.

Philips GR2.3AA Chassis

This 16:9 aspect ratio set was dead. It didn't take me long to discover

that the mains fuse had failed and the BUT11AF chopper transistor was short-circuit. As a check on the surrounding circuitry didn't reveal anything amiss, a new fuse and chopper transistor were fitted. At switch on they went the way of the originals. The power supply control circuitry is on a subpanel, and incorporates a CNR50 optocoupler. As these devices have proved to be troublesome in other Philips chassis I replaced it, along with the fuse and BUT11AF transistor. This time the set worked.

The degaussing thermistor was also replaced as it was crumbling. It's not a standard device: one half is used as a surge limiter, as in some versions of the 2A chassis. S.L.

Ferguson IKC2 Chassis

This set was dead though the chopper power supply's HT output was normal - there was 111V at the cathode of DP50. The 7V output was at zero however, while the other outputs were approximately fifty per cent low. This situation means that there are no line pulses because the line output stage isn't working. In fact there was no line drive.

Further checks showed that the

safety circuit was in operation, with transistor TV01 (BC558C) conductive for no apparent reason. When I removed it for testing I found that there was collector-emitter leakage. Not much, but enough to reduce the 15V supply and shut down both the power supply and the line drive. This is comprehensive protection, but it does make fault finding difficult.

When TV01 had been replaced the set worked but there was no colour and an ominous ticking sound came from the line output transformer. The transformer had pinholes and occasionally arced. In view of these defects it seemed likely that the TA8659CN timebase generator/colour decoder chip IV01 was faulty. When this item had been replaced and a new line output transformer had been fitted the set worked well. S.L.

Granada C59FZ6

These sets, which are fitted with the Salora M chassis, always seem to come in with the same complaint: the S2000AF line output transistor is either leaky or short-circuit. A replacement will usually fail in the same way, especially from cold.

Replace the 220µF electrolytics C624 and C523, which are close by, and all should be well.

These sets also suffer very badly from dry-joints. It's usually necessary to blanket resolder the power supply and the line output stage. S.L.

Osaki P146R

The customer complained about "lines on the screen". They started at the top left-hand corner and curved down towards the right-hand edge of the screen. It looked as if the flyback was slow. The cause of the trouble was C310 (4.7µF, 160V) which was virtually open-circuit. S.L.

Ferguson TX100 Chassis

This set was supposed to be dead though the HT and EHT supplies were present. But there was no 12V output from the MC7812CT regulator IC8. Its input is obtained from the line output transformer via a rectifier circuit that consists of D21 (RGP10G), surge limiter R145 (0.22Ω) and reservoir capacitor C135 (4.7µF, 40V). D21 was open-circuit and R145 read 20Ω. I replaced these two items and, as a precaution, C135 and IC8. S.L.

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NV7800/7200 = RK7902 = 1125
NV333 = RK7903 = 1095
NV777 = RK7904 = 1050
NV730 = RK7905 = 885
NV370 = RK7906 = 795

NV230 = RK7907 = 795
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NVD48/80 = RK7936 = 1185
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VTC5000 = RK7956 = 1175
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= RK7960 = 2200
VHR153 = RK7959 =
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John Edwards'

Service Notebook

Samsung CI5937AN

This set was dead except for a high-pitched squeal that came from the chopper power supply. There was no line timebase operation because the outputs on the secondary side of the chopper transformer were all very low. With the set switched off (and unplugged) I disconnected each line in turn and checked for a short-circuit. The reading obtained across the 32V line, which feeds the TDA2161 audio output chip, was about 10Ω to chassis. When pin 7 of this chip was unsoldered the short cleared. A new TDA2161 IC restored the set to life.

The customer subsequently mentioned that just before the fault occurred he had connected two external speakers to the set. I decided to check them out and was glad I did. One very tiny, under-rated speaker was connected by threadbare wires joined in several places – the leads were just wrapped around the speaker terminals. The other speaker was not only of different size and impedance – it also had a ripped cone!

Finlux 5025S

This set has a built-in satellite receiver. It suffered from intermittent loss of picture because the tube's heaters would go out at random. As no obvious dry-joints could be seen, I resoldered the heater supply resistors, R929 on the tube base panel and Rz2 and Rz5 on the main board, hard wired between them, then resoldered the ribbon cable connections from the main board to the CRT base panel. There was no further trouble after that.

I was not impressed by the fact that the back cover provides, via two screws, the support for the satellite PCB. When the cover is taken off the PCB is free to move. A vertical plastic leg protrudes from the bottom of the satellite PCB and clips loosely on to a metal frame attached to the main board. But this doesn't provide sufficient support. You have been warned.

Akai CT2870UK

This set led me a merry dance. It would tune in the lower channels,

e.g. 23 and 26, but not channels 30, 33 and higher – the ones available in my area. I suspected the ZTK33B tuning voltage stabiliser, which according to the manual is D7102 and is connected to pin 7 of the tuner/IF module. I soon found that D7102 didn't exist, and that the print layout was slightly different from that shown in the manual. Yes the model number, and a few others, were clearly printed on the front cover of the manual, the chassis type being shown as the Nokia Compact D-E.

While scratching my head and preparing myself for a grand tour of the PCBs in a search for the diode I spotted the words "Compact D-2" etched in small type on the vertically-mounted audio output board. Naturally I didn't have the Compact D-2 manual in stock, so the grand tour began anyway.

There are so many plugs and sockets fixed to ribbon cables going here, there and everywhere that tracing the path from pin 7 of the tuner/IF module became too frustrating. I resorted to a visual check of the boards and eventually found the diode on the audio output board, where I began! The circuit reference is D901. Within minutes of fitting a replacement I had a normally working receiver.

I realised later that the reason I had so much difficulty finding the diode is that in this chassis the 33V tuning supply is not connected to the tuner/IF module directly. It's taken to an interface chip which in turn feeds the module.

Sanyo CBP3012 (A3-A14 Chassis)

I had three of these portables in for repair in quick succession, each with a different fault. I tackled the first one without a circuit diagram. Having learnt my lesson, I obtained one before delving into the other two.

Set number one's symptom was a very bright raster with flyback lines. The first anode control on the line output transformer had little effect. I eventually traced the cause of the fault to loss of the 130V HT supply to the RGB output transistors be-

cause the smoothing resistor R557 (10Ω) was open-circuit. It shouldn't have taken so long, but R557 is in the chopper power supply, which in this chassis supplies all the power circuits – audio, field and line. The line output transformer is restricted to generating the EHT, first anode and focus voltages, some pulses and the CRT's heater supply. Because I didn't have a circuit diagram I had been searching in the line output stage for the source of the supply for the RGB output transistors. We live and learn.

The second set was dead, but life was easier now that I had a circuit diagram. The surge limiter resistor R502 (3.9Ω, 6W) was open-circuit, so it was no surprise to find that the 2SD1710 chopper transistor Q513 was short-circuit. While checking in the power supply I found that Q553 (2SC536) was also short-circuit. It's the error voltage sensing transistor and in addition drives the PC1138 optocoupler D515. To be on the safe side I replaced both these items.

I then powered up the set slowly, using the variac and monitoring the 130V HT supply at the cathode of D551. At an input of about 150V AC the power supply sprang to life, delivering an HT of 175V. I shut down, to save all my hard work, and checked around again. Q512 (2SC3807), which controls the chopper transistor drive, was short-circuit base-to-emitter. Although cheap, it's a little special because of its high base-to-emitter voltage rating, so there's no real equivalent. I resisted the temptation to experiment with different transistor types and ordered the correct replacement. Next day, with the new 2SC3807 fitted, the set worked normally.

The third set was stuck in standby. This time the chopper power supply was working correctly, delivering 130V to the line output stage. But there was no line drive because the line driver transistor Q431 had no 24V collector supply. This comes from the 2SB764 pnp-type transistor Q551, which was short-circuit base-to-emitter. It acts as a switch. I found that the BC640 is a suitable replacement.

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	325p	MJ4502	300p	4N35	50p	LINEAR ICs		AN6340	600p	BA335	55p
BC108	8p	BD435	31p	BU128	125p	BUV48C	250p	MJ10012	300p					AN6341	200p	BA338	80p
BC109	8p	BD436	30p	BU133	125p	BUV50	425p	MJ10115	300p	RECTIFIER DIODES				AN6342	325p	BA340	75p
BC109C	10p	BD437	28p	BU137	150p	BUV61	1000p	MJ10116	300p	BY127	8p	AN210	165p	AN6344	440p	BA343	60p
BC140	20p	BD438	36p	BU180	100p	BUV70	200p	MJ11032	800p	BY128	8p	AN214Q	170p	AN6345	400p	BA336	175p
BC142	20p	BD439	36p	BU184	100p	BUV90	175p	MJ11033	800p	BY129	8p	AN217P	95p	AN6346	350p	BA401	60p
BC143	20p	BD440	40p	BU204	65p	BUV93	375p	MJ15003	250p	BY133	8p	AN228	280p	AN6352	450p	BA511	145p
BC147	8p	BD441	40p	BU205	70p	BUW11A	200p	MJ15004	300p	BY164	40p	AN252	150p	AN6356	300p	BA514	160p
BC149	8p	BD442	50p	BU206	100p	BUW11AF	225p	MJ15015	250p	BY179	35p	AN253	250p	AN6359	500p	BA518	150p
BC159	8p	BD534	38p	BU207	150p	BUW12	125p	MJ15016	350p	BY184	32p	AN263	140p	AN6360	400p	BA521	100p
BC160	30p	BD535	38p	BU208	70p	BUW12A	150p	MJ15022	250p	BY206	11p	AN271	230p	AN6363	375p	BA524	240p
BC171	10p	BD536	38p	BU208A	75p	BUW12F	250p	MJ15023	400p	BY207	20p	AN272A	250p	AN6365	400p	BA526	180p
BC172	10p	BD537	40p	BU208AT	200p	BUW12FA	250p	MJ15024	400p	BY227	19p	AN277B	400p	AN6367NK	400p	BA527	95p
BC177	14p	BD538	40p	BU208B	200p	BUW22A	250p	MJ15025	400p	BY228	28p	AN278	60p	AN6368	275p	BA532	100p
BC178	14p	BD543	50p	BU208D	130p	BUW48	550p	MJE340	25p	BY298	15p	AN302	650p	AN6371	350p	BA534	220p
BC179	14p	BD645	50p	BU209	90p	BUW49	550p	MJE350	80p	BY299	15p	AN302	650p	AN6372	400p	BA536	150p
BC182	7p	BD647	50p	BU225	120p	BUW50	400p	MJE520	60p	BY329-1200	150p	AN303	250p	AN6373	400p	BA536	150p
BC182L	7p	BD649	50p	BU226	120p	BUW81A	150p	MJE259T	35p	BY448	20p	AN304	360p	AN6375	300p	BA546	160p
BC183	7p	BD675	40p	BU12	90p	BUW85	85p	MJE13004	100p	BY449	25p	AN304	360p	AN6376	300p	BA546	160p
BC184	7p	BD678	40p	BU125	90p	BUW85	85p	MJE13005	100p	BY711	11p	AN305	350p	AN6377	300p	BA546	160p
BC184L	7p	BD678	40p	BU125	90p	BUW85	85p	MJE13005	100p	BY713-1000	30p	AN305	350p	AN6378	300p	BA546	160p
BC184L	7p	BD678	40p	BU125	90p	BUW85	85p	MJE13005	100p	BY956E	36p	AN306	100p	AN6379	300p	BA546	160p
BC212	7p	BD679	40p	BU406D	85p	BUX12	150p	MJE13009	100p	BYX10	15p	AN315	210p	AN6382	45p	BA612	720p
BC213	7p	BD680	40p	BU407	85p	BUX10	350p	MJE13010	100p	BYX10	15p	AN315	210p	AN6383	45p	BA614	720p
BC213L	7p	BD681	40p	BU407D	75p	BUX21	450p	MJE15029	200p	BYX55/600	32p	AN315	210p	AN6384	45p	BA614	720p
BC212L	7p	BD682	45p	BU408	60p	BUX22	450p	MJE15030	200p	IN4002	3p	AN315	210p	AN6385	45p	BA614	720p
BC214	7p	BD705	50p	BU408D	75p	BUX23	900p	MJE15031	400p	IN4003	3p	AN315	210p	AN6386	45p	BA614	720p
BC214L	7p	BD707	50p	BU409	85p	BUX37	220p	MJE18004	125p	IN4004	3p	AN315	210p	AN6387	45p	BA614	720p
BC237	7p	BD709	50p	BU412	175p	BUX40	210p	MJF18204	350p	IN4005	3p	AN315	210p	AN6388	45p	BA614	720p
BC238	7p	BD711	50p	BU413	65p	BUX41	210p	OC28	350p	IN4007	4p	AN315	210p	AN6389	45p	BA614	720p
BC238	7p	BD736	50p	BU414B	250p	BUX42	200p	OC29	350p	IN4007	4p	AN315	210p	AN6390	45p	BA614	720p
BC300	20p	BD826	50p	BU415A	170p	BUX42	200p	OC39	350p	IN4007	4p	AN315	210p	AN6391	45p	BA614	720p
BC301	20p	BD828	50p	BU426A	70p	BUX47A	220p	OC35	250p	IN4007	4p	AN315	210p	AN6392	45p	BA614	720p
BC302	20p	BD839	55p	BU433	120p	BUX48A	150p	S2000A3	150p	IN4007	4p	AN315	210p	AN6393	45p	BA614	720p
BC303	20p	BD897	50p	BU500	100p	BUX55	80p	S2000AF	130p	IN4007	4p	AN315	210p	AN6394	45p	BA614	720p
BC304	25p	BD899	50p	BU500D	225p	BUX80	180p	S2000AF	130p	IN4007	4p	AN315	210p	AN6395	45p	BA614	720p
BC327	7p	BD977	50p	BU505	90p	BUX81	160p	S2055A	175p	IN4007	4p	AN315	210p	AN6396	45p	BA614	720p
BC328	7p	BD978	50p	BU505D	90p	BUX84	160p	S2055AF	175p	IN4007	4p	AN315	210p	AN6397	45p	BA614	720p
BC337	7p	BDX37	100p	BU505DF	90p	BUX85	50p	S2530A	100p	IN4007	4p	AN315	210p	AN6398	45p	BA614	720p
BC338	7p	BDX44	100p	BU506	90p	BUX86	50p	S2530AF	100p	IN4007	4p	AN315	210p	AN6399	45p	BA614	720p
BC441	25p	BDX47	60p	BU506D	70p	BUX87	50p	TI29A	12p	IN4007	4p	AN315	210p	AN6400	45p	BA614	720p
BC446	8p	BDX54C	75p	BU506DF	100p	BUX98A	350p	TI29C	25p	IN4007	4p	AN315	210p	AN6401	45p	BA614	720p
BC477	18p	BDX62C	150p	BU508A	70p	BUZ71	75p	TI29E	25p	IN4007	4p	AN315	210p	AN6402	45p	BA614	720p
BC516	22p	BDX63C	175p	BU508AF	95p	BUZ71AF	100p	TI30	25p	IN4007	4p	AN315	210p	AN6403	45p	BA614	720p
BC537	25p	BDX64C	175p	BU508AFPH	80p	BUZ72AF	100p	TI30C	25p	IN4007	4p	AN315	210p	AN6404	45p	BA614	720p
BC546	8p	BDX65	80p	BU508D	75p	BUZ73AF	100p	TI31A	25p	IN4007	4p	AN315	210p	AN6405	45p	BA614	720p
BC547	8p	BDX66C	80p	BU508DF	85p	BUZ73A	150p	TI31C	27p	IN4007	4p	AN315	210p	AN6406	45p	BA614	720p
BC548	8p	BDX67C	275p	BU508DR	130p	BUZ73AF	60p	TI32	24p	IN4007	4p	AN315	210p	AN6407	45p	BA614	720p
BC549	8p	BDX71	70p	BU508V	110p	BUZ76A	110p	TI32A	21p	IN4007	4p	AN315	210p	AN6408	45p	BA614	720p
BC550	8p	BDX77	175p	BU508VF	100p	BUZ80	135p	TI32C	28p	IN4007	4p	AN315	210p	AN6409	45p	BA614	720p
BC556	8p	BDX82	175p	BU509	120p	BUZ80AF	150p	TI32E	28p	IN4007	4p	AN315	210p	AN6410	45p	BA614	720p
BC557	8p	BDX88C	150p	BU536	100p	BUZ83	200p	TI33C	60p	IN4007	4p	AN315	210p	AN6411	45p	BA614	720p
BC558	8p	BDW24	55p	BU546	125p	BUZ90A	180p	TI34	65p	IN4007	4p	AN315	210p	AN6412	45p	BA614	720p
BC559	8p	BDW93	50p	BU603	125p	BUZ91A	260p	TI34C	65p	IN4007	4p	AN315	210p	AN6413	45p	BA614	720p
BC560	8p	BDW94	50p	BU603D	225p	BUZ91A	260p	TI35	65p	IN4007	4p	AN315	210p	AN6414	45p	BA614	720p
BC567	20p	BDY29	225p	BU603D	225p	BUZ91A	260p	TI35C	65p	IN4007	4p	AN315	210p	AN6415	45p	BA614	720p
BC639	20p	BDY56	225p	BU603D	225p	BUZ91A	260p	TI36	65p	IN4007	4p	AN315	210p	AN6416	45p	BA614	720p
BC640	20p	BDY58	225p	BU603D	225p	BUZ91A	260p	TI37	65p	IN4007	4p	AN315	210p	AN6417	45p	BA614	720p
BCY33	200p	BDY90	125p	BU706DF	175p	BUZ91A	260p	TI38	65p	IN4007	4p	AN315	210p	AN6418	45p	BA614	720p
BCY34	200p	BDY92	100p	BU706F	150p	BUZ91A	260p	TI39	65p	IN4007	4p	AN315	210p	AN6419	45p	BA614	720p
BCY70	16p	BF137	35p	BU724A	100p	BUZ91A	260p	TI40	65p	IN4007	4p	AN315	210p	AN6420	45p	BA614	720p
BCY71	16p	BF161	35p	BU724B	100p	BUZ91A	260p	TI41	65p	IN4007	4p	AN315	210p	AN6421	45p	BA614	720p
BCY72	16p	BF181	18p	BU806	70p	BUZ91A	260p	TI42	65p	IN4007	4p	AN315	210p	AN6422	45p	BA614	720p
BD115	50p	BF183	20p	BU807	60p	BUZ91A	260p	TI43	65p	IN4007	4p	AN315	210p	AN6423	45p	BA614	720p
BD124P	50p	BF195	7p	BU807F	75p	BUZ91A	260p	TI44	65p	IN4007	4p	AN315	210p	AN6424	45p	BA614	720p
BD131	25p	BF199	8p	BU808DF	210p	BUZ91A	260p	TI45	65p	IN4007	4p	AN315	210p	AN6425	45p	BA614	720p
BD132	25p	BF210	12p	BU809	110p	BUZ91A	260p	TI46	65p	IN4007	4p	AN315	210p	AN6426	45p	BA614	720p
BD133	50p	BF225	30p	BU824	60p	BUZ91A	260p	TI47	65p	IN4007	4p	AN315	210p	AN6427	45p	BA614	720p
BD135	20p	BF240	15p	BU826	120p	BUZ91A	260p	TI48	65p	IN4007	4p	AN315	210p	AN6428	45p	BA614	720p
BD136	20p	BF245	25p	BU826A	160p	BUZ91A	260p	TI49	65p	IN4007	4p	AN315	210p	AN6429	45p	BA614	720p
BD137	20p	BF254	15p	BU902	110p	BUZ91A	260p	TI50	65p	IN4007	4p	AN315	210p	AN6430	45p	BA614	720p
BD138	20p	BF255	12p	BU910	80p	BUZ91A	260p	TI51	65p	IN4007	4p	AN315	210p	AN6431	45p	BA614	720p
BD139	20p	BF256	12p	BU911													

JAPANESE TRANSISTORS

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
2SC1675	90p	2SC2261	700p	2SC2719	25p	2SC3263	280p	2SC3798	220p	2SD257	195p	2SD880	40p	2SD1327	150p	2SD1763A	60p	2SK312	750p
2SC1676	80p	2SC2267	90p	2SC2721	120p	2SC3264	390p	2SC3807	120p	2SD287	250p	2SD882	25p	2SD1328	60p	2SD1764	70p	2SK315	70p
2SC1683	100p	2SC2270	60p	2SC2724	15p	2SC3269	50p	2SC3808	70p	2SD291	250p	2SD889	35p	2SD1330	70p	2SD1765	70p	2SK320	120p
2SC1684	30p	2SC2271	25p	2SC2726	200p	2SC3270	50p	2SC3811	80p	2SD313	25p	2SD892A	75p	2SD1347	50p	2SD1769	110p	2SK323	130p
2SC1685	30p	2SC2274	15p	2SC2727	350p	2SC3271	75p	2SC3831	25p	2SD315	75p	2SD894	35p	2SD1348	65p	2SD1773	100p	2SK332	175p
2SC1729	900p	2SC2276	50p	2SC2750	300p	2SC3272	280p	2SC3832	135p	2SD325	30p	2SD895	100p	2SD1350	150p	2SD1776	70p	2SK359	40p
2SC1730	10p	2SC2278	70p	2SC2751	270p	2SC3273	30p	2SC3833	250p	2SD330	65p	2SD896	200p	2SD1376	60p	2SD1783	70p	2SK363	50p
2SC1735	10p	2SC2283	700p	2SC2752	75p	2SC3279	200p	2SC3851	100p	2SD348	300p	2SD898B	225p	2SD1378	60p	2SD1785	160p	2SK367	40p
2SC1740	10p	2SC2290	1800p	2SC2757	300p	2SC3281	200p	2SC3852	80p	2SD350	320p	2SD900	400p	2SD1379	100p	2SD1789	210p	2SK369	40p
2SC1741	35p	2SC2291	40p	2SC2759	400p	2SC3284	600p	2SC3853	200p	2SD357	40p	2SD905	450p	2SD1380	100p	2SD1796	120p	2SK377	40p
2SC1755	90p	2SC2298	35p	2SC2773	700p	2SC3283	85p	2SC3855	220p	2SD358	40p	2SD916	130p	2SD1382	60p	2SD1802	75p	2SK369	30p
2SC1756	35p	2SC2307	300p	2SC2774	500p	2SC3288	50p	2SC3857	50p	2SD359	50p	2SD917	300p	2SD1384	50p	2SD1806	75p	2SK373	40p
2SC1758	30p	2SC2308	10p	2SC2785	40p	2SC3289	120p	2SC3858	550p	2SD361	100p	2SD921	320p	2SD1385	350p	2SD1812	45p	2SK374	30p
2SC1760	70p	2SC2312	300p	2SC2786	20p	2SC3300	400p	2SC3866	100p	2SD362	100p	2SD923	360p	2SD1391	250p	2SD1815	50p	2SK386	60p
2SC1775	10p	2SC2314	70p	2SC2787	10p	2SC3303	100p	2SC3870	20p	2SD363	240p	2SD946	120p	2SD1392	85p	2SD1825	60p	2SK389	115p
2SC1781	20p	2SC2316	150p	2SC2791	500p	2SC3306	130p	2SC3872	20p	2SD364	650p	2SD947	100p	2SD1395	85p	2SD1827	120p	2SK400	70p
2SC1789	100p	2SC2320	10p	2SC2792	220p	2SC3307	600p	2SC388A	25p	2SD368	50p	2SD950	300p	2SD1396	120p	2SD1843	70p	2SK405	450p
2SC1809	40p	2SC2324	120p	2SC2793	700p	2SC3309	150p	2SC3883	210p	2SD372	75p	2SD951	200p	2SD1397	100p	2SD1846	350p	2SK414	550p
2SC1810	250p	2SC2328A	50p	2SC2808	40p	2SC3310	125p	2SC3884A	200p	2SD376	70p	2SD957A	520p	2SD1398	120p	2SD1847	275p	2SK415	50p
2SC1815	10p	2SC2310	25p	2SC2810	360p	2SC3316	280p	2SC3885	250p	2SD388	150p	2SD958	60p	2SD1400	280p	2SD1850	325p	2SK423	75p
2SC1819	70p	2SC2315	175p	2SC2812	40p	2SC3317	350p	2SC3885A	290p	2SD389	60p	2SD965	35p	2SD1402	120p	2SD1853	40p	2SK427	50p
2SC1826	60p	2SC2329	480p	2SC2814	40p	2SC3326	50p	2SC3886A	275p	2SD400	14p	2SD970	170p	2SD1403	225p	2SD1857	75p	2SK430	200p
2SC1827	60p	2SC2320	300p	2SC2824	75p	2SC3327	60p	2SC3890	150p	2SD401	50p	2SD972	40p	2SD1405	80p	2SD1858	40p	2SK511	450p
2SC1829	50p	2SC2331	50p	2SC2825	900p	2SC3328	50p	2SC3892A	250p	2SD402	120p	2SD973	60p	2SD1406	60p	2SD1863	35p	2SK513	325p
2SC1833	270p	2SC2333	200p	2SC2826	200p	2SC3330	20p	2SC3893	225p	2SD414	45p	2SD973A	70p	2SD1408	60p	2SD1864	85p	2SK526	160p
2SC1834	50p	2SC2334	80p	2SC2827	130p	2SC3331	25p	2SC3895	325p	2SD415	55p	2SD982	90p	2SD1409	60p	2SD1867	175p	2SK531	350p
2SC1841	12p	2SC2335	55p	2SC2832	300p	2SC3333	120p	2SC3896	400p	2SD424	350p	2SD985	120p	2SD1408	125p	2SD1877	150p	2SK534	700p
2SC1844	50p	2SC2336A	125p	2SC2834	280p	2SC3345	100p	2SC3897	200p	2SD426	150p	2SD986	120p	2SD1409	170p	2SD1877	175p	2SK537	900p
2SC1845	15p	2SC2344	150p	2SC2837	250p	2SC3346	130p	2SC3907	250p	2SD427	350p	2SD998	70p	2SD1411	85p	2SD1878	160p	2SK539	350p
2SC1846	35p	2SC2347	35p	2SC2839	40p	2SC3352	200p	2SC3927	250p	2SD438	35p	2SD1010	40p	2SD1412	75p	2SD1879	275p	2SK543	300p
2SC1847	45p	2SC2353	120p	2SC2853	70p	2SC3353	280p	2SC3940	40p	2SD467	15p	2SD1012	40p	2SD1413	60p	2SD1880	360p	2SK549	1100p
2SC1855	85p	2SC2360	120p	2SC2873	60p	2SC3355	50p	2SC3943	75p	2SD468	15p	2SD1020	40p	2SD1415	190p	2SD1881	350p	2SK544	30p
2SC1856	25p	2SC2361	150p	2SC2877	120p	2SC3356	120p	2SC3944	80p	2SD471	20p	2SD1021	120p	2SD1417	75p	2SD1884	300p	2SK545	250p
2SC1865	700p	2SC2362	50p	2SC2878	20p	2SC3358	50p	2SC3950	120p	2SD476	100p	2SD1022	250p	2SD1425	260p	2SD1886	300p	2SK553	225p
2SC1870	70p	2SC2365	280p	2SC2879	3200p	2SC3376	300p	2SC3953	50p	2SD525	50p	2SD1024	850p	2SD1426	135p	2SD1887	225p	2SK552	30p
2SC1871	425p	2SC2369	10p	2SC2882	60p	2SC3377	50p	2SC3955	60p	2SD526	70p	2SD1027	850p	2SD1427	160p	2SD1894	300p	2SK553	225p
2SC1875	220p	2SC2371	25p	2SC2883	60p	2SC3378	120p	2SC3964	100p	2SD545	18p	2SD1030	75p	2SD1428	180p	2SD1895	225p	2SK555	300p
2SC1881	70p	2SC2373	210p	2SC2888	200p	2SC3379	1200p	2SC3972	250p	2SD549	120p	2SD1031	70p	2SD1430	280p	2SD1910	175p	2SK556	500p
2SC1890	15p	2SC2383	50p	2SC2899	50p	2SC3381	130p	2SC3973	210p	2SD551	300p	2SD1036	600p	2SD1431	200p	2SD1911	300p	2SK557	400p
2SC1895	500p	2SC2389	45p	2SC2909	60p	2SC3383	80p	2SC3975	210p	2SD554	225p	2SD1046	200p	2SD1432	400p	2SD1913	50p	2SK559	600p
2SC1904	125p	2SC2407	110p	2SC2910	25p	2SC3393	80p	2SC3987	160p	2SD555	500p	2SD1047	180p	2SD1433	300p	2SD1929	50p	2SK560	580p
2SC1906	15p	2SC2408	120p	2SC2911	80p	2SC3397	20p	2SC3996	600p	2SD556	225p	2SD1051	130p	2SD1438	60p	2SD1930	50p	2SK566	475p
2SC1907	20p	2SC2412K	50p	2SC2912	120p	2SC3399	50p	2SC3997	1250p	2SD558	200p	2SD1055	60p	2SD1439	165p	2SD1933	45p	2SK566	580p
2SC1909	25p	2SC2440	200p	2SC2921	650p	2SC3400	35p	2SC3998	800p	2SD560	50p	2SD1060	130p	2SD1441	220p	2SD1939	60p	2SK606	70p
2SC1913	90p	2SC2458	10p	2SC2922	480p	2SC3401	50p	2SC4006	100p	2SD571	20p	2SD1062	150p	2SD1442	80p	2SD1941	350p	2SK612	80p
2SC1914	30p	2SC2459	50p	2SC2923	75p	2SC3402	40p	2SC4020	150p	2SD575	530p	2SD1063	200p	2SD1445	200p	2SD1944	50p	2SK684	950p
2SC1921	15p	2SC2466	55p	2SC2928	550p	2SC3405	130p	2SC4023	325p	2SD592	25p	2SD1064	250p	2SD1446	300p	2SD1958	80p	2SK685	1100p
2SC1922	175p	2SC2486	275p	2SC2929	280p	2SC3409	400p	2SC4029	35p	2SD596	25p	2SD1065	160p	2SD1450	60p	2SD1959	210p	2SK699	100p
2SC1923	10p	2SC2492	50p	2SC2934	75p	2SC3416	30p	2SC4043	45p	2SD600	30p	2SD1069	150p	2SD1451	200p	2SD1978	50p	2SK719	300p
2SC1929	180p	2SC2470	60p	2SC2937	250p	2SC3417	90p	2SC4046	40p	2SD601	40p	2SD1073	350p	2SD1452	275p	2SD1984	60p	2SK724	500p
2SC1940	110p	2SC2481	125p	2SC2939	400p	2SC3419	120p	2SC4056	200p	2SD602	60p	2SD1088	150p	2SD1453	140p	2SD1991	50p	2SK725	550p
2SC1941	27p	2SC2482	20p	2SC2944	300p	2SC3420	80p	2SC4059	400p	2SD612	50p	2SD1094	375p	2SD1455	250p	2SD1994	200p	2SK726	425p
2SC1942	35p	2SC2483	120p	2SC2958	50p	2SC3421	45p	2SC4064	140p	2SD613	70p	2SD1110	225p	2SD1457	165p	2SD1996	45p	2SK727	475p
2SC1944	35p	2SC2484	185p	2SC2962	800p	2SC3422	75p	2SC4106	150p	2SD617	300p	2SD1111	20p	2SD1458	50p	2SD2006	75p	2SK739	400p
2SC1945	300p	2SC2485	400p	2SC2979	160p	2SC3423	60p	2SC4107	175p	2SD633	70p	2SD1113	225p	2SD1459	60p	2SD2010	250p	2SK758	300p
2SC1946	1500p	2SC2491	200p	2SC2987	250p	2SC3425	65p	2SC4123	230p	2SD636	100p	2SD1128	200p	2SD1468	40p	2SD2011	60p	2SK759	500p
2SC1947	450p	2SC2498	50p	2SC2988	150p	2SC3446	150p	2SC4124	200p	2SD637	15p	2SD1133	65p	2SD1487	225p	2SD2012	50p	2SK769	100p
2SC1953	75p	2SC2500	25p	2SC2995	60p	2SC3447	130p	2SC4125	275p	2SD638	15p	2SD1135	75p	2SD1494	160p	2SD2018	65p	2SK786	200p
2SC1957	40p	2SC2502	140p	2SC2999	50p	2SC3456	200p	2SC4137	40p	2SD639	20p	2SD1138	40p	2SD1496	300p	2SD2033	80p	2SK787	800p
2SC1959	10p	2SC2503	600p	2SC3001	1400p	2SC3457	125p	2SC4138	200p	2SD640	350p	2SD1140	40p	2SD1497	230p	2SD2061	100p	2SK791	225p
2SC1962	130p	2SC2512	120p	2SC3019	320p	2SC3459	180p	2SC4157	200p	2SD645	18p	2SD1142	350p	2SD1497-02	350p	2SD2066	250p	2SK792	300p
2SC1967	160p	2SC2519	180p	2SC3020	1850p														

PINCH ROLLERS

Model	Price	Model	Price	Model	Price	Model	Price	Model	Price
AKAI VS10, VS900, VS9500, VS9700, VS9800, VP7100, VP77 140p		FVHP615, 618, 620, 622, 710, 711, 715, 716, 720, 721, 722, 725, 730, FVHP810, 830, 840 140p		BR5600, 605, 747, 777, 920, 925 140p		NS7000 140p		681, 682, 684, 685, 693, VC699, 700, 772, 750, 779, 780, 781, 7810, 782, 782MK2, 782Z, 783, VC785, 786, 787, 793, 800, 7810, 7822, VCT72, VCF63, VCF63, VCA 100, 102, 104, 131, 140, 170, 202, 303, 211, 234, 303, 501, 502, VCA602, 5011, VCD801, 802, 851, 852, 881, 882, VCM73, VCT73, VCT72, VCS361 140p	
VS1, VS2, VS3, VS4, VS5, VS6, VS8, VS9, VS12, VS15 140p		VBR300, VBS3500, 7000, 7100, 7500, 7600, 9000, 9000 140p		BP5500, HRD110, 111, 120, 220, 225, 450 1100p		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, 1000, 2948, 3030, 3312 140p		VC785, 786, 787, 793, 800, 7810, 7822, VCT72, VCF63, VCF63, VCA 100, 102, 104, 131, 140, 170, 202, 303, 211, 234, 303, 501, 502, VCA602, 5011, VCD801, 802, 851, 852, 881, 882, VCM73, VCT73, VCT72, VCS361 140p	
VS22, 23, 25, 35, 37, 38, 53, 66, 75, 422, 425, 426, 427, 462, 465, 467, VS485, 765, 767, 768, 865, 867, 965, 967, VSA77, VSA650, VSF10, 11, 12, 15, 180, 190, 200, 210, 220, 221, 222, 230, 240, 30, 33 140p		FVHD230, 250, 270, 370, 2000D, FVHP3, 210, 250, 300, 310, 1100, FVHP1200, 1250, 130, 132, 1340, 1340, 1400, 1410, 1440, 1500, 200, FVHP20410, 420, 430, 440, 445, 470, 475, FVSP2905, 495, 2905 140p		PINCH ROLLER ASSEMBLY HRD140, 141, 142, 143, 150, 152, 157, 158, 160, 556, 566, 725, 755, HRP50 1350p		VR2200, VR2021, VR2022, VR2023, VR2024 140p		VC785, 786, 787, 793, 800, 7810, 7822, VCT72, VCF63, VCF63, VCA 100, 102, 104, 131, 140, 170, 202, 303, 211, 234, 303, 501, 502, VCA602, 5011, VCD801, 802, 851, 852, 881, 882, VCM73, VCT73, VCT72, VCS361 140p	
VS27, 28, 29, 30, 33, 34, 35, 51, 54, 55, 60, 64, 65, 70, 73, 74, 75, VSP110, VS2X60, VSX580 140p		FVHP140, FVHD40, FVHD55, FVHP1, FVHP10, FVHP20, FVHP30, FVHP40, FVHP50, FVHP60, FVHP70, FVHP80, FVHP90, FVHP100, FVHP110, FVHP120, FVHP130, FVHP140, FVHP150, FVHP160, FVHP170, FVHP180, FVHP190, FVHP200, FVHP210, FVHP220, FVHP230, FVHP240, FVHP250, FVHP260, FVHP270, FVHP280, FVHP290, FVHP300, FVHP310, FVHP320, FVHP330, FVHP340, FVHP350, FVHP360, FVHP370, FVHP380, FVHP390, FVHP400, FVHP410, FVHP420, FVHP430, FVHP440, FVHP450, FVHP460, FVHP470, FVHP480, FVHP490, FVHP500, FVHP510, FVHP520, FVHP530, FVHP540, FVHP550, FVHP560, FVHP570, FVHP580, FVHP590, FVHP600, FVHP610, FVHP620, FVHP630, FVHP640, FVHP650, FVHP660, FVHP670, FVHP680, FVHP690, FVHP700, FVHP710, FVHP720, FVHP730, FVHP740, FVHP750, FVHP760, FVHP770, FVHP780, FVHP790, FVHP800, FVHP810, FVHP820, FVHP830, FVHP840, FVHP850, FVHP860, FVHP870, FVHP880, FVHP890, FVHP900, FVHP910, FVHP920, FVHP930, FVHP940, FVHP950, FVHP960, FVHP970, FVHP980, FVHP990, FVHP1000 140p		HRD470, 500, 530, 700, 750, 950, HR5000, 5500, 9000 875p		VR2200, VR2021, VR2022, VR2023, VR2024 140p		VC785, 786, 787, 793, 800, 7810, 7822, VCT72, VCF63, VCF63, VCA 100, 102, 104, 131, 140, 170, 202, 303, 211, 234, 303, 501, 502, VCA602, 5011, VCD801, 802, 851, 852, 881, 882, VCM73, VCT73, VCT72, VCS361 140p	
VS27, 28, 29, 30, 33, 34, 35, 51, 54, 55, 60, 64, 65, 70, 73, 74, 75, VSP110, VS2X60, VSX580 140p		GOLDSTAR GHV51, 1221, 1232, 1233, 1240, 1241, 1242, 1243, 1244, 1245, 1246, 140p GHV1247, 1248, 1250, 1266, 1290, 1291, 1295, 1296, 1392, 1393, GHV1891, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430 GHV1240, 1241, 1247, 1248, 1290, 1291, GHV1295, 1296, VCP4000, 4100, 4130, 4200, 4300, 4301, 4305, VCP4306, 4310, 4311, 4315, 4316, 4320, 4321, 4325, 4326, 4330, GSE1290, 1291, 1295, 1296, 1297, 1891, 1910, 20005, 2000 140p		MATSUI VX6000, 730, 735, 750, 755, 765, 800, 850, VXR888 140p		VR2200, VR2021, VR2022, VR2023, VR2024 140p		VC785, 786, 787, 793, 800, 7810, 7822, VCT72, VCF63, VCF63, VCA 100, 102, 104, 131, 140, 170, 202, 303, 211, 234, 303, 501, 502, VCA602, 5011, VCD801, 802, 851, 852, 881, 882, VCM73, VCT73, VCT72, VCS361 140p	
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VS27, 28, 29, 30, 33, 34, 35, 51, 54, 55, 60, 64, 65, 70, 73, 74, 75, VSP110, VS2X60, VSX580 140p		SHARP VCR1000X, VCR4000 140p		VX6000A 140p		VR2200, VR2021, VR2022, VR2023, VR2024 140p		VC785, 786, 787, 793, 800, 7810, 7822, VCT72, VCF63, VCF63, VCA 100, 102, 104, 131, 140, 170, 202, 303, 211, 234, 303, 501, 502, VCA602, 5011, VCD801, 802, 851, 852, 881, 882, VCM73, VCT73, VCT72, VCS361 140p	
VS27, 28, 29, 30, 33, 34, 35, 51, 54, 55, 60, 64, 65, 70, 73, 74, 75, VSP110, VS2X60, VSX580 140p		VCR5000, VCR6000 140p		VX6000A 140p		VR2200, VR2021, VR2022, VR2023, VR2024 140p		VC785, 786, 787, 793, 800, 7810, 7822, VCT72, VCF63, VCF63, VCA 100, 102, 104, 131, 140, 170, 202, 303, 211, 234, 303, 501, 502, VCA602, 5011, VCD801, 802, 851, 852, 881, 882, VCM73, VCT73, VCT72, VCS361 140p	
VS27, 28, 29, 30, 33, 34, 35, 51, 54, 55, 60, 64, 65, 70, 73, 74, 75, VSP110, VS2X60, VSX580 140p		VCR7000, VCR7800, VCR8000, VCR8800 140p		VX6000A 140p		VR2200, VR2021, VR2022, VR2023, VR2024 140p		VC785, 786, 787, 793, 800, 7810, 7822, VCT72, VCF63, VCF63, VCA 100, 102, 104, 131, 140, 170, 202, 303, 211, 234, 303, 501, 502, VCA602, 5011, VCD801, 802, 851, 852, 881, 882, VCM73, VCT73, VCT72, VCS361 140p	
VS27, 28, 29, 30, 33, 34, 35, 51, 54, 55, 60, 64, 65, 70, 73, 74, 75, VSP110, VS2X60, VSX580 140p		SHARP VCR1000X, VCR4000 140p		VX6000A 140p		VR2200, VR2021, VR2022, VR2023, VR2024 140p		VC785, 786, 787, 793, 800, 7810, 7822, VCT72, VCF63, VCF63, VCA 100, 102, 104, 131, 140, 170, 202, 303, 211, 234, 303, 501, 502, VCA602, 5011, VCD801, 802, 851, 852, 881, 882, VCM73, VCT73, VCT72, VCS361 140p	
VS27, 28, 29, 30, 33, 34, 35, 51, 54, 55, 60, 64, 65, 70, 73, 74, 75, VSP110, VS2X60, VSX580 140p		VCR5000, VCR6000 140p		VX6000A 140p		VR2200, VR2021, VR2022, VR2023, VR2024 140p		VC785, 786, 787, 793, 800, 7810, 7822, VCT72, VCF63, VCF63, VCA 100, 102, 104, 131, 140, 170, 202, 303, 211, 234, 303, 501, 502, VCA602, 5011, VCD801, 802, 851, 852, 881, 882, VCM73, VCT73, VCT72, VCS361 140p	
VS27, 28, 29, 30, 33, 34, 35, 51, 54, 55, 60, 64, 65, 70, 73, 74, 75, VSP11									

VIDEO SERVICE KITS

<p>AMSTRAD VCR700 <i>Contents</i> BELT SET, PINCH ROLLER, REEL IDLER, VIDEO LAMP Order Code: SK41</p> <p style="text-align: right;">£5.50</p> <p>FERGUSON & JVC 3V42/43 HRD455/HR0725 <i>Contents</i> BELT SET, PINCH ROLLER, CLUTCH MECHANISM, TENSION BAND Order Code: SK37</p> <p style="text-align: right;">£9.00</p> <p>3V58/59/64/65 HRD170/180/210/230/300/320/370/400/430/530/700/750 HR55000 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER ARM, TENSION BAND Order Code: SK44</p> <p style="text-align: right;">£7.00</p> <p>3V29/3V30 HR7200/7300/7350 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK05</p> <p style="text-align: right;">£5.00</p> <p>3V35/36, 38/39/49 HRD110/111/120/225 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK04</p> <p style="text-align: right;">£5.00</p> <p>3V31/3V42 HR7600/7610/7650/7655 <i>Contents</i> BELT SET, T/U REEL TABLE TYRE, PINCH ROLLER, REEL IDLER, T/U CLUTCH, T/U IDLER, TENSION BAND, VIDEO LAMP Order Code: SK33</p> <p style="text-align: right;">£11.00</p> <p>3V35/36/38/39/49 HRD110/111/120/121/225 <i>Contents</i> 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: SK35</p> <p style="text-align: right;">£10.00</p> <p>3V29/3V30 HR07200/7300/7350 <i>Contents</i> 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</p> <p style="text-align: right;">£10.00</p> <p>3V44/45/48/53/54/55/57 HRP50/HRD140/150/158/160 HRD250/251/565/566/755 <i>Contents</i> BELT SET, PINCH ROLLER, CLUTCH MECHANISM, TENSION BAND Order Code: SK39</p> <p style="text-align: right;">£15.00</p> <p>FISHER FVHP905/906/907/908/910/911/916/918 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER, GEAR IDLER UNIT, TENSION BAND Order Code: SK57</p> <p style="text-align: right;">£13.00</p> <p>FVHP615/618/620/622/710/711/715/716/720/721/722/725/730/830/840 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER, GEAR IDLER UNIT, TENSION BAND Order Code: SK68</p> <p style="text-align: right;">£11.00</p>	<p>HITACHI VT11/VT33 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK08</p> <p style="text-align: right;">£5.00</p> <p>VT11/VT33 <i>Contents</i> BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, FF/REW IDLER, CLUTCH PLATE, TENSION BAND Order Code: SK45</p> <p style="text-align: right;">£13.00</p> <p>VT52/61/62/63/64/65/85/86/640 <i>Contents</i> BELT SET, PINCH ROLLER, FF/REW ARM, CLUTCH PLATE, TENSION BAND Order Code: SK49</p> <p style="text-align: right;">£14.00</p> <p>VT400/405/410/13/14/15/18/420/25/26/28/430/31/35/48/450/498/510/520/25/26/530/35/36/540/545/46/48/570/75/576/580/85/88 <i>Contents</i> TIMING BELT, PINCH ROLLER, FF/REW ARM, CLUTCH BASE, TENSION BAND Order Code: SK52</p> <p style="text-align: right;">£9.75</p> <p>VT100/110/111/113/115/118/120/125/128/130/135/138/145/150/175/220/225/250/255/258/260/VT130 <i>Contents</i> BELT SET, PINCH ROLLER, FF/REW ARM, CLUTCH PLATE, TENSION BAND Order Code: SK51</p> <p style="text-align: right;">£14.00</p> <p>PANASONIC NV2000/NV2010/NV7000/NV7200/NV7800 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK03</p> <p style="text-align: right;">£5.00</p> <p>NV300/NV330/NV333/NV340/NV366 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRE Order Code: SK01</p> <p style="text-align: right;">£5.00</p> <p>NV2000/NV2010 <i>Contents</i> BELT SET, PINCH ROLLER, FF IDLER, PLAY IDLER, TENSION BAND, VIDEO LAMP Order Code: SK13</p> <p style="text-align: right;">£6.00</p> <p>NV7000/NV7200/NV7800 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER UNIT, PLAY IDLER, TENSION BAND Order Code: SK11</p> <p style="text-align: right;">£8.50</p> <p>NV300/NV330/NV333/NV340/NV366 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER UNIT, PLAY IDLER, TENSION BAND Order Code: SK15</p> <p style="text-align: right;">£7.00</p> <p>NV67/NV69/NV10/NV11/NV12/NV14/NV16/NV18/NV30/NV60/NV120/NV130/NV400/NVH65 (PX/AC)/AG1810 (P/K) <i>Contents</i> LOADING BELT, CAPSTAN BELT, PINCH ROLLER, IDLER, TENSION BAND Order Code: SK27</p> <p style="text-align: right;">£6.00</p> <p>NV332 <i>Contents</i> BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND, FF/REW TYRE Order Code: SK29</p> <p style="text-align: right;">£12.00</p> <p>NV230/250/260/280/430/450/460/470/650/810/830/AG1200/PK/AG1500/PK <i>Contents</i> BELT SET, PINCH ROLLER, IDLER, TENSION BAND Order Code: SK23</p> <p style="text-align: right;">£5.00</p>	<p>NV600/NV688 <i>Contents</i> BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND Order Code: SK25</p> <p style="text-align: right;">£12.00</p> <p>NV730/NV770 <i>Contents</i> SLOT IN BELT, LOADING BELT, PINCH ROLLER, IDLER UNIT, TENSION BAND Order Code: SK19</p> <p style="text-align: right;">£5.50</p> <p>NV370/NV380/480/630/780/830/850/AG2100/PK/AG2200/PK <i>Contents</i> BELT SET, PINCH ROLLER, IDLER, TENSION BAND Order Code: SK21</p> <p style="text-align: right;">£5.00</p> <p>NV777/NV788 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER UNIT, TENSION BAND Order Code: SK17</p> <p style="text-align: right;">£6.00</p> <p>SHARP VC381 <i>Contents</i> BELT SET, PINCH ROLLER, REEL IDLER, TENSION BAND, VIDEO LAMP Order Code: SK47</p> <p style="text-align: right;">£8.00</p> <p>VC500/VC571/VC581/VC582/VC583/VC584/VC5F3 <i>Contents</i> BELT SET, PINCH ROLLER, REEL IDLER, TENSION BAND Order Code: SK60</p> <p style="text-align: right;">£9.50</p> <p>VC781/VC7810/VC7822/VC785/VC786/VC793/VC800/VCA100/VCA102/VCA104/VCA202 <i>Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT, TENSION BAND Order Code: SK64</p> <p style="text-align: right;">£13.50</p> <p>VC681/VC682/VC684/VC685/VC693/VC699/VC6F3/VC700 <i>Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT, TENSION BAND Order Code: SK62</p> <p style="text-align: right;">£13.50</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, PLAY IDLER TYRE, FF/REW IDLER TYRE Order Code: SK26</p> <p style="text-align: right;">£6.00</p> <p><i>Economy Kit Contents</i> SLOT IN BELT, LOADING BELT, PINCH ROLLER, IDLER TYRE Order Code: SK20</p> <p style="text-align: right;">£3.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK22</p> <p style="text-align: right;">£2.75</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK18</p> <p style="text-align: right;">£4.00</p> <p><i>Economy Kit Contents</i> REEL IDLER TYRE Order Code: SK48</p> <p style="text-align: right;">£3.25</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, REEL IDLER Order Code: SK61</p> <p style="text-align: right;">£5.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT TYRE Order Code: SK65</p> <p style="text-align: right;">£3.75</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT TYRE Order Code: SK63</p> <p style="text-align: right;">£5.00</p>
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**FOR MORE DETAILS OF OVER 500
TYPES OF SERVICE KITS ...
PLEASE RING US!**

BABY 10 REGULATOR !!!
See Page 274
SPECIAL OFFER !!!

REPLACEMENT VIDEO CASSETTE HOUSINGS

Name	Models	Code	Price	Name	Models	Code	Price	Name	Models	Code	Price
AKAI	VS35, VS53, VS55, VS56, VS75	CH18	3200p		FV31R	CH19	4300p		VCA103, 103GV, 106, 106GVM, 254GVM	CH23	2500p
GRANADA	VHSDP1, VHSYJ2	CH05	1100p		HR0515, 520, 527, 540, 550, 580, 600, 610, 620, 660, 670, HR0830, 840, 850, 860, 4050, 6600, FV37H	CH20	2200p		VCS211, 244, 5055, 605, VCB230, VCD8066, 8106, VCT122, 310, 410G, 610	CH24	2500p
GDLOSTAR	GHV1290P, 1291P, 1295P, 9400, 73401, GSE1295P, GSE1891P, 20001Q, 20051Q, VCP4200, 4300, 4301, 4305, VCP4306, 4311, 4315, 4316, 4320, 4321, 4325	CH25	2000p		HRD540, 580, 830, 850, 910, 960, HRD970, HROX20, FV57H	CH27	2400p	TELEFUNKEN	VR2970	CH02	2800p
	GHV51, 1221, 1232, 1240, 1241, 1242, 1244, 1246, 1248, GHV8000, 8200	CH26	2900p	FERGUSON	VR3805, VR3905	CH01	2800p	THOMSON	V320, 321, 323, 326, 4200, 4300	CH01	2800p
FERGUSON & J.V.C.	3V38, 3V39, 8943, 8944, 8951, 3V35, 3V36, 3V49, HRD 110, 111, 120, 121, 225	CH01	2800p	I.T.T.	VR3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948	CH02	2800p		V342, 343, 352, 353, 360, 364, 368, 4210, 4230, 4260, 4400, V5500, 6000, 8540	CH02	2800p
	3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V57, 8945, 8947, 8948, HRD 140, 141, 150, 157, 158, 160, 250, HRD257, 455, 565, 566, 725, 755	CH02	2800p		VR3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948	CH02	2800p	TOSHIBA	V65, V67	CH01	2800p
	8948, 8950, FV10B, 12L, 13H, 14T, 20B, 21R, 22L, 26, 395, HRD230, 430, 530	CH03	2800p	NATIONAL PANASONIC	NV730	CH06	4300p		V65, V66	CH02	2800p
	3V58, 3V59, 3V64, 3V65, FV11R, 8950, 8951, HRD170, HRD180, HRD370	CH04	2800p	N.E.C.	N830EG, N831EG, N831EG, N832, N833EG, N835	CH01	2800p				
				PHILIPS	CASSETTE LIFT ASSEMBLY (69120366)						
					DV186, 190, 286, 471, 562, 761, VR6180, 6182, 6185, 6285, VR6290, 6291, 6293, 6362, 6367, 6393, 6467, 6468, 6470, VR6561, 6670, 6760, 6761, 6870, 6970	CH05	1100p				
					VR6443	CH22	2900p				
					VR6448	CH23	2500p				
					49SB66	CH24	2500p				
				SHARP	VCA100, VCH851, VCH852	CH22	2900p				

☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆
AMSTRAD MOD KIT
 ☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆
 FITS :
 VCR 4500, 4600, 4700, 5200, TVR 1,2,3
 PRICE : £2.25 + VAT each
 ☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆

MODE SWITCH

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

AUDIO CONTROL HEADS

AMSTRAD ORIGINAL NO: 150751
 Used on: AMSTRAD TVR1, 2, 3, VCR4600, 4600MKII, 4700, FUNAI VS2, VCR4600, 4800, 5200, 5600, 6600, VIP3000, 5000
 Also fits: FIDELITY, FUNAI, HINARI, PROLINE, SCHNEIDER, TOWADA, UNIVERSUM **ORDER CODE: AH01 PRICE: 1350p**

AMSTRAD ORIGINAL NO: 153134
 Used on: AMSTRAD DD8900, 8904, VCR2000, 6000, 6100, 8600, 8602, 8603, VCR8604, 8700, 8704, 8714, 8800, 9005, 8244
 Also fits: ANTECH, BONDSTEC, CASIO, CROWN, FIDELITY, GOLD-HAND, GRANADA, HINARI, MARQUANT, OMEGA, PROFEX, SCHNEIDER, SEG, SENTRA, SHINTOM, TASHIKO, TATUNG, TOWADA, UNIVERSUM **ORDER CODE: AH02 PRICE: 1450p**

Replacement Audio Control Video Sound Head for National Panasonic

PART NUMBER	MODELS	PRICE
VBR 0091	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.
Order code: TOOL 8, Price 600p

VCR ALIGNMENT KIT

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

3 REVERSIBLE SCREWDRIVERS
SPRING HOOK

SET OF 8 ALLEN KEYS

0.77mm	0.90mm
1.27mm	1.50mm
1.60mm	2.00mm
2.40mm	3.00mm

CIRCLIP PLIERS
MICRO SCREWDRIVER

VCR HEAD EXTRACTOR
Order code: TOOL 10, Price 2900p

TRANSPARENT REPAIR/ADJUSTMENT CASSETTE

This transparent videocassette replaces a normal videotape during measurements, adjustments and inspection. The mechanical parts come into sight and become accessible.

Order code: TOOL 23, Price 500p

BACK UP BATTERIES

PHILIPS

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	600p
PACE SS9000, 9200, 9010, 9210, 9220	SATPSU2	550p
AMSTRAD SRD510, SRD520	SATPSU3	600p
AMSTRAD SRD500	SATPSU4	600p
AMSTRAD SRX340, SRX345, SRX350	SATPSU5	600p
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	650p
ECHOSTAR SR5500	SATPSU12	1600p
ECHOSTAR 6500/7700/8700	SATPSU13	2750p
AMSTRAD SRD600	SATPSU14	2600p
MIMTEC (Surensen)	SATPSU15	700p
AMSTRAD SRD700, SR950, SRX100, 301, 501, 502, 1002, 2001, SRD2000 SAT250	SATPSU16	650p

SATELLITE TUNERS

PACE PRD800/MSS200 2Ghz (221-2077062)
 ORDER CODE: TUNER01 PRICE: 1400p + VAT

PACE PRD900/MSS1000 2Ghz (221-21770112)
 ORDER CODE: TUNER02 PRICE: 1400p + VAT

SWITCH MODE TRANSFORMERS

PACE 9000
 ORDER CODE: PACE9000 PRICE: 800p

PRD800/PRD900
 ORDER CODE: PRD800 PRICE: 550p

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

FUSES

CURRENT RATING	TIME LAG (20mm)	ORDER CODE	PRICE	QUICK BLOW (20mm)	ORDER CODE	PRICE
100mA		FUSE36	75p		FUSE37	60p
160mA		FUSE01	75p		FUSE17	60p
250mA		FUSE02	75p		FUSE18	60p
315mA		FUSE03	75p		FUSE19	60p
400mA		FUSE04	75p		FUSE20	60p
500mA		FUSE05	75p		FUSE21	60p
630mA		FUSE06	75p		FUSE22	60p
800mA		FUSE07	60p		FUSE23	60p
1A		FUSE08	60p		FUSE24	60p
1.25A		FUSE09	60p		FUSE25	60p
1.6A		FUSE10	60p		FUSE26	60p
2A		FUSE11	50p		FUSE27	60p
2.5A		FUSE12	50p		FUSE28	60p
3.15A		FUSE13	55p		FUSE29	50p
4A		FUSE14	55p		FUSE30	50p
5A		FUSE15	60p		FUSE31	50p
6.3A		FUSE16	60p		FUSE32	50p

CERAMIC PLUG TOP

CURRENT RATING	ORDER CODE	PRICE
3A	FUSE33	100p
5A	FUSE34	100p
13A	FUSE35	100p

20mm CERAMIC TIME LAG

CURRENT RATING	ORDER CODE	PRICE
6.3A	FUSE38	100p
8A	FUSE39	100p
10A	FUSE40	100p
3.15A	FUSE41	85p
4A	FUSE42	85p
5A	FUSE43	85p

32 mm CERAMIC SLOW BLOW

CURRENT RATING	ORDER CODE	PRICE
8A	FUSE44	185p
10A	FUSE45	185p
15A	FUSE46	185p
20A	FUSE47	210p

38mm CERAMIC TIME LAG

CURRENT RATING	ORDER CODE	PRICE
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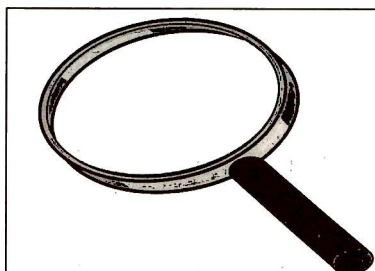
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D 050/37	LOT27	1600p	2432651	LOT80	1800p	4515 03 04	LOT169	1500p	TLF 14585 F	LOT42	1800p	094-01057/1.1	LOT186	1825p	1-439-311-31	LOT95	1550p
D 053/37	LOT207	1550p	2432761	LOT169	1500p	4515 03 05	LOT180	1550p	TLF 15068 F	LOT256	2000p	610.018.6620	LOT189	1650p	1-439-311-32	LOT95	1550p
D 056/37	LOT56	1650p	2432981	LOT37	1200p	4515 03 06	LOT168	1550p	TLF 70012	LOT78	1500p	610.018.6637	LOT189	1650p	1-439-331-22	LOT96	1550p
D 059/37	LOT200	1450p	2432981	LOT37	1200p	4515 03 08	LOT22	1250p	TLF 70012 F	LOT78	1500p				1-439-331-41	LOT98	1550p
D 089/37	LOT56	1650p	2432982	LOT37	1200p	4515 03 09	LOT178	1500p	TLF 70012A	LOT78	1500p	SHARP			1-439-332-11	LOT99	1600p
FCM 2015 AL	LOT78	1500p	2433011	LOT171	1650p	4515 03 10	LOT168	1550p	TLF 70018 F	LOT274	1550p	RTRNF 1220 CEZZ	LOT39	1850p	1-439-332-11	LOT99	1600p
FERGUSON			2433012	LOT171	1650p	4515 03 13	LOT30	1250p	TLF 70018 F	LOT274	1550p	RTRNF 1783 BMZZ	LOT202	1800p	1-439-332-11	LOT99	1600p
00 D-3-508-001	LOT38	1250p	2433014	LOT171	1650p	4515 03 14	LOT174	1400p	TLF 70161	LOT278	1300p	RTRNF 1786 BMZZ	LOT211	1850p	1-439-332-41	LOT100	1500p
00 D-3-508-002	LOT38	1250p	2433212	LOT168	1500p	4515 03 15	LOT22	1250p	TLF 70162	LOT72	1600p	RTRNF 1786 CEZZ	LOT211	1850p	1-439-332-42	LOT101	1500p
00 D-3-508-003	LOT276	1400p	2433291	LOT172	1350p	4515 03 18	LOT192	1550p	TLF 70162A	LOT72	1600p	RTRNF 2000 BMZZ	LOT214	1600p	1-439-332-52	LOT100	1500p
00 D-3-515-001 PL1	LOT276	1400p	2433301	LOT246	1600p	4515 03 19	LOT30	1250p	TLF 70162B	LOT72	1600p	RTRNF 2002 CEZZ	LOT307	1450p	1-439-333-00	LOT270	1550p
00 D-4-208-001	LOT79	1600p	2433441	LOT188	1900p	4515 03 20	LOT190	1650p	TLF 70162G	LOT72	1600p	RTRNF 2007 BMZZ	LOT307	1450p	1-439-333-12	LOT270	1550p
00 D-4-208-002	LOT79	1600p	2433442	LOT191	1600p	4515 03 22	LOT196	1550p	TLF 77001 B	LOT274	1550p	RTRNF 2003 BMZZ	LOT308	1350p	1-439-333-11	LOT270	1550p
00 D-4-235-002	LOT240	1250p	2433451	LOT81	1350p	4515 03 24	LOT194	1550p	PHILIPS			RTRNF 2004 BMZZ	LOT307	1450p	1-439-333-12	LOT268	1400p
00 D-4-235-002 HTI	LOT81	1350p	2433452	LOT82	1250p	4515 03 25	LOT22	1250p	4822 140 10142	LOT142	1800p	RTRNF 2005 BMZZ	LOT308	1350p	1-439-333-21	LOT268	1400p
00 D-4-235-00201G	LOT81	1350p	2433453	LOT82	1250p	4515 03 26	LOT198	1550p	4822 140 10145	LOT134	1450p	RTRNF 2006 BMZZ	LOT308	1350p	1-439-337-11	LOT311	1450p
00 D-4-260-004 HTI	LOT38	1250p	2433455	LOT234	1600p	4515 03 28	LOT27	1450p	4822 140 10146	LOT112	1700p	RTRNF 2007 BMZZ	LOT307	1450p	1-439-387-21	LOT311	1450p
00 H-0-701-2400	LOT182	1450p	2433521	LOT85	1600p	4515 03 29	LOT193	1550p	4822 140 10151	LOT102	1700p	RTRNF 2023 BMZZ	LOT310	1500p	1-439-416-11	LOT255	1600p
06 D-3-083-001	LOT82	1250p	2433581	LOT22	1250p	4515 03 30	LOT179	1550p	4822 140 10161	LOT103	1250p	SONY			1-439-416-12	LOT255	1600p
06 D-3-083-002	LOT82	1250p	2433721	LOT83	1400p	4515 03 31	LOT207	1550p	4822 140 10171	LOT104	1500p	3753100	LOT275	1500p	1-439-416-21	LOT255	1600p
06 D-3-084-001	LOT23	1400p	2433751	LOT01	1300p	4515 03 34	LOT56	1650p	4822 140 10176	LOT114	1150p	1-439-243-00	LOT791	1600p	1-439-416-23	LOT255	1600p
06 D-3-084-002	LOT23	1400p	2433752	LOT01	1300p	4515 03 35	LOT193	1550p	4822 140 10184	LOT105	1500p	1-439-243-11	LOT791	1600p	1-439-416-41	LOT255	1600p
06 D-3-088-001	LOT84	1450p	2433752	LOT250	1350p	4515 03 38	LOT27	1450p	4822 140 10188	LOT116	1600p	1-439-243-12	LOT791	1600p	1-439-387-21	LOT255	1600p
06 D-3-093-001	LOT204	1600p	2433891	LOT23	1400p	4515 03 40	LOT200	1400p	4822 140 10201	LOT104	1500p	1-439-243-31	LOT229	1700p	1-439-430-21	LOT271	1550p
06 D-3-095-001	LOT87	1000p	2433892	LOT84	1450p	4515 03 41	LOT84	1450p	4822 140 10236	LOT118	1550p	1-439-243-32	LOT229	1700p	154125A	LOT275	1500p
06 D-3-095-002	LOT87	1000p	2433893	LOT23	1400p	4515 03 43	LOT196	1550p	4822 140 10246	LOT111	1500p	1-439-244-00	LOT229	1700p	TOSHIBA		
06 D-3-095-002	LOT87	1000p	2433952	LOT33	1000p	4515 03 44	LOT56	1650p	4822 140 10247	LOT105	1500p	1-439-244-11	LOT48	1600p	37010	LOT131	1450p
06 D-333-512-001	LOT204	1600p	2434002	LOT200	1400p	4515 03 46	LOT201	1550p	4822 140 10254	LOT107	1450p	1-439-244-21	LOT48	1600p	37011	LOT131	1450p
FETX 100 90 DEG	LOT04	1500p	2434141	LOT33	1000p	4515 03 50	LOT27	1450p	4822 140 10263	LOT117	1550p	1-439-244-31	LOT48	1600p	37012	LOT131	1450p
FETX 90 WHITE	LOT06	1650p	2434141	LOT33	1000p	4515 03 51	LOT27	1450p	4822 140 10269	LOT210	1350p	1-439-244-31	LOT48	1600p	37013	LOT131	1450p
FETX 100 100 DEG	LOT34	1500p	2434274	LOT44	1050p	4515 03 75	LOT56	1650p	4822 140 10271	LOT208	1650p	1-439-256-00	LOT45	1650p	37014	LOT131	1450p
GRUNDIG			2434274	LOT44	1050p	4516 16 01	LOT22	1250p	4822 140 10274	LOT123	1450p	1-439-256-11	LOT45	1650p	37015	LOT131	1450p
29201.008.01	LOT153	1750p	2434453	LOT86	1600p	MITSUBISHI			4822 140 10282	LOT122	1300p	1-439-256-22	LOT45	1650p	37016	LOT131	1450p
29201.014.01	LOT140	1500p	2434455	LOT234	1600p	731003	LOT51	1550p	4822 140 10283	LOT104	1500p	1-439-276-21	LOT45	1650p	37017	LOT131	1450p
29201.015.01	LOT149	1400p	2434593	LOT44	1050p	276-16399	LOT49	1500p	4822 140 10294	LOT125	2150p	1-439-280-00	LOT92	1700p	37018	LOT131	1450p
29201.017.01	LOT60	1250p	2435062	LOT296	1400p	334 B 07803	LOT50	1450p	4822 140 10306	LOT110	1200p	1-439-280-13	LOT92	1700p	37019	LOT131	1450p
29201.018.01	LOT163	1300p	2435121	LOT87	1000p	334 B 08100	LOT74	1600p	4822 140 10325	LOT132	1500p	1-439-286-00	LOT46	1300p	1810951	LOT131	1450p
29201.018.02	LOT61	1700p	2435131	LOT251	1450p	334 B 08104	LOT74	1600p	4822 140 10326	LOT122	1300p	1-439-286-11	LOT46	1300p	2433751	LOT131	1450p
29201.019.01	LOT62	1250p	2435141	LOT282	1300p	334 B 08108	LOT295	1600p	4822 140 10328	LOT124	1450p	1-439-286-12	LOT46	1300p	2433752	LOT131	1450p
29201.019.02	LOT62	1250p	2435301	LOT88	1450p	334 P 18506	LOT51	1550p	4822 140 10349	LOT106	1250p	1-439-286-13	LOT46	1300p	23236023	LOT131	1450p
29201.022.01	LOT63	1700p	2435671	LOT89	1600p	334 P 18507	LOT75	1500p	4822 140 10353	LOT284	1450p	1-439-286-21	LOT46	1300p	23236052	LOT131	1450p
29201.022.02	LOT166	1600p	2436201	LOT109	1200p	5908-05008A-AA	LOT70	1500p	4822 140 10356	LOT284	1400p	1-439-288-00	LOT46	1300p	23236098	LOT288	1400p
29201.022.03	LOT165	1350p	2436202	LOT109	1200p	D 108/37	LOT49	1500p	4822 140 10367	LOT286	1400p	1-439-288-12	LOT46	1300p	23236198	LOT288	1400p
29201.022.04	LOT165	1350p	2432101-2	LOT79	1600p	DCF1577	LOT273	1700p	4822 140 10369	LOT109	1200p	1-439-289-00	LOT47	1400p	23236255	LOT289	1500p
29201.022.04A	LOT165	1350p	2433451H	LOT81	1350p	DCF2077A	LOT272	1300p	4822 140 10381	LOT128	1300p	1-439-289-21	LOT47	1400p	23236424	LOT288	1400p
29201.024.01	LOT65	1500p	2433453H	LOT82	1250p	KFS 60226B	LOT279	1550p	4822 140 10384	LOT127	1550p	1-439-289-22	LOT47	1400p	23236428	LOT289	1500p
29201.024.04	LOT164	1400p	2433891H	LOT23	1400p	MSH-1FBW08	LOT78	1500p	4822 140 10395	LOT116	1600p	1-439-291-00	LOT47	1400p	3122113837011	LOT131	1450p
HINARI			2433892G	LOT84	1450p	NIKKAI			4822 140 10406	LOT73	1150p	1-439-294-11	LOT93	1450p	150F6D	LOT131	1450p
154 138 K	LOT24	1500p	I.T.T.			BABY10	LOT67	1450p	4822 140 10421	LOT169	1200p	1-439-303-00	LOT93	1450p	TFB 4039 AD	LOT281	1300p
51 13914 K	LOT24	1500p		LOT113	1400p	ORION	LOT02	1500p	4822 140 10421	LOT103	1250p	1-439-303-11	LOT94	1300p	TFB 4048 AD	LOT281	1300p
51 14184 I	LOT24																

HELP WANTED

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

Wanted: A Panasonic NV430 VCR, also a TDA5651 IC. Peter Ward, Petgra, Forest Corner, Ringwood, Hants BH24 3JW. 01425 475 445.

Wanted: Name, address and phone/fax number for a UK distributor of spares for Gelhard products, believed to be of German manufacture. Eddie Cox 01489 782 885 (phone/fax).

Wanted: Information/spares to rectify white video dropouts present before and after head replacement with a Sony SLC9 Beta VCR. Also, can anyone help identify a GoldStar VHS VCR model badged as the Susumi XR1. Alan Stubbings, 7 Church Road, Saxilby, Lincoln LN1 2HH. 01522 702 601 (evenings/weekends), 01522 583 373 (daytime).

Wanted: Service manual/circuit diagram for the Shivaki TV/VCR Model VT14, also a tuner. Am trying to convert this unit to PAL I format. Robert Crawford, 44 Castle Park Drive, Fairlie, Ayrshire KA29 0DG. 01413 327 777.

Wanted: Three video boards and one logic board for the Sony VO2630 U-Matic VCR; a Sony SLC30 Beta VCR; and a Sanyo VTC-M3 Beta VCR, Japanese home market version, or circuit diagram in English for this. N.D. Wenham, 17 Sheringham Court, Swindon, Wilts SN3 6HJ. 01793 526 744.

Wanted: Chopper transformer for the Zanussi Model 22ZT505 or complete power supply panel. G.R. Goldsmith, 2 Stanley Close, Verwood, Dorset BH31 6EX. 01201 824 398.

Wanted: Working power supply PCB (in good condition) for the Amstrad SRD500 satellite receiver. Also copies of *Television* for January to December 1994. John Whittle, 12 Manet Square, Fairlands, Bognor Regis, Sussex PO22 9BC.

Wanted: Lower head drum motor for the Sony SLO1700 industrial

Betamax VCR, or information on a source of supply for this item. P.R. Marshall, MVS Video Productions, Rehoboth, Alkham Valley Road, Folkstone, Kent CT18 7EH. 01303 891 468.

Wanted: DC-to-DC converter for the Sony Betamax C9 VCR, or a fully-working C9 with handset! Also interested in servicing/repair manuals for any or all Betamax machines (photocopies would do). Lee Lewis, Glanhwy House, Park Place, Tredegar, Gwent NP2 4LD. 01495 722 446 (evenings) or e-mail l.lewis@rocketmail.com.uk

Wanted: Service manual for the Mitsubishi Model CT3701TX. J.H. Roberts, Roughlee, Bull Bay, Anglesey LL68 4DF. 01407 832 229.

Wanted: 22in. TV set fitted with the Ferguson TX100 chassis, working or not. Can collect in the S. London/Surrey area. Paul Farnfield, 24 Hillside Road, Ashted KT21 1RX. 01372 275 351.

Wanted: Circuit diagram/service manual, copy or loan, for the Philips PM3212R 0-25MHz oscilloscope. F. Bathurst, 75 Lisher Road, Lancing, Sussex BN15 9EY. 01903 752 163.

Wanted: IC type TLP581Y (IC602) for the Sony Model KV27XRTU or a complete power supply board. Colin Tooze, 8 Pear Tree Close, Bell Green, Coventry CV2 1JL. 01203 685 085.

Wanted: Remote control and tele-text (Fastext) board 1637-001, using an MAB8461 chip (IC1806), for the Ferguson TX100 chassis. Also front control flap for the same TV (Model 59G3). R. Walton, Rogers Television Service, 44 Johnson Street, Cleethorpes, NE Lincs DN35 7NA. 01472 362 071.

Wanted: Secam board 6911-19-35, PAL board 6911-29-02 and text decoder board 6911-19-54/82 for the ITT Compact 80 chassis. Also any information on upgrading the Philips CTU900 D2-MAC decoder for a better picture. I. Mackintosh

(Mac), 7 Wellington Court, Trearddur Bay, Holyhead LL65 2LJ. 01407 860 864.

Wanted: JVC HRD660/540/520 or Ferguson FV37H or similar VCR with VPT facility: timer-display, syscon and PSU must be working. Ian Jackson, Flat 6, The Grange, 5 Harlow Oval, Harrogate HG2 0DS. 01423 508 197.

Wanted: Can anyone suggest alternatives for the Y1044 (SCR1) and Y1043 (SCR2) thyristors used in the early version (PC1001) of the Ferguson TX9 chassis. Also require a TDA1035T sound chip (IC53). Roy Bailey, 22 Grebe Close, Waterlooville, Hants PO8 9UT. 01705 783 811.

For disposal: ITT CVC40 type TV for spares or repair; Ferguson 9653 TV for spares or repair plus box of 9600 series panels; Ferguson 24in. 1500 chassis set in working order but tube rather soft; two mechanical tuners for the Ferguson 1500 chassis; about 30 elliptical TV speakers, various sizes, ex-equipment. Token payment please and prospective owner(s) to collect. M.K. Hayter, 24A St. Albans Road, Moseley, Birmingham B13 9AS. 0121 449 5508.

Wanted: SBX-M904A IT055 control module for the JVC Model CS2180EK. Also a chopper transformer for the Hitachi Model CPT2508 (G7P chassis). Good salvaged components OK. R. Waller, 25 Laceby Close, Bramley, Rotherham, S. Yorkshire S66 0YF. 01709 544 079.

Wanted: Service manual and operator's manual for the Philips PM3211 oscilloscope, photocopy OK. J. Southwell, Aquarius Electronics, 125 Honeysuckle Road, Bassett, Southampton, Hants S016 3BT. 01703 396 567.

Wanted: Circuit diagram or service information for the Orla Prestige Electronic Organ. Donald McIntosh, 11F Colonsay Terrace, Soroba, Oban, Argyll PA34 4YN. 01631 563 337.



Reports from
Pete Gurney, LCGI
Stephen Leatherbarrow
Bob McClenning
V.W. Cox
Brian Storm
Michael J. Cousins
Michael Dranfield
P.J. Roberts and
Chris Watton

JVC HRD820

The original fault had been no play-back picture. So someone had fitted new heads. This hadn't cured the fault and in addition there was now no colour with prerecorded tapes. The colour problem was the easiest one to deal with – the heads had been fitted 180° out. These drums have an index hole in both the head and the lower cylinder boss. They don't align next to each other. If in doubt, look at the mounting surface when the head is removed: there is usually a ring of dust where the index hole had been.

I was now back to square one, with what admittedly looked like a head problem at first glance. The picture sometimes returned however, and when it did the head switching varied between its correct point and somewhere half way up the picture. I've had similar problems before, caused by the lower drum – specifically C6, which is a 3.3µF surface-mounted capacitor. A dose of freezer proved its guilt. Once a replacement had been fitted and the head switching had been set up the machine produced a good picture.

Note that the lower drum drive PCB is common to quite a few JVC Models. P.G.

Alba VTV10

This little TV/VCR combination kept on trying to load a tape that wasn't there, then shut down. It looked like a mode switch problem,

VCR Clinic

which is becoming increasingly common with the type of deck this model uses. As the deck is not the easiest to work on without an extension lead set I replaced the mode switch on spec. No luck. After a lot of searching about I eventually discovered that there was an end-stop sensor fault – no illumination because of a hairline crack around the IR-emitting diode D01. Resoldering cured the problem.

Note that any faults which result in deck shut down will also switch the TV to standby.

I've also had several loading motors go open- or short-circuit, with the result that the TV switches off after ten seconds or so because the deck is unable to initialise. The same deck is used in the Matsui VX735A/Saisho VR3300 and related models. P.G.

Sharp VCH841

This machine came in several times over a period of a month or so with the complaint that it would shut down, refuse to respond to the controls and trap a cassette inside. But each time it appeared in the workshop it would reset then work faultlessly.

Clutching at straws, I replaced the mode switch. This made no difference. Eventually the machine came to a complete halt: the cause was immediately traced to a seized capstan motor. A strip down and clean cured the problem. P.G.

Ferguson FV82

This dead machine had no functions or clock display. There were no shorts or obvious open-circuits in the power supply, so I decided to check the two electrolytics on the primary side. As is so often the case, the cause of the problem lay here. CP007 (10µF, 50V) had gone very low in value. I decided to replace CP008 (100µF, 25V) for good measure. Capacitors rated at 105°C were used. They are asso-

ciated with pins 9 and 11 respectively of the power supply chip IP001 (U4616B). S.L.

Baird 8940/JVC HR7350

Following a service this venerable machine produced no E-E or play-back sound. After checking for any obvious switch position sillies I traced the audio output from the IF strip to the AN6394 chip IC2. The signal was present here but got no farther because this chip's supply at pin 14 was missing. It's derived from Q11 (2SC2673). There was no 11V supply at its emitter because of an open-circuit junction. S.L.

Hitachi VTF860E

This VCR failed to start up after disconnection from the mains supply. I found that C6 (1µF, 250V) which supplies the kick-start to Q1 in the power supply was low in value. B.McC.

Grundig VS510

If the machine is dead with the solenoid clicking, replace C1325 (1µF) in the start-up circuit. B.McC.

Aiwa FX1500

There were no record problems but occasionally the playback disappeared, as though the head amplifiers had failed. The fault would come and go with the slightest movement but, despite this, the cause was tricky to find. There are some straggling wired-on extras close to the LA7449 video processor chip. One, a resistor, was only in contact and had never been soldered. V.W.C.

Panasonic NVHD605

This machine would accept a tape then go straight into the rewind mode. Apart from tape ejection that's all it would do. Suspecting a faulty end sensor I removed the main PCB and found that the 0.1µF capacitor fitted across the end-sen-

sor transistor Q6003 was leaky. **B.S.**

Panasonic NVFS90

This S-VHS machine's E-E pictures were over-white and distorted. Oscilloscope checks brought me to the ceramic module IC303, which had become damaged by capacitor leakage. A new module, part no. VCR0389, cleared the fault. **B.S.**

Panasonic NVHD650

This machine produced neither menus nor a test signal. When a tape was inserted F05 was displayed, indicating loss of reel drive. The 2SD1996STTA 5V regulator transistor Q1002 in the power supply had failed. A replacement restored the missing functions. **B.S.**

Panasonic NVHS1000

This machine was completely dead. There was no display – nothing at all. Fearing extensive component failure in the power supply, I gloomily removed the module. Fortunately all that had failed was the 2SD1996STTA transistor Q1102 in the 5V regulator circuit. **B.S.**

Ferguson FV67/77HV

This Nicam VCR was dead, with no display and no functions. Power supply checks revealed that the voltages on the secondary side of the circuit were very low. So the capacitors on the primary side were checked. CP11 in the start-up supply to the chip, IP01, was low in value at 90 μ F instead of 220 μ F. A replacement restored normal operation. **M.J.C.**

Daewoo DVR5172P

This machine wouldn't come out of standby. As the 5V supply to the microcontroller chip was OK I checked the power control pin 41, which was stuck high – it should go low at switch on. The 12MHz clock (pins 31-32) was running, but a check at the reset pin 29 produced a low-voltage reading of 2.5V instead of 5V. Replacing the three-pin reset chip IC603 made no difference however.

This left only two items that could be faulty, either the microcontroller chip itself or C515 (10nF) which decouples its reset pin. C515, which is a small brown disc capacitor, turned out to have a 1.6k Ω leak. **M.Dr.**

Samsung VI621

This machine wouldn't switch on. The clock was OK, but pressing the power button did nothing. As a first

step I removed the front panel – a stuck-down button can cause this fault. Not this time however. The cause was R7 (1.5k Ω), which was open-circuit. It's in the power supply and is part of the power control circuit. **M.Dr.**

Ferguson FV10

There was low playback sound. The E-E sound was also low, though it was OK via the scart socket. Checks revealed that the modulator was at fault: the 0.1 μ F non-polarised audio coupling electrolytic capacitor C3 had failed. **M.Dr.**

Panasonic NVG10

There was a chroma fault – the symptom varied between flashing colours and no colour. Luckily I remembered a similar fault we'd had with a Matsui VCR. The item to replace is C2 (100 μ F, 35V) in the power supply. It's next to the power regulator chip on the main board – no wonder it dries out. **M.Dr.**

Aiwa HVGX350

This VCR wouldn't play tapes. While testing it on the bench I noticed that it would occasionally lock up. After this it would work only when the mains supply had been disconnected then reconnected. As the cause of the trouble seemed to be a reset fault, I replaced the KIA7033P reset chip IC504. The machine then worked normally.

Next day it failed again. This time the machine was dead with no outputs from the power supply. The fuse was intact, and there was 320V across the mains bridge rectifier's reservoir capacitor and at pin 7 of the chopper transformer. A scope check on the drive waveform at the gate of the chopper transistor FEP01 showed that its frequency was very low (50Hz). At this point I noticed a very fine break in the PCB track between RP04 (0.47 Ω) and FEP01. Once this had been repaired the machine sprang back to life. After a good soak test it was returned to the customer. **P.J.R.**

Aiwa VXT1420

This tele-video wouldn't play tapes. I stripped the unit down and noticed that once a tape had been threaded up the machine would shuffle it back and forth then eject it – I was using a prerecorded tape. While this was going on the drum and the capstan rotated. So a new mode switch was fitted and the deck alignments were checked. This failed to cure the problem.

The power supplies and reset etc. were next checked and found to be OK, and replacing the reel sensor made no difference. As the syscon chip's drum, capstan and reel sensor inputs were fine, the chip itself (IC1001) seemed to be the culprit. When a replacement (part no. SE-C90-28B-8BO, type OEC6025A) was obtained and fitted the machine worked normally. **P.J.R.**

Amstrad TVR2

The VCR section appeared to be stuck in the forward search mode, but was actually in the play mode with the capstan motor running too fast. A check showed that there was no capstan motor FG signal at pin 1 of connector CL-FG on the main PCB. There should be a 250Hz (approximately) sinewave at about 0.5V p-p here. As a new motor is expensive, I prised the lid off and checked the coil. The enamelled wire inside wasn't connected, so a repair was possible. **C.W.**

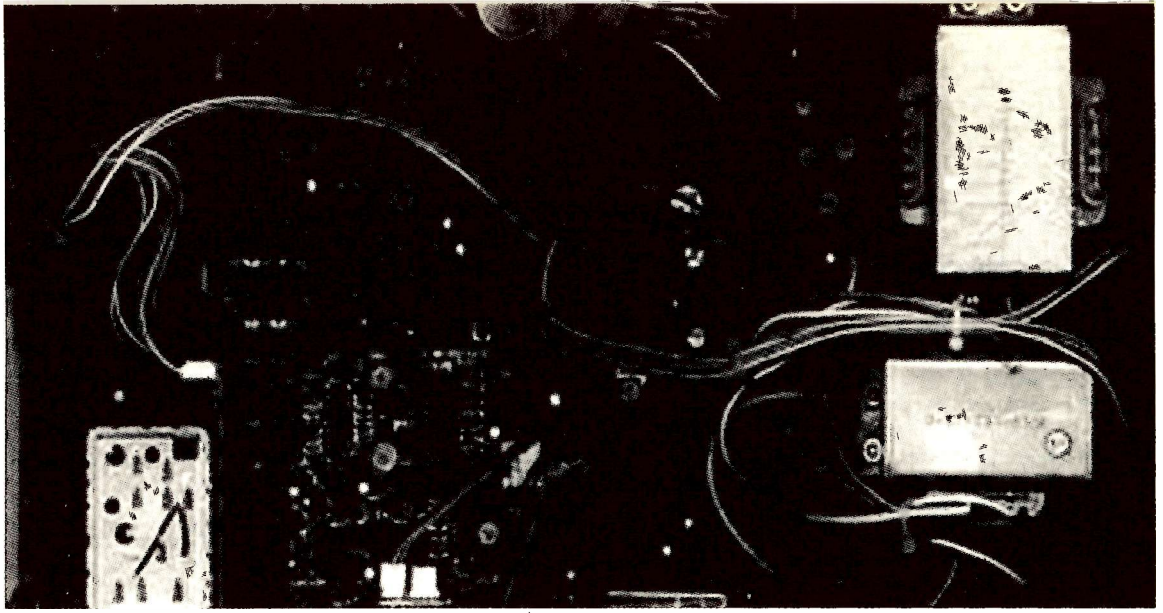
Ferguson FV30

"Can't set the clock" was the complaint with this elderly VCR. All other functions were fine, and the playback picture and sound were good. They don't make them like that now! The cause of the fault was glue beneath the tuner/timer PCB, where a disc capacitor is fixed to the foil side. Correct operation was restored when the glue had been removed. Manufacturers should surely know about the effects of this type of glue, so why do they still use it? Who knows?! **C.W.**

Panasonic NVJ40

The card said that this machine was dead. In fact it came on for about a minute, and during this time a tape could be played. There was no picture however, though the sound was all right. The E-E picture was also OK. I noticed that the drum was running slowly, and when I tried the machine again the E-E picture was covered with swirling lines of white dots. Then the machine went dead.

The power supply seemed to be the obvious place to look. C1110 (10 μ F, 400V) and C1127 (330 μ F, 10V) were both found to be low in value. After replacing them the machine seemed to work all right, but further checks revealed that C1131 (330 μ F), C1126 (10 μ F) and C1125 (680 μ F) were faulty – they all read about half the correct value. After replacing them I put the machine on test for a day. The symptoms had all been cured. **C.W.**



Satellite Notebook

Reports from
Alan J. Roberts
John C. Priest
Hugh Cocks and
Michael Dranfield

Philips STU3601

The customer complained about this receiver's poor pictures. It was only about a year old. On test I found that after several hours the picture started to develop a jitter and shadows appeared. Tapping anywhere produced interference.

Resoldering dry-joints in the power supply didn't seem to make much difference. It looked like a modulator fault, which was confirmed by the fact that reception via the scart socket was OK. So I removed the modulator and had a look inside. There was an earthing plate that had cracked solder at one end. After resoldering this and some other suspicious-looking joints I replaced the modulator and gave the receiver a long soak test. Everything was now OK. **A.J.R.**

Pace PRD800+

If the channel number and identification displays tear and appear for only a couple of seconds at channel change, and the menu graphics tear and go off after a second menu, suspect the sync separator transistors Q23, Q24 and Q25. In the most recent case Q25 (ZTX314) was leaky. **J.C.P.**

SVA1 Sky Decoder

The problem with this unit was intermittent decoding. While checking around the power supply I noticed that, judging by their condition, the two presets had already been twiddled (sorry, adjusted!). PP02 fell to bits when I tried to set it up for 5V at TP01. Replacing them both restored normal operation. For good measure I also replaced the two large electrolytics CP01 and CP03 as they were rather discoloured.

The decoder had been installed in a cabinet with little room for ventilation – a sure way to get trouble! **H.C.**

Dish Sharing

A number of our customers share a dish. Installation is usually no problem, but difficulties can arise with horizontal/vertical polarisation switching – more often than not a Pace SS9000/9200 receiver is the cause of the trouble.

The situation is as follows: the two receivers work fine when they are both operating with vertically-polarised signals, but when one receiver selects the higher 17-18V horizontal-polarisation voltage the other one won't receive the vertically-polarised channels. If the vertical/horizontal selection is reversed however the results are as they should be. The receivers generally share a twin-output LNB, and are not connected to a 'magic switch'.

The cause of the trouble is that the higher horizontal-polarisation voltage from one receiver results in loss of vertical-polarisation reception by the other one. The cure is simple enough: insert two silicon diodes in series in the offending receiver's feed to the LNB. This will reduce the supply by just over 1V: normal operation should then be resumed.

After doing this, check all permutations and combinations of channels with both receivers. Make sure that the horizontal-polarisation voltage from the modified receiver is about 17V.

With SS9000/9200 receivers the easiest way to add the two diodes is to cut link LK210, which is adjacent to crystal X7 near the front of the board, and fit them here with

their cathodes pointing towards the tuner assembly. Note that fitting them here will reduce both the horizontal- and vertical-polarisation supplies, though I've never found that this affects the vertical-polarisation performance. You could however fit the diodes in series with the supply to Q3, reducing only the horizontal-polarisation supply.

The problem can come and go with LNB temperature variation. If the problem returns in the evening, a third diode can be added. I had to do this recently with an SS9200 that was paired with a Bang and Olufsen satellite receiver.

In another recent case a Pace SS9000 and an SS9200 shared the dish, the source of the problem being the SS9000 receiver. Two diodes in series put things right.

The effect doesn't, in my experience anyway, show up with multiple receiver IF distribution systems. In this case the problem is more often lack of the horizontally-polarised channels. What usually happens is that only one receiver is in operation, the LNB is a 'twin' type (with horizontal and vertical output at each socket) and the magic switch fails to provide approximately 17V at its horizontal output to make the LNB switch over. It's much better to use a 'dual' type LNB (with the horizontal-polarisation supply at one socket and the vertical-polarisation supply at the other). It then doesn't matter, within reason, what voltage is passed to the LNB from the magic switch. The receiver will generally provide enough voltage to make the switch select the horizontal signals.

With a large IF system, it's better to install a DC power injector so that the LNB is powered indepen-

dently. This avoids trouble – some older receivers don't like to supply too much LNB current.

When installing a new receiver and an older one together we sometimes use the original 10GHz LNB oscillator frequency. The older receiver can then be used in the normal way, the new Pace receiver being used to tune down to 700MHz to provide Astra 1D reception. Sometimes Channel 5 is a requirement with the older receiver. In this case the LNB's local oscillator is adjusted to give Channel 5 at an IF of around 955MHz, Sky Sports 3 appearing at around 1,700MHz.

With the IF shifted by some 30MHz and the local oscillator frequency at about 9.97GHz, I assumed that it would be simple to key this frequency in the new Pace receiver's LNB oscillator frequency selection menu. But life isn't that simple, because in the 'variable-frequency mode' the receiver's tuner won't go below 950MHz. The answer to this is to keep the receiver set to the 10GHz oscillator frequency and increase each channel frequency by some 30MHz. This sounds like a lot of work, but I keep 'offset-frequency files' for the purpose in the memory of my Pacelink receiver PC tuning system, so immediate downloading of the channel-frequency information is available.

With a multiple-receiver system and distribution via a magic switch, the 700-950MHz IF may not be passed by the switch. So keep to a standard 9.75GHz enhanced LNB. If an older receiver is connected, use a frequency extender to convert the 1,750-2,000MHz IF so that it is within the receiver's tuning range. **H.C.**

Pace PRD800

Reception of the horizontally-polarised channels was intermittent, together with some patterning. The 18V supply's reservoir capacitor C23 (2,200µF) was open-circuit and bulging. **H.C.**

Digital Upgrade

The Dutch digital package via Astra has been available for more than a year now. Not so long since the national terrestrial Netherlands 1, 2 and 3 channels were added, also a "summer TV" channel aimed at Dutch expatriates and holiday-makers around Europe. A Pace DVR500 is generally used for reception, but strangely enough its on-screen menus and subscription

messages are all in English.

While at a customer's house recently I checked the "software upgrade" message box and saw that one is available. On-screen advice told me that it would take eleven minutes to complete and asked me whether I wanted to continue – it didn't however say what the nature of the upgrade was. As the customer was keen to see what it was, 'OK' was pressed to start the upgrade procedure.

The receiver then turned off its video output, and the display at the front went repeatedly from 1 through to 7, accompanied by a circular movement beside the number (this is similar to the default frequency search display but is more rapid).

True to its word, after exactly eleven minutes the receiver went back to the standby mode. When it was switched back on the channels reappeared, though in a different order to that prior to the upgrade (they are easily set in the preferred order however). But the main change was that the menus and on-screen messages were now all in Dutch, while the main menu had had a Canal Plus logo added to it. This used to be Filmnet in the Benelux and Scandinavian areas, but they have now merged. Receiver operation is otherwise exactly as before.

It was always odd that the DVR500 didn't have a Dutch menu option – the Italian version has English/Italian switchable language facilities. **H.C.**

Shift from 601

BBC TV Prime and its predecessors have in the past been available via Intelsat 601 at 27.5°W. This satellite is now ending transmissions, but BBC Prime in MAC continues via Intelsat 707 at 1°W – frequency around 11.67GHz, with horizontal polarisation. A new MAC-D2 viewing card is being issued, by a Norwegian company. It allows only those viewers outside Scandinavia to receive BBC Prime.

A lot of old, fixed dishes were in use for 27.5°W reception. It has sometimes been quite a battle to persuade a rather corroded 1.8m dish support structure to move around to the new position. In some cases the ancient coaxial cable, which was quite happy coping with the relatively low (approximately 1GHz) IF from the old satellite, fails miserably with the new IF at just under 1.7GHz (assuming that the original 10GHz local oscillator

LNB is still in use). The highest IF that this cable would previously have been required to handle would have been CNN at around 1.15GHz. CNN left Ku band via 601 when it moved to Astra back in 1991 (it's still available in C band at 27.5°W however). So it's essential to take new coaxial cable along to these jobs – plus plenty of WD40 to free the dish support! **H.C.**

BT SVS300

Poor video with rolling was the complaint with one of these receivers. I found that the pictures from the video and decoder scart sockets were OK, but the picture from the TV scart socket was bad. The cause was C207 (0.47µF, 50V), which had dried up. It couples the video input to the on-screen display chip. **M.Dr.**

Pace SS9000

At power up the standby and stereo lights came on together. Apart from this the receiver remained lifeless. Checks at the microcontroller chip's clock and data pins 15 and 38 revealed that they were both at 0V. As a first step the chip's reset capacitor C146 (1µF) was replaced, but this made no difference. The 5.62MHz clock (pins 2 and 3) was OK, and there was 5V at pin 1. The next step was to disconnect the clock and data lines. Disconnecting the clock line brought back some activity, and the disconnected data line was found to be at 5V. The culprit was in fact the Z86E21 microcontroller chip U4.

I feel that the repair kits for these receivers are becoming a bit of a waste of money. To do a quality repair, you need twice as many capacitors as are included in the kits. When we repair one of these receivers we replace all the electrolytic capacitors on the primary and secondary sides of the power supply plus a handful around the tuner. Cost is not a problem when you get your electrolytics from Farnell Electronic Components in Leeds (01132 636 311) who do a bulk discount on a hundred 10µF, 105°C capacitors made by Panasonic. In general we use 105°C electrolytics for replacement purposes. To improve reliability, we replace both the electrolytics associated with the Pace satellite tuner: in the 2.2µF position we use a solid aluminium type rated at 125°C, Farnell part no. 577-406; for the 47µF subminiature type we use Farnell part no. 490-738 which is rated at 105°C. **M.Dr.**

Thomson TX805 Technology

The Thomson TX805 small-screen TV chassis is used in Ferguson and Goodmans models. J. LeJeune takes a look at the technology and circuitry employed

The Thomson TX805 chassis is used in the Ferguson Models D14R and T14R, also the Goodmans Model 1410. It has similarities to the older, successful TX80, and follows that design in having a 'hot' chassis and a combined line output/chopper power supply of the Wessel type. The tuner therefore has an isolated aerial socket.

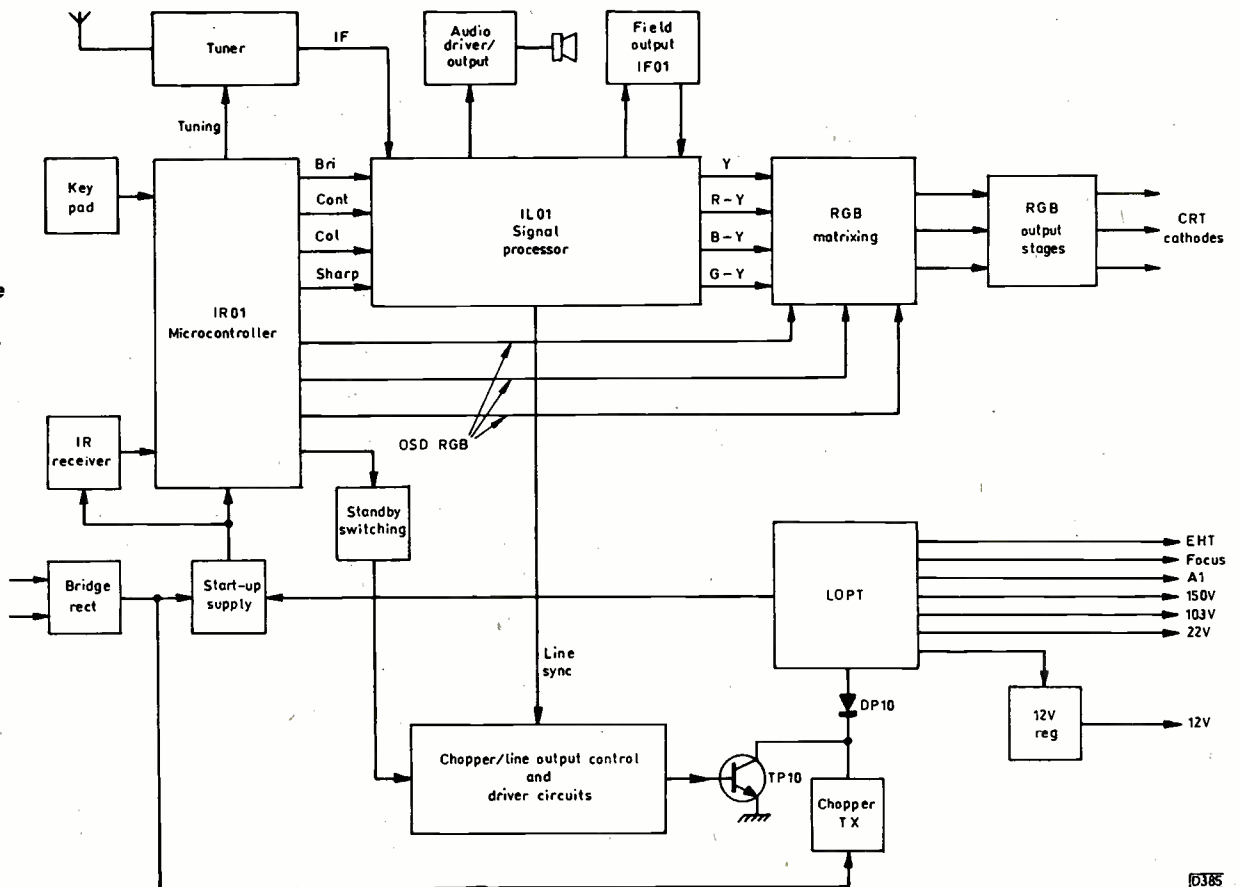
Much of the circuitry is contained in two large ICs, the TMP47C834-47C634 microcontroller IR01 and the M52038-SP (PAL) signal processor chip IL01. The latter incorporates the IF strip, the colour decoder and the sync and field timebase generator sections. It provides luminance and colour-difference outputs which are matrixed externally to produce RGB signals to drive the output stages on the CRT base panel. There's a discrete component audio driver/output stage, while for field output an LA7830 chip (IF01) is used. Fig. 1 shows a block diagram of the chassis.

The Tuner

We'll begin with the tuner, which is a Thomson type MTP-BG-2024. A block diagram is shown in Fig. 2. The original version has a VHF section, which is omitted for UK sets. There are four stages, starting with a BF998 MOSFET RF amplifier. The input to this is fairly broadband: there's bandpass tuning in its output circuit, using varicap diodes. The following mixer stage is based on an earthed-base transistor, with the local oscillator and UHF input signals both being applied to its emitter circuit. Earthed-base operation is also used in the local oscillator stage, with feedback from a capacitive tap across the oscillator coil. The mixer transistor's collector feeds a bottom-coupled bandpass filter. This is followed by an emitter-follower buffer stage (TH93).

The tuner uses a voltage swing of 0.5-30V to cover the

Fig. 1: Block diagram of the Thomson TX805 chassis.



range 470-860MHz. It's a variant of the tuner used in the Thomson IKC2 chassis.

The IF Strip

The tuner's IF output is fed to a SAWF driver transistor, TI02 (BF959), which uses selective feedback in its emitter circuit to provide frequency compensation. The SAWF, QI01, provides a balanced output which is fed to pins 8 and 9 of the signal processing chip IL01, see Fig. 3.

Within the IC a differential amplifier converts the signal to the normal unbalanced state. This is followed by a gain-controlled (AGC) amplifier then a linear amplifier, after which the signal is at a suitable level for application to the

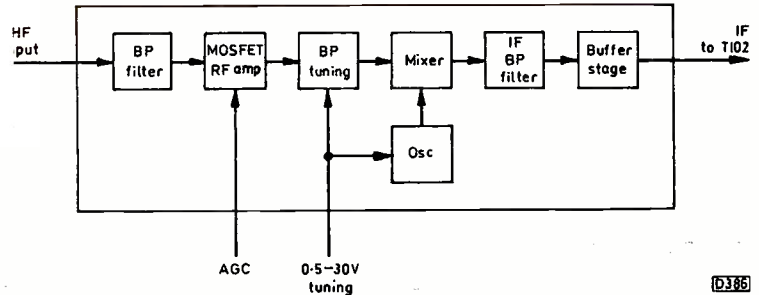


Fig. 2: Block diagram of the tuner.

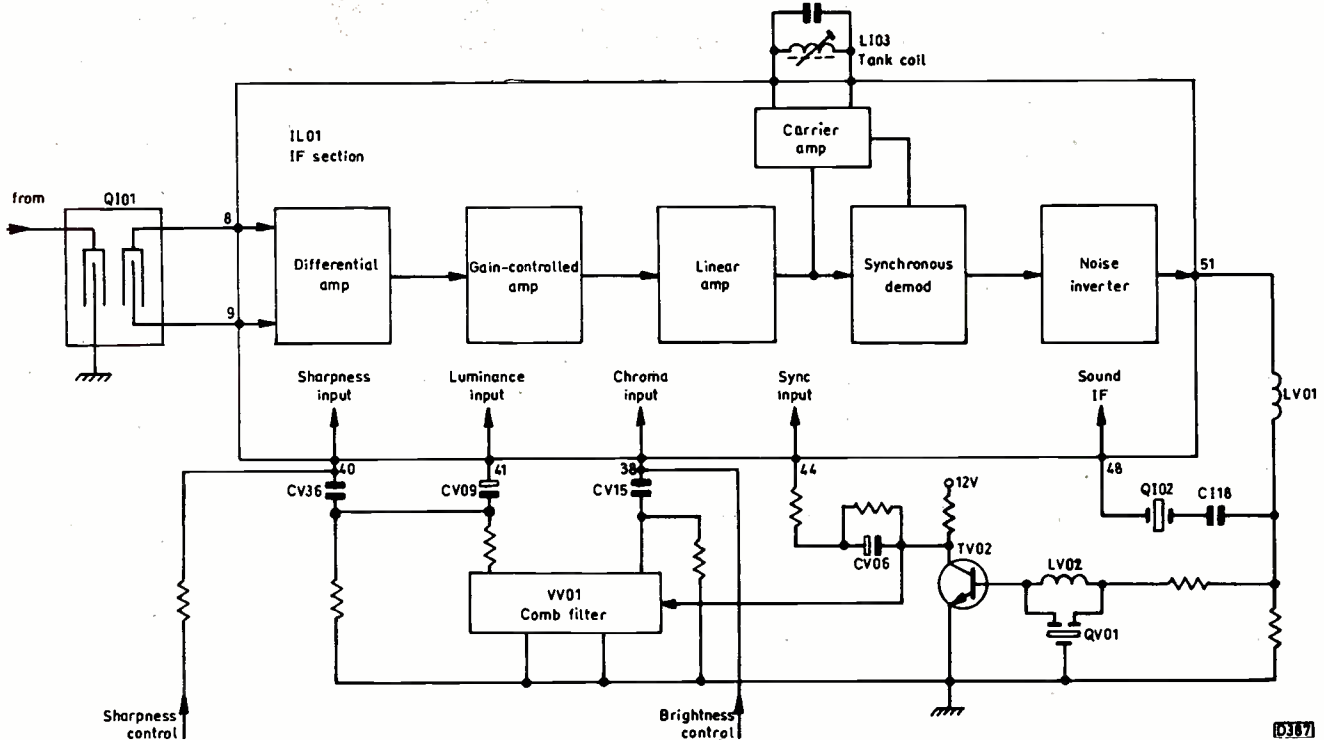


Fig. 3: Block diagram of the IF section of the signal processor chip IL01.

synchronous demodulator. Demodulation of this type is basically a switching process: the signal is sampled at the IF carrier peaks to extract the video information. The demodulator therefore requires a second, switching input. For this purpose the IF carrier drives a 'tank' coil, LI03, which produces a pure sine wave at the carrier frequency. LI03 should normally be left well alone: if adjustment is needed, it should be done using a good oscilloscope to observe the sharpness of the video transients at pin 51 of IL01.

The IC produces, at pin 52, a negative-going AGC voltage for the MOSFET RF amplifier transistor in the tuner. This is effective up to high-level inputs. The internal AGC system is of the forward type and can be monitored at pin 5 which is connected to the filter capacitor CI07.

The demodulated output at pin 51 of IL01 is filtered by LV01. It also contains the 6MHz FM sound signal. The latter is fed via CI18 to the 6MHz ceramic filter QI02, re-entering the chip at pin 48.

Luminance Signal Processing

The video component of the signal is fed via filter QV01/LV02 (to remove the 6MHz signal) to TV04 which drives the comb filter VV01. This separates the luminance and chrominance components of the video signal, providing separate feeds to pins 38 (chroma) and 41 (luminance) of

IL01. VV01 also provides the luminance signal delay required.

The first process when the luminance signal re-enters IL01 is sharpness control. For this purpose an HF filter (CV36 and RV41) provides a second input at pin 40. The arrangement is shown in Fig. 4. It involves three voltage-controlled amplifiers. Amplifier A receives the full bandwidth luminance signal, amplifier B a signal with reduced HF content and amplifier C the HF input at pin 40. This pin also receives the DC sharpness control voltage, which is obtained from pin 6 of the microcontroller chip IR01. The outputs from the three amplifiers are added then fed to the following contrast control stage. The gain-control characteristics of the three amplifiers are tailored to provide a smooth transition from a 'soft' picture to a sharp, somewhat overshoot one, over the range of the electronic sharpness control.

Sharpness control is followed by contrast control then brightness control. A simple video amplifier whose gain is controlled by the DC voltage applied to pin 36 of IL01 is used for contrast control. Brightness is controlled by adjusting the clamp potential on which the video signal sits - the clamp reservoir capacitor is connected to pin 39, while the DC brightness control voltage is applied to pin 38. Note that pins 36 and 38 both serve two purposes: pin 36 is also used

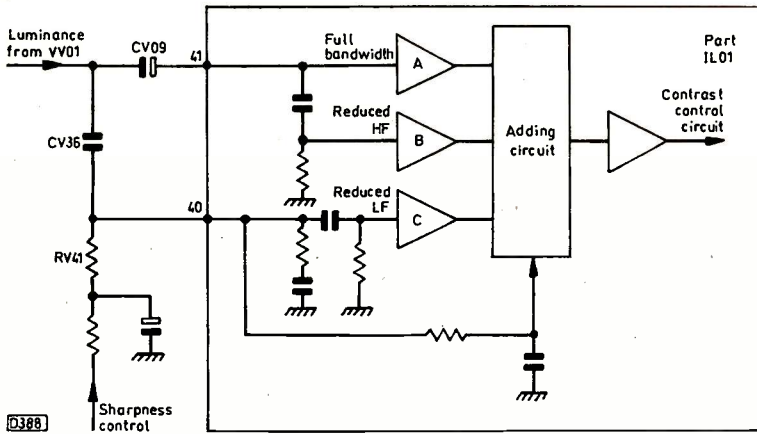


Fig. 4: The sharpness control arrangement.

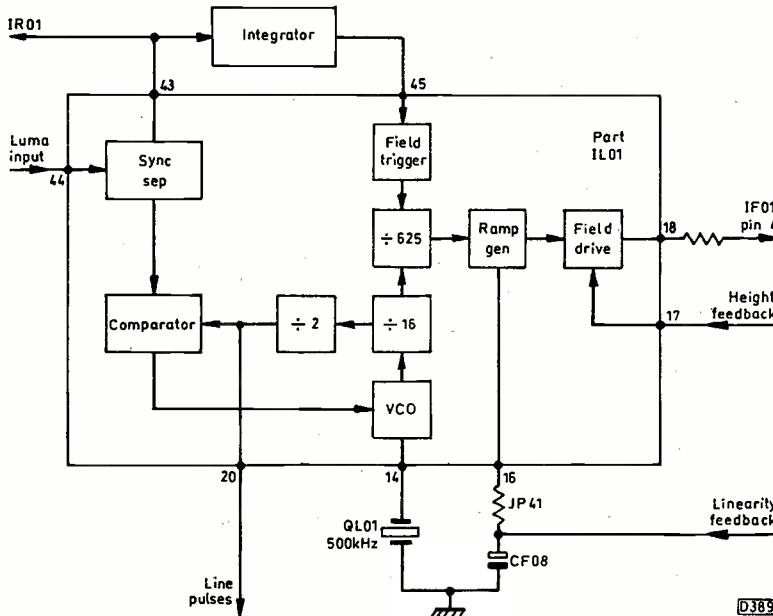


Fig. 5: Block diagram of the sync/timebase generator section of IL01.

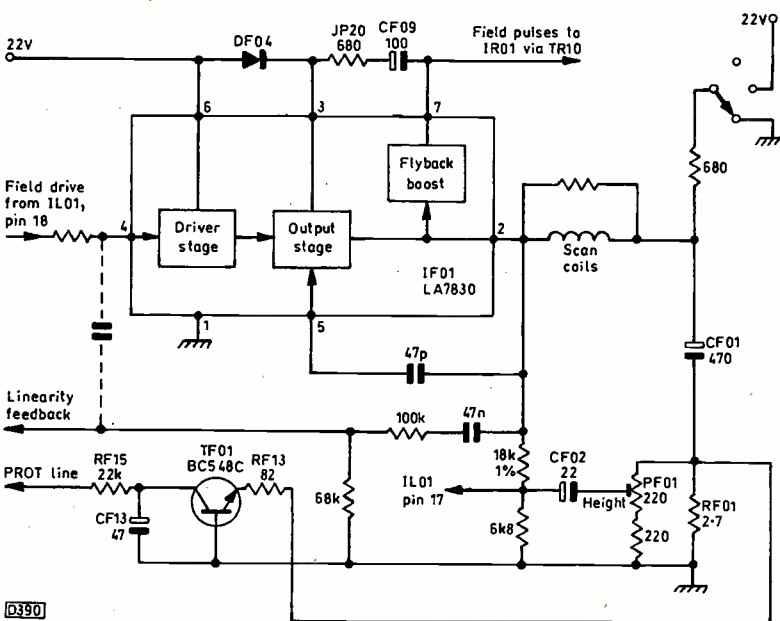


Fig. 6: The field output stage.

for the burst filter while pin 38 is also the chroma input pin. The IC's 'official' brightness control pin is pin 42: beam current limiting is applied here, also to the contrast control pin.

The luminance signal is finally fed via an open-emitter buffer stage to output pin 22 – by open-emitter we mean that the emitter load resistor is an external component, RV25. There is also a further, external emitter-follower buffer transistor here, TV05, which provides current amplification and impedance matching to the RGB matrixing stages. On-screen display (OSD) blanking is also applied to the base of TV05, to insert a rectangular black box for the graphics. The OSD blanking originates at pin 25 of the microcontroller chip, and is shaped by the circuitry around TR02 and TR13 to enhance the edge sharpness.

Colour Decoding

IL01 also incorporates the PAL colour decoder, which operates in the conventional manner. The chroma input is at pin 38. Pin 34 provides an output to the chroma delay line circuit which in turn provides R – Y and B – Y inputs at pins 27 and 28 respectively. The 4-433MHz crystal is connected to pin 32.

The only slightly unusual thing here is the origin of the pulses for the ident switch. They are obtained from the heater winding on the line output transformer and fed via CP61 (1µF) and RP46 (39kΩ) to pin 26, where they are fed to a flip-flop circuit.

More IL01 Functions

IL01 also contains the 6MHz FM sound detector, volume control and audio preamplifiers stages, with output at pin 4, and the sync and field timebase generator system, see Fig. 5.

The heart of the sync and field timebase generator section is a voltage-controlled 500kHz crystal oscillator – the crystal is connected to pin 14. Division by 16 then 2 provides line-frequency (15.625kHz) pulses at pin 20. We will see how these are used when we come to the Wessel circuitry. The sync separator receives a video input from the collector of TV04 at pin 44. It provides a sync pulse output to the field sync integrator at pin 43 and in addition feeds pulses to the comparator stage. This also receives the line-frequency pulses, generating an output to control the VCO. In the absence of a video input at pin 44 the receiver will free-run at frequencies very close to normal. The sync output at pin 43 is also fed to pin 36 of the microcontroller chip to control the OSD.

The integrated field sync pulses return to IL01 at pin 45, where they are applied to a trigger circuit which resets a divide-by-625 counter. This in turn restarts a ramp generator connected to pin 16. CF08 is charged via JP41 from an internal current source to produce the ramp. Linearity feedback from the field output stage is applied to the junction of CF08 and JP41. The linear ramp is fed to a driver stage which also receives feedback for height control at pin 17. The field drive output appears at pin 18.

The Field Output Stage

An LA7830 chip is used in the field output stage. As usual with such devices, it contains a drive amplifier, an output stage and a flyback boost circuit – see Fig. 6. A 22V supply that's derived from the line output transformer is fed to pin 6. This is inadequate to produce the flyback, hence the boost circuit which operates as follows, see Fig. 7.

A pulse drive is applied to the bases of transistors Qf and Qs. During the scan period Qs is held conductive and boost capacitor C charges via D from the 22V rail. During the flyback period Qf is switched on and Qs switches off. The 22V supply thus appears at the negative plate of capacitor C,

which retains its 22V charge, and diode D switches off. The supply to the output stage is now approximately 44V – the 22V supply plus the charge across C. In the TX805 circuit C is CF09 (100µF) and has a 680Ω resistor in series (JP20) to provide current limiting.

DC can be fed to the scan coils to provide shift adjustment. A three-position switch gives either no shift, slightly upwards or slightly downwards shift selection.

Protection for the field scan coils is provided by transistor TF01. Should the field scan coupling capacitor CF01 go short-circuit, a negative voltage will be developed across RF01. This will forward bias TF01, applying the negative voltage to the protection (PROT') line. This line is connected to the base of TR07, whose role is described below.

Signal Output Stages

The RGB and audio output stages are quite conventional. Colour-difference signal and luminance signal matrixing is carried out by the BC546A transistors TV101/2/3 on the main panel: they receive colour-difference signals at their bases and the luminance signal at their emitters, where the RGB OSD signals are also applied. TV101/2/3 drive the emitters of the BF422 RGB output transistors on the tube base panel.

The complementary-symmetry audio output stage (a pair of pnp/npn transistors, TA03/4) delivers 1.5W to the 16Ω speaker. TA05 is connected between the bases of the audio output pair to stabilise their operating points. Bootstrap feedback is applied to the driver transistor's load circuit.

The Microcontroller Chip

The dedicated microcontroller chip IR01 fulfils several functions: it decodes the infra-red remote control commands and the front panel key operations; it supplies on-screen graphics to accompany operation of the receiver controls; it provides pulse-width modulated outputs for brightness, sharpness, colour and contrast control; it provides audio muting; and it carries out channel selection using a phase-locked loop for tuning.

Fig. 8 shows the system control circuitry associated with IR01. When the set is switched on at the mains, LED DK01 lights and the 'LED2' supply (at the earthy side of DK01) appears at the collector of TR08, whose base is forward biased by RR50 and DR05. TR08's emitter then provides an output voltage for the microcontroller's power supply pin 42, via DR01, and the IR receiver's power supply pin, via RR91. This is the standby state, with IR01's on/standby pin 20 at 5V.

When an on command is received, the voltage at pin 20 of IR01 falls to zero. This controls the emitter of transistor TP12 in the power supply. It switches on, in turn switching TP11 on. The chopper/line output circuit then starts up. This circuitry will be shown in Part 2 next month.

When the mains supply is disconnected, there is no longer a voltage feed to the collector of TR08. TR08, zener diode DR04 and TR07 switch off, while TR06 switches on (CR20 is still charged). As a result, the 'start' line goes low. CR14 discharges, switching TR12 off momentarily. IR01's reset pin 33 goes high for 1msec, allowing it to store the user settings before the 5V supply decays.

TR07 is normally on, being forward biased via DR04 and RR48. Thus TR06 is held cut off. As a result IR01's hold pin 34 and the start line, which is connected to the base of TP12 in the power supply, are in the high state. TR07's base is also connected to the PROT' line. When this goes low, TR07 switches off and TR06 switches on. The start line goes low, switching off TP12 with the result that the receiver shuts down.

The PROT' line is linked to TF01 (see above) and the excess-current detection circuit in the power supply. It goes

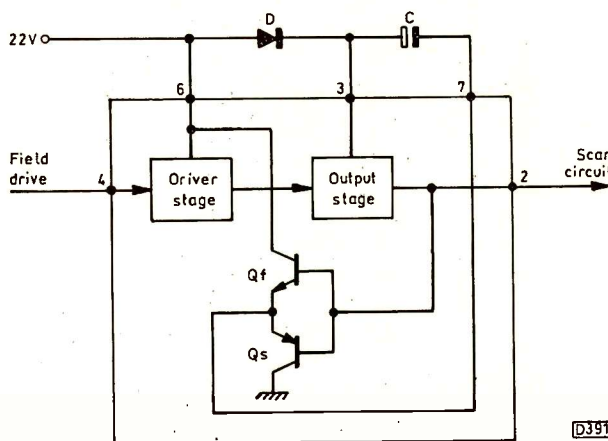


Fig. 7: Operation of the field fly-back boost circuit.

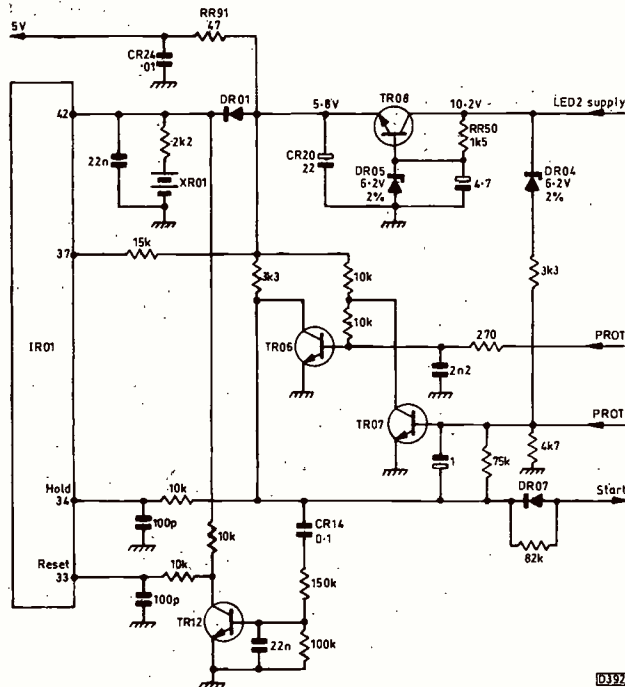


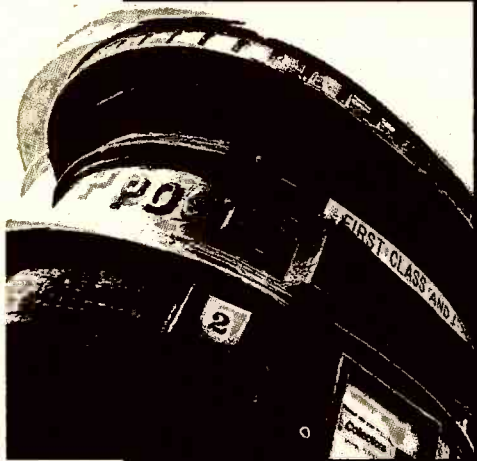
Fig. 8: System control circuitry associated with the microcontroller chip IR01.

negative when a fault is detected, overriding the bias via DR04. Thus TR07 switches off and TR06 switches on, with the results described above.

There's no mains switch at the front of the receiver, but a substantial rocker-type switch is fitted at the rear for mains switch-off if required.

Next Month

The main section of the receiver not so far touched on is the combined power supply/line timebase circuit. We will be dealing with it in the concluding instalment next month.



We welcome letters from our readers and try to publish as many as we can. You can send them typed, handwritten, or on disc. Address them to the Letters Editor, Room L302, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Electrical Safety

C.N. Cory (Letters, November) raised the subject of the electrical safety of consumer electronic products. It should be of concern to the general public and service personnel alike. Some reduction in the level of safety can be blamed on the effects of CENELEC harmonisation of the various European standards and the introduction of certain EEC directives. The main cause however is poor design and a lack of understanding of basic safety principles.

Products made by major manufacturers generally exceed the legal safety requirements by a good margin, but some products from Asia and other developing countries are downright dangerous. A good example is a pair of Chinese-made 'Multi-Media' speakers, in which the only insulation between the live mains supply and the audio connectors was the varnish on the transformer wires!

All electrical products sold in Europe and the UK are covered by The Low Voltage Directive, which requires the product to comply with the "essential" safety requirements of an appropriate CENELEC standard such as EN60065 (BS415). It's up to the manufacturer or importer to decide which parts of the standard are "essential", and the company can then self-certify its product(s) if it thinks that they comply. This is obviously open to abuse.

Reputable companies normally

Letters

have their products tested by an independent test house to ensure that they comply with the whole of the relevant standard, and will also have a good quality-control system in place. Organisations such as BEAB in the UK, TÜV in Germany and UL in the USA also offer an approvals and production monitoring service. This ensures that a high safety level is maintained. Unfortunately there is no compulsion in Europe to join such schemes.

So why are modern TV receivers designed without earthing or aerial isolators? The EN60065 safety standard accepts either Class I construction, with an earthed chassis, or Class II construction, with double insulation. There are several reasons why only Class II is in practice used.

John Woodgate's letter (December) pointed out a problem in Germany, with circulating currents that can melt aerial leads. This is because of the widespread use of TN-C or TN-C-S mains supply systems, with a combined neutral and earth that can float above 'true earth' by a significant amount. When a TV set is connected to a communal aerial system which is grounded to 'true earth', or to another part of the supply system at a different earth potential, high circulating currents can arise.

Another problem in Continental Europe is the lack of a standard three-pin plug. The two-pin "Europlug" will fit any socket in Europe. There are at least seven different and non-compatible three-pin plug systems in use however, and the correct plug or adaptor would have to be supplied with each set. There are some combinations of plugs and sockets that can cause a potential hazard, such as exposed pins or no earth connection.

The other factor that affects the design of sets is the EEC directives. One requires that all mains-powered sets are fitted with a scart (Peritel) socket. Because of this the designer has to use an isolated, non-live chassis (it would be very difficult to

isolate all the signal and switching connections if the chassis was live).

The EMC directive also imposes restrictions on the mains cable and aerial socket. For reasons of safety EMC filters, whether part of the chassis or incorporated in the mains plug, usually don't filter the earth conductor. Computer monitors are usually earthed, and it is surprising how much interference can travel down the earth lead unless expensive countermeasures are taken.

The aerial socket must pass the aerial immunity test, which means that it must be located close to the tuner and that any aerial isolator unit is well screened. The easy way to guarantee compliance is to use a tuner with an integral aerial socket. *J.R. Allison, Bradford, West Yorkshire.*

I am encouraged by John Woodgate's response (December) to my letter (November) and hope that other influential readers have taken note. I can now report on developments since I originally wrote to you.

In the first receiver the degaussing coil had been tightly tie-wrapped to the CRT rimband. When the tie-wraps were cut, it was found that the PVC tape on the coil bore deep grooves made by the tie-wrap's ratchet profile and that cuts had been made by the sharp metal edge. The outcome of this method of construction is inevitable, bearing in mind the energetic vibration of the coil each time the AC mains supply is applied. In this case a static test during manufacture is clearly irrelevant. The aerial socket was not isolated, which was one of the concerns raised in my first letter.

The retailer has replaced the receiver with a brand new model of the customer's choice. I have been told that the defective set is now being investigated by Trading Standards officers. The importer does not have BEAB approval for his TV sets; and I was surprised to learn that this is not mandatory. The importers are reluctant to discuss the matter - I have still had no writ-

ten response from them.

The second receiver was exactly as John Woodgate predicted, the problem being caused by faulty reassembly following a cabinet change. It is unlikely that we will be able to trace the person responsible, though this is being attempted. I shall certainly in future inspect the degaussing coils in all sets brought to me for repair.

There is quite a lot of exposed metalwork involved in this case. The TV set's loop aerial, a metal-cased aerial changeover switch, and of course the aerial plugs/sockets in the system. Don't forget that the covers of VCRs and satellite receivers are usually metal and are connected electrically by springs or contact-screw arrangements to the chassis and aerial socket. The customer mentioned that her daughter had reported receiving a tingle from the VCR. I still get a knot in my stomach when I think about it.

If an aerial cable melts because of an earth loop, this surely indicates that there is a serious installation problem. It should not result in us throwing away our safety earth.

The isolation provided by a

mains or chopper transformer is bypassed by the degaussing system, to which equal importance must be attached. If there are two insulated paths in parallel and failure of either can result in a lethal hazard, is the product really double-isolated?

I see no reasonable excuse for the use of non-isolated aerial sockets. All the TV sets in my workshop have been fitted with simple ferrite transformers. At UHF these are small, virtually lossless, simple to make and of little cost.

Finally, in my experience coincidences regularly occur. This is however the first time I've lost sleep over one.

Chris Cory, T.Eng., MIQA,
Tekelex, Thatcham, Berks.

Microwave Oven Problem

The following problem caused us so much trouble that I think it's worth a mention. It involved a Thorn Multiwave MH1080 microwave oven with twin halogen grill. When it was plugged in the cavity light came on, also the magnetron cooling fan which ran continuously. A time could be entered, but there was no response to the start button.

We had no service information, so a lot of time was spent on finding the cause of the fault: the 1M Ω resistor R6 on the power PCB was open-circuit. It's connected to the lower latch switch, and tells the microcontroller chip whether the door is open or closed. When R6 is open-circuit the oven assumes that its door is open, disables the cook button and turns the fan and light on.

Michael Dranfield,
Buxton, Derbyshire.

Doming

I was recently asked to look at a Panasonic TX212V TV set, the problem being very bad purity at the centre of the left half of the screen. It seems that the tube's shadowmask is buckled. A note written by another service engineer said the fault is "doming". He suggested keeping the contrast and brightness at minimum to prevent overheating the shadowmask. Shouldn't the beam limiter have prevented this? It seems that a lot of work has already been done on the set. Any comments?

Jim Littler,
Wigan, Lancs.

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Long-distance Television

**Terrestrial DX and satellite news and reception, the Hot Bird 3 line up, 1998 meteor shower dates and a Band I notch filter design.
Roger Bunney reports**

The main event during November was the Leonids Meteor Shower peak on the 17th. When I checked early in the day I found that Band I, particularly ch. E4, was very active, with many signal pings and some more sustained reception. Signals from Scandinavia predominated, with PM5534/44 test patterns alternating and floating with each other. It was not unlike a minor Sporadic E opening, though less intense.

As I had to leave for work I was unable to continue monitoring Band I. Subsequently Cyril Willis (King's Lynn) commented that the Leonids event "wasn't as good as expected". He received an SpE signal in ch. R2 at 1035 that day.

Peter Schubert (Rainham) laments the poor conditions during the month. Apart from his usual ch. E4 reception from Lopik, the Netherlands, he had no tropospheric reception. SpE reception was limited to an unidentified signal on the 8th.

In all, a very poor month for ter-

restrial DX-TV reception.

Down under, on November 7th Robert Copeman (Victoria) logged a ch. C1 signal (49.75MHz vision carrier) during the period 1910-1950 local time. As no other signals were present, this suggests TE (transequatorial skip) rather than multi-hop SpE reception. On the theme of TE and the increasing solar activity, *Six News* reports several cases of cross-equator signal hops, mainly northwards to the Mediterranean area. As yet, the density of F2 layer ionisation has not been sufficient for signal reflection to the southern UK, but hopefully we'll see traces of ch. E2 signals from Ghana/Nigeria/Zimbabwe during the early evening period sometime this winter.

As solar activity increases with the start of the new cycle, check for flares and other disturbances. On November 6th for example there was the fourth largest flare ever recorded, leading to signal fadeouts and other problems over the following two-three days. It's always worth checking 27 days later, when the sun has rotated, to see whether more solar radiation produces further effects such as an aurora.

Satellite Sightings

Despite the increased use of digital transmission, there has been an upsurge of analogue signals from the satellite belt. You often find anything up to four clear analogue Ku-band feeds via Intelsat K (21.5°W) east-bound to Europe. PAS-3R (43°W) is another favourite for analogue reception. There was a lot of transatlantic activity during late November, thanks in part to spectacular skiing reports from British Columbia. The

snow-clad slopes of the Rockies look fantastic. Sports feeds for Europe were noted via both PAS-3R and K. Identifications indicate that several uplink companies were active at a number of sites. For example on the 20th Sky Sports carried "BC - Park City" (via K) and on the 27th "PSSI NYBC Mammoth CA". I'm uncertain about the significance of the latter.

Did anyone see the "Shell Test" on November 12th at 0730 via Intelsat 803 at 27.5°W (11.680GHz vertical, with sound at 6.6MHz)? I did, but had to leave for work before the transmission came off colour bars.

On November 21st the United Nations "Symposium on TV" from New York was carried in clear analogue form via PAS-3R (at 12.64GHz horizontal). Some of the big guns of the broadcast TV world, including Dan Rather and Rupert Murdoch, presented their views. The programme consisted of recorded highlights from a TV Forum that lasted over a three-day period. Interesting that the 6.2MHz sound carrier was in English and the 6.8MHz one in Spanish.

Cyril Willis saw the Telethon on November 27th via Intelsat K (at 11.62GHz horizontal) - not the UK version but the "Armenian Telethon Fund '97". Various presenters and a scrolling caption at the bottom of the picture provided details of the latest pledges. The carrier ceased abruptly at 2000 hours: little charity from Intelsat!

I hope some of you manage to see the 1997 SatFest, a veritable feast of informal and informative TV on satellites and broadcasting. Line up and rehearsals are to be on January 16th, followed by program-

CNCT - Rabat received via Eutelsat. Photo from John Locker.



ming from 0900-2100 during the next two days via the newly-launched Sirius 2 satellite at 5°E (it's a high-power satellite). SatFest (Satellite Festival) is organised by TESUG (01227 265 222) and is supported by most satellite operators, equipment makers and broadcasters.

Dean Rogers (Abbeywood, London SE2) watched most of the EEFA football cup/champions league during late October via Telecon 2C and Eutelsat II F4. The European Cup Winners game was carried, for Channel 5, by Eutelsat II F3 (16°W), in the clear from a snowy and freezing Norwegian pitch! Dean mentions that Sky Sports often uses the 11.163GHz horizontal transponder aboard this satellite (16°W) for clear analogue feeds.

There has been a little more information on the sighting, mentioned last month, of unmanned surveillance aircraft via Intelsat 803. Roy Carmen comments that the type of aircraft, though slow, is almost impossible to detect and for missile systems to lock on to. They can also downlink information up to five times faster than conventional aircraft. My sightings were of a new type of aircraft however, not the American Bronco unmanned craft. Apparently satellite surveillance can now locate missile launch sites to within 6mm of true grid!

So there's plenty going on in the analogue satellite world, even during quiet months.

Terrestrial News

UK: There have been thirty one applications from across the UK to operate Restricted Service Licence (RSL) TV stations. They range from single-town coverage to larger areas such as the Isle of Wight. Licence periods will be for either 56 days or two years. Decisions from the ITC are due in the spring.

Hungary: Two commercial TV stations are now in operation. The first was TV2, Budapest, which came on-air in early October. It was followed a few days later by RTL Klub.

Denmark: The plan to sell off TV2 has been shelved for at least four years.

Mexico: TV Azteca plans to expand its network to Costa Rica, Nicaragua, Panama, the Dominican Republic, Honduras and Peru during 1998 and expand farther to Chile, Colombia, Ecuador and Venezuela by the year 2000. It now

claims over a third of viewers in Mexico itself and generated profits of nearly \$300m last year.

Digital TV

In the USA the FCC has announced the likely closure of all analogue TV services in the year 2007. The Harris Corporation has just transmitted a live digital outside broadcast, via terrestrial transmitters WHD-TV and WETA-TV in Washington. It's thought to have been a world first.

Sweden's Teracom has installed digital terrestrial broadcast transmitters (DVB-T) at Stockholm, Goteborg and Norrkoping. They should now be on-air with full-time broadcasting. Teracom started DVB-T tests back in 1995.

The European Union is discussing a timetable for the end of analogue TV transmissions across Europe. It seems likely that Brussels rather than individual European countries will decide on the analogue TV switch-off timetable. The idea is to ensure a smooth start to European digital transmissions.

Notch Filter

The fight against interference in Band I is never ending. Robert Copeman recently came across a filter circuit (see Fig. 1) on the

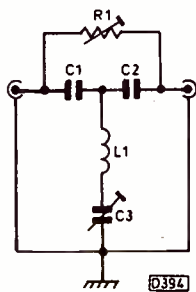


Fig. 1: Bridged-T notch filter design for Band I, noted on the internet by Robert Copeman.

internet. The details provided there relate to US channels: the Video Media page originates in Florida, access being at

<http://www.tvfilter.com/video-media/notch-dir/fkits-info>

Otherwise the address is PO Box 93/6025, Margate, FL 33093, USA. Complete filter kits can be purchased at \$20 each one off (\$7 each in quantities of twenty plus).

The kit PCB is designed around F connectors. No component values are given. I suggest 120pF for C1/2, 100Ω for R1 (miniature carbon preset) and 30pF maximum for C3 (sub-miniature preset). Coil turns listed are 26 for ch. 2, 24 for ch. 3, 20 for ch. 4, 15 for ch. 5 and



14 for ch. 6, wound on a quarter-inch coil former. Remember that these are US channels, i.e. ch. 2 is 55-25MHz. But C3 should tune down to ch. E2, or rather the rubbish at 49MHz. The internet details don't include performance figures. Let us know how you get on!

The Dr Dish TV programme which is broadcast on the second Friday of each month via Kopernikus 2 (28.5°E). Photo from John Locker.

Aerial Techniques

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Unidentified EBU feed via Eutelsat II F4 (7°E). Photo from John Locker.

Satellite News

Sirius 2 is now in orbit at 5°E. It's a high-power satellite which is operated by GE Americom to provide analogue and digital TV transmissions to Europe. England is within the 50dBW vertical footprint, which extends to the Black Sea in the east and from Germany in the north to Sicily in the south, the frequency coverage being 11.747-12.687GHz. The horizontal footprint, with 55dBW, is centred on Scandinavia, the frequency coverage being 11.727-12.729GHz. The Swedish SVT International channel is one of the first that should be available, with programming that's a combination of material from the terrestrial SVT-1 and SVT-2 channels.

Eutelsat's Hot Bird 3 is now up and running. The transponder line up is shown in the accompanying table. Eutelsat has signed a contract to launch a fourth satellite in the W series: W4 is due to be in operation in early 1999 at 36°E. The Eutelsat TDF2 satellite started TV transmissions from 36°E in November. Its SESAT craft is due to enter service at the same orbital position at the same time as W4.

Intelsat reckons that the 605 craft can continue to be used despite the intermittent/partial loss of telemetry. The fault relates to the pointing accuracy of the solar panels: since the satellite is built to spin upright, the panels receive constant solar illumination and the telemetry information is thus not essential.

Hughes Aircraft has produced a higher efficiency solar panel that's based on a twin-layer, dual-junction gallium arsenide solar cell. Its sun energy conversion efficiency is 21.6 per cent, which compares with the 12.3 per cent efficiency of a standard solar cell. The double-

Hot Bird 3 Transponders

No.	Frequency (GHz)	Channel	Type*
71	12.13026	MTV-2 (Hungary)	A
72	12.14944	TPS (France)	D
73	12.16862	Nethold Hellas (Greece)	D
74	12.18780	BT (UK)	-
75	12.20698	CME (Central Europe)	D
76	12.22616	German digital service	D
77	12.24534	MCM (France)	D
78	12.26452	German digital service	D
79	12.28370	ET1 (Greece)	A
80	12.30288	Slovenian/Croatian TV	D
81	12.32206	Polish digital service	D
82	12.34124	D+ (Italy)	D
83	12.36042	Polish digital service	D
84	12.37960	French digital service	D
85	12.39878	SSR (Switzerland)	D
86	12.41796	D+ (Italy)	D
88	TBA	D+ (Italy)	D

* A = analogue, D = digital.

layer cell fabrication can react selectively to long and short wavelengths.

Iridium has now launched 39 low Earth orbiting satellites – the eventual total (66) should be in service this autumn, providing global coverage.

The merger of Kirch and Bertelsmann has been completed: as a result, the DF1 and Premiere TV programme packages now operate as Premiere. Several Italian digital TV packages have merged: RAI, Canal Plus, Fininvest and Cecechi have formed a single digital system called Stream – the Telepiu name has been dropped.

Chinasat 8 is to be launched later this year, with 36 37W C band transponders and 16 125W Ku band transponders.

The digital Canal Plus Polska service is due to start in April/May. Rival Entertainment is expected to start in April.

Armstrong Electronics (Dublin) and Videocom (Boston, USA) have set up a digital TV link to relay Irish news and sports programmes to Celtic Vision's cable systems around Boston and New York five times a week. Israeli company Tadiran Scopus has provided the MPEG-2/DVB equipment.

The Gardiner stand-alone Ku band LNB is apparently to be discontinued: the company will continue to produce the LNBF, an LNB with a feed horn/polariser for an offset dish. The stand-alone LNB for prime-focus dishes required a separate polariser and feed horn.

Main Meteor Shower Dates - 1998

Our thanks to the British Astronomical Association, Meteor Branch, for the following 1998 MS details. Neil Bone, the director, thinks that 1998/9 could be a "big one" for the Leonids shower in November.

Shower	Overall period	Main peak
Lyrids	April 19-25th	April 22nd
May Aquarids	April 24th-May 20th	May 4-5th
Cetids	May 7th-June 9th	May 14-25th
Delta Aquarids	July 15th-August 20th	July 29th and August 6th
Perseids	July 20th-August 20th	August 12th (late evening)
Giacobinids	October 7-10th	October 8th (late evening)
Orionids	October 16-27th	October 20-22nd
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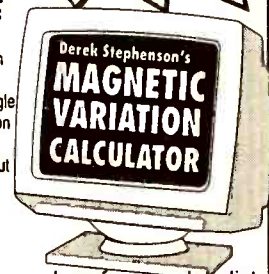


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Answer to Test Case 422

- see page 241 -

Before we proceed any further, Sage wishes it to be known that he has some goods for disposal: the three bottles of red wine that remain, a slightly worn but perfectly functional ACE head suitable for a Toshiba V411, and a faulty IC that was the real cause of the trouble with the VCR. Offers to Resident Workshop Sage Esq., Test Case Workshop, c/o Television magazine!

You cannot monitor the control pulses at the ACE head during playback - they are of too low amplitude for a conventional oscilloscope. So Sage checked them at output pin 11 of IT10, the U2561B control-pulse amplifier chip. He found a nasty waveform here. It looked as if mains hum was superimposed on the squarewave control-pulse signal. He decided to check the voltage at the chip's supply pin (Vcc, pin 20) to see whether it was of correct amplitude and smooth. It was. He also checked the decoupling capacitor CT18 in the CTL return line. It was OK, likewise the two resistors associated with the chip's input pin 8.

The obvious conclusion was that IT10 was faulty. This was confirmed by fitting a new U2561B IC, after which the Toshiba V411 worked perfectly. It all goes to show that you should never jump to conclusions, no matter how many times you've known a symptom to be caused by a particular component.

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Servicing the Toshiba 2505/2805DBT

John Coombes provides a fault-finding guide.

VCR/CCTV Trigger Timer

Closed-circuit TV equipment for basic surveillance is now readily available and cheap. But the ability to record events using a time-lapse VCR is still very expensive. To resolve this problem, Ian Rees has devised a way of using an ordinary domestic VCR to record short bites of scenes. The recording process can be triggered by sensors.

The Wessel Circuit

The idea of the Wessel circuit is to simplify design: a single switching transistor acts as both the chopper and line output device. But the control arrangements can be quite complex. J. LeJeune on the basic circuit and its implementation in the TX805 chassis.

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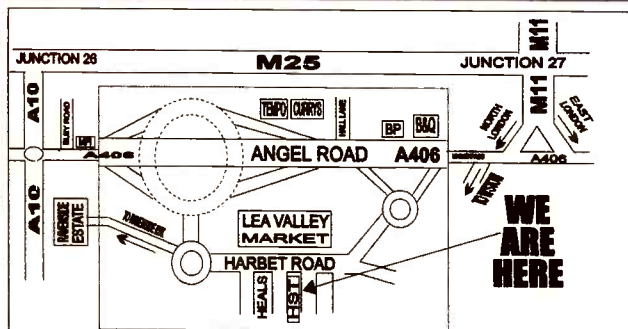
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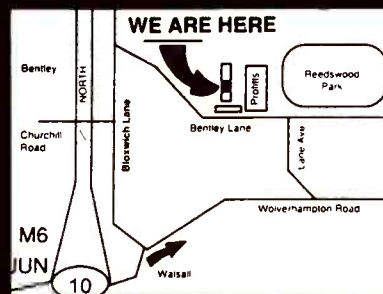
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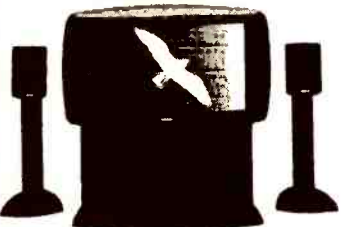
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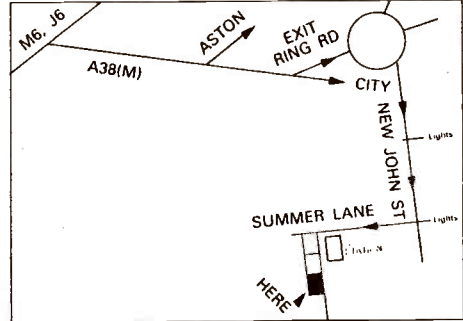
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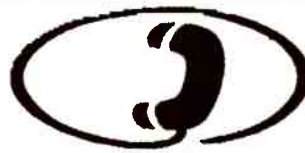
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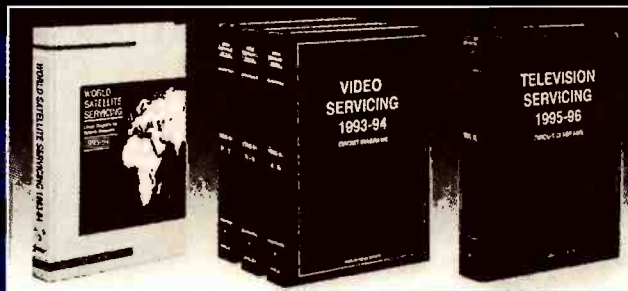
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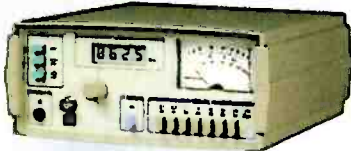
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