THE LEADING UK CONSUMER ELECTRONICS TECHNOLOGY MAGAZINE

TELEVISION

SERVICING·VIDEO·SATELLITE·DEVELOPMENTS

A REED BUSINESS PUBLICATION

APRIL 1998 £2.50

CES '98 Las Vegas report

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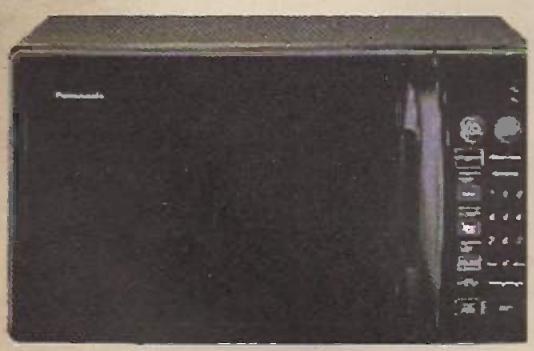

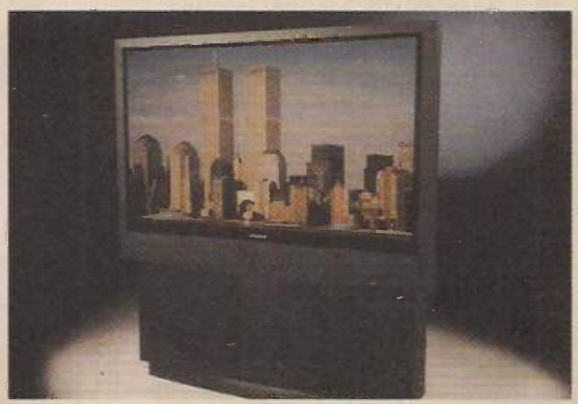

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Preparing for Digital TV

Digital TV will hit us in the UK later this year. Will we be ready for it then? Do I hear coughs and shuffling feet? Let's start with the public before we think about the technical side.

To its credit Pace Micro Technology of satellite receiver fame, whose future is closely bound up with the success of digital TV, has commissioned and published some market research which is not very encouraging. The Pace Report is based on the responses from some 1,200 viewers to questions on their attitudes to digital TV. Only 36 per cent knew what digital TV was. A high proportion of the viewers consider what should be the main advantages of digital TV as being "of no value at all". Asked about the benefits of increased choice of programming only 21 per cent saw this as being a reason for buying digital TV equipment: 35 per cent said that increased choice would be of no value to them. What about interactive TV? An even greater number of the viewers, 57 per cent, gave this the thumbs down – "of no value at all" was their reaction. As to home shopping, 64 per cent could see no benefit in this. When it came to pay-per-view, 65 per cent showed no interest.

From the technical point of view the prospect of better quality pictures and sound is of greater interest than the extra services made possible by digital TV. The viewers seemed to agree: 46 per cent thought that this would be "of some value" while 30 per cent were prepared to buy sets for this reason. Other prospects that elicited interest were "more local news" and "improved access to government and local authority services".

Well, it was a rather small sample, but the results do suggest that a major marketing effort will be required to get the public interested. In particular it may be difficult to get the public to pay more for TV. If Rupert Murdoch and others can sign up the best entertainment, films and sports fixtures for pay-TV services, the public may have little option.

The public has hardly been primed for the advent of digital TV. What about the trade? Surely by now the set-makers should be running courses for their technical staff and for dealers' service engineers. But there has been hardly a murmur. Well we do know that money is hard to find in this highly competitive industry, but surely someone should see that this is an investment for future success and profits.

In the past local colleges have been responsible for much technical training. But in recent years there have been fewer and fewer courses for prospective or established TV/video technicians to attend.

It all looks to be rather a shambles. But perhaps we needn't be too alarmed. With modern technology, by which I mean all the work being done within those little plastic things, it's not so important to have a detailed knowledge of signal decoding and processing techniques. How many headaches has teletext caused, or Nicam sound? Do you know exactly how these systems work and what goes on in those chips? Probably not. And by and large it doesn't matter. You check the supplies and the conditions at the various pins. Anything badly amiss here and the problem is soon solved.

It was quite different in the otherwise comparable early days of colour TV, when discrete component technology was used for decoding. Then you did need to know what went on and which stage did what if you were to be able to deal with faults such as no colour, unlocked colour, incorrect colours, Hanover bars and so on. The chip has made this largely unnecessary, and as a result has simplified servicing no end. The main headaches with today's servicing are caused by things like dry-joints that can be responsible for intermittent and other hard to pin down conditions.

I don't want to sound unduly blasé about this however. Clearly if no one has a clue we will be in difficulties and the trade will get a lousy reputation. Some training is essential, and now is the time when it should be being organised. Training is required for bench technicians, field and installation technicians and technical sales staff. The fact that so little is being done is not an encouraging start to the digital era.

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2SB647	0.57	2SD1887	3.56	BC308	0.09	BF421	0.24	BYD33D	0.12	LA4460	2.50	STK7348	5.74	TDA3190	2.05	U2829B	3.40		
2SB649A	0.77	2SD288	0.85	BC308A	0.09	BF422	0.19	BYD33J	0.16	LA4700	4.27	STR11006	7.37	TDA3330	14.21	UC3842	1.46		
2SB688	1.61	2SD350A	1.97	BC308C	0.26	BF423	0.14	BYD33M	0.26	LA6324	2.05	STR4211	9.40	TDA3505	2.40	UC3844	1.20		
2SB698	0.35	2SD381	1.66	BC309B	0.10	BF459	0.43	BYV10-40	2.55	LA6510	2.94	STR50020	9.38	TDA3560	6.13	UC3844N	1.91		
2SB716	0.43	2SD400	0.34	BC327	0.10	BF471	0.37	BYV95B	0.21	LA7830	1.88	STR50103	4.48	TDA3561A	3.85	UPC1318AV	3.85		
2SB772	0.50	2SD401A	0.77	BC328	0.14	BF487	0.57	BYV95C	0.28	LA7832	2.40	STR50103A	5.56	TDA3562A	4.62	UPC1365C	1.70		
2SB774	1.61	2SD468	0.28	BC337	0.14	BF491	0.41	BYV96D	0.27	LA7835	2.99	STR54041	5.15	TDA3565	2.74	UPC1378H	1.71		
2SB891	0.60	2SD667	0.38	BC338	0.06	BF494	0.12	BYV96E	0.53	LA7837	4.19	STR5412	4.02	TDA3566	6.41	UPC1394C	1.92		
2SB892	0.35	2SD669A	0.64	BC368	0.18	BF759	0.38	BYW56	0.31	LC7132	4.70	STR58041	3.42	TDA3576B	10.31	UPC1488H	2.99		
2SC1008	0.24	2SD718	1.90	BC369	0.18	BF869	0.38	BYW95C	0.21	LED3G	0.10	STR59041	8.11	TDA3592A	4.60	UPC1498H	2.31		
2SC124	0.48	2SD756	0.47	BC372	0.53	BF871	0.41	BYW96F	0.50	LED3R	0.10	STR6020	6.07	TDA3640	5.98	UPC574J	0.86		
2SC1318	0.19	2SD837B	1.12	BC546A	0.11	BF959	0.18	BYX55600	0.23	LED3Y	0.10	STRD1816	7.69	TDA3650	11.04	X2402P	5.78		
2SC1473	0.21	2SD856	0.79	BC546B	0.12	BF960	0.30	BZV10	1.34	LM317T	1.29	STRD4420	10.64	TDA3653B	1.54	ZTK33B	0.28		
2SC1573	0.52	2SD882	0.43	BC547	0.11	BF970	0.43	BZV85C5V1	0.15	LM324N	1.48	T9053V	1.35	TDA3653C	2.82	ZTX650	0.51		
2SC1675	0.14	2SD888	6.41	BC547A	0.04	BFR90A	0.68	BZX6110	0.16	LM339N	0.50	T9064V	1.87	TDA3653CQ	2.57				
2SC1685	0.21	2SD965	0.67	BC547B	0.11	BFY51	0.39	BZX6111	0.10	M4948	11.85	TA7120P	0.66	TDA3654	1.44				
2SC1740	0.16	2SD965R	1.05	BC548	0.11	BR100	0.18	BZX6112	0.13	M5218L	0.69	TA7280P	2.74	TDA3654Q	2.82				
2SC1815Y	0.11	2SK1117	3.40	BC548A	0.11	BR103	0.62	BZX61120	0.28	M54544L	2.04	TA7281P	3.20	TDA4500	4.66				
2SC2001	0.23	2SK1118	3.40	BC548B	0.06	BRX44	1.02	BZX6113	0.11	M58655P	4.96	TA7698AP	5.97	TDA4501H	9.57				
2SC2023	3.18	2SK30A	0.35	BC548C	0.14	BRX49	0.43	BZX6116	0.19	MAX232CPE	4.70	TA7778P	5.11	TDA4503	4.00				
2SC2073	1.03	7407	0.69	BC549B	0.11	BRY55	0.28	BZX6120	0.19	MC13002P	7.69	TA8205AH	4.50	TDA4505E	7.35				
2SC2078	1.00	74HC04	0.88	BC550B	0.16	BSX20	0.35	BZX6122	0.19	MC7812CT	0.77	TA8210AH	0.00	TDA4505M	11.97				
2SC2120	0.23	7805	0.78	BC550C	0.09	BT139600	1.29	BZX612V4	0.07	MJ15003	2.23	TA8210H	4.79	TDA4510	2.74				
2SC2229	0.31	7806	0.60	BC556A	0.11	BT151500R	1.12	BZX6133	0.19	MJ2955	0.77	TA8215H	4.96	TDA4580	10.05				
2SC2230	0.55	7809	0.69	BC556B	0.14	BT151800R	1.15	BZX6136	0.19	MJ802	2.91	TA8216H	8.01	TDA4600	2.14				
2SC2235	0.36	7812	0.52	BC557	0.09	BU208A	1.46	BZX613V9	0.14	MJE13005	0.86	TA8221H	0.00	TDA4600/2/3	2.82				
2SC2236	0.36	78L05	0.35	BC557B	0.18	BU208D	1.61	BZX615V6	0.11	MJE18004	2.05	TA8403K	2.31	TDA4601	1.46				
2SC2240	0.21	AA119	0.36	BC558B	0.18	BU2508AF	1.58	BZX6168	0.11	MJE3055T	0.45	TA8427K	3.76	TDA4601D	1.46				
2SC2271	0.67	AC127	0.71	BC558C	0.09	BU2508DF	1.58	BZX616V2	0.11	MJE340	0.45	TA8718N	7.69	TDA4605	4.10				
2SC2274	0.35	AD162	0.96	BC559B	0.14	BU326A	1.36	BZX616V8	0.19	MJF18004	2.05	TA8739P	6.01	TDA46052	1.97				
2SC2335	1.12	AF127	2.48	BC560C	0.11	BU406	0.69	BZX617V5	0.09	MJF18204	6.07	TAA550B	0.31	TDA4950	1.76				
														TDA7240A	2.57				

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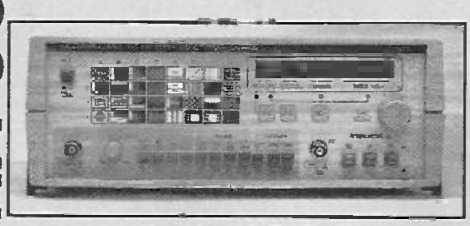

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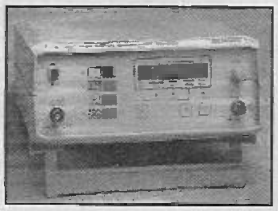

GV 264 SATELLITE TV GENERATOR
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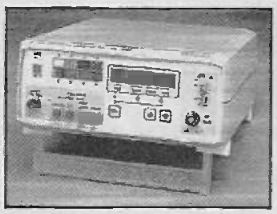

GV 298 TV PATTERN GENERATOR
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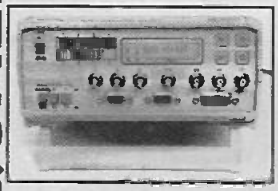

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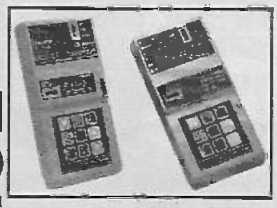

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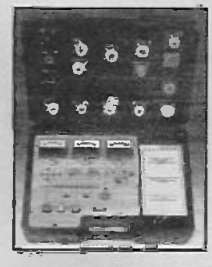

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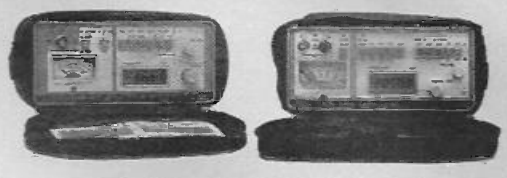

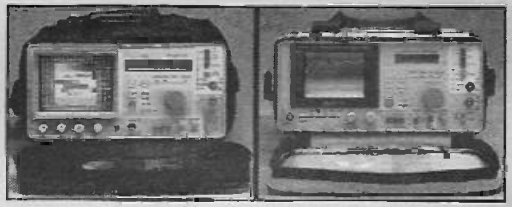

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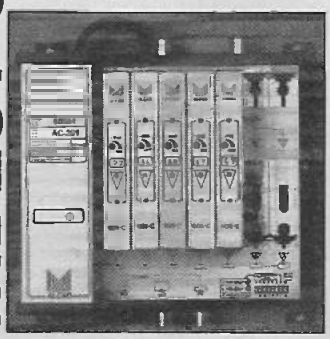

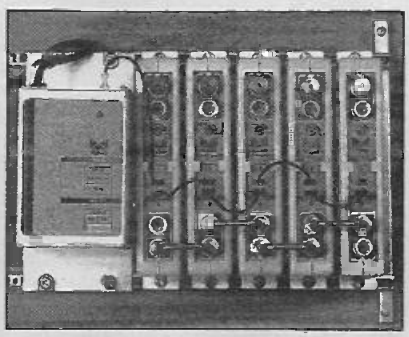

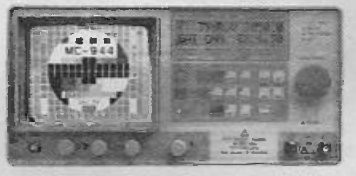

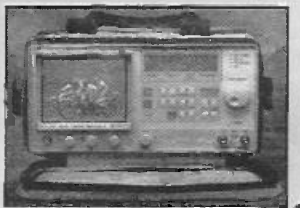

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Reports from David C. Woodnott and Adrian Spriddell

Sony CCDTR305E

No playback was the complaint with this camcorder. Inspection revealed that there were other problems, like a rolling black-and-white E-E picture. Although there was no playback, as far as could be ascertained the mechanism operated normally in all modes.

I've had problems with this particular model before because of incorrect or scrambled data in the EEPROMS (pages D and F). So I did a quick reading. This was a good move – page D was empty! All was well after reprogramming.

Checks were carried out to determine the cause of the memory loss, but none was found. After a long soak test the unit was returned to the customer. That was eight months ago, and all seems to be well so far. Of course he probably hasn't used it yet! **D.C.W.**

Panasonic NVMS2B

The complaint with this full-size unit was "weak camera pictures". All playback etc. functions were OK. On test I found that the camera E-E picture signal was of low amplitude at only some 0·5V – checked at the AV connector with 75Ω termination. Since the signal level remained the same under all lighting conditions it seemed that the iris assembly might be at fault. This turned out to be the case.

The iris motor had leaked oil which had contaminated the iris vane assembly. From past experience I have found that it's unwise to try to clean these units to save expense – the cost of a complete new assembly is modest. Bear in mind the considerable amount of time required for dismantling, cleaning, setting up etc. Having to do the whole thing twice is not recommended! **D.C.W.**

Sony CCDV5000E

This top-of-the-range (in its day) camcorder was brought in because it was inoperative, with only the DEW symbol flashing – in the EVF and LC displays. The cause was simply a bad connection at CN002 on the main syscon PCB. I cleaned and refitted the connector pins then carried out a service to complete the repair. **D.C.W.**

Canon UC10E

I've on several occasions mentioned the common types of mechanical fault that you get with units which use this mechanism – they are often caused by excessive pressure being applied to the cassette when it's inserted. This can bend the supply reel spindle etc. (or worse). So when this one arrived with a note that said "noise band on picture and intermittent shut down" I was not unduly worried. Quite normal I thought, and estimated accordingly.

After straightening the supply reel spindle and checking for correct back tension I realigned the tape path. OK so far. A tape was inserted (fortunately not an 8mm test tape) and playback was selected. The monitor produced a picture, which looked to be OK. After thirty seconds of play however a noise band appeared at the bottom of the picture then disappeared, only to reappear after a short while. This state of affairs continued until I stopped the tape.

The other mechanical functions were then tried. Fast forward was OK. also rewind apart from a cyclic rattle and vibration that came from the back-tension assembly. I also found that the lower edge of the tape was being severely chewed.

Play was once again tried, which confirmed the previous symptoms. I also noticed that the tape was being stretched and chewed at the point between the take-up guide and the pinch roller. In fact the tape was under so much tension at this point that it would sometimes 'sing' like a violin string! Yet the back-tension was OK. The tape would ride up and down around the drum, and was also under excessive tension here.

I eventually found that the supply roller guide sleeve had seized on its spindle. It looked OK and was correctly positioned, but it wouldn't revolve. A new guide cured the problem.

Since that first experience I've had other units with 'sticky', erratically revolving guides. If the guide has not totally seized, cleaning usually clears the trouble. We live and learn! **D.C.W.**

Chinnon VC1700

I was told that this handy-cam style unit wouldn't record or play back. The cause was lack of the capstan FG signal. This was immediately obvious, not only from observing the action of the mechanism but from the fact that the motor ribbon cable was damaged! The damage was satisfactorily repaired by linking across the area affected. Just as well, as the motor is now no longer available. **D.C.W.**

JVC GRS505E

All functions worked but there was no output to the monitor when the RF unit was used – when an AV lead was used the picture and sound were OK. Diode D2 on the jack PCB had failed, removing the 8V RF supply. A faulty AV lead, which had previousy shorted out the 8V supply, was the cause of D2's failure. **D.C.W.**

Canon E50E

If there is no viewfinder picture, check for around 1V or so of luminance at the input pin (11) of the AN2514 viewfinder driver IC. Then see if it comes out at pin 13. If there's luminance at pin 11 but nothing comes out, replacing C2901 (100µF, 6V) will probably put matters right. **A.S.**

TELETOPICS

Conditional Access Row

British Digital Broadcasting (BDB) has chosen SECA's Mediaguard conditional access (CA) system for its set-top decoder boxes in preference to a News Datacom system. BSkyB is to use the News Datacom system and is threatening to take legal action against BDB, alleging that when BSkyB withdrew from the BDB consortium there was an agreement to use a common CA system. News Datacom is a subsidiary of News Corporation, which has a forty per cent stake in BSkyB. SECA is a partnership between the French pay-TV group Canal Plus and the German publisher/TV company Bertelsmann.

It's believed that BDB's decision was taken on cost and proven technology grounds. The SECA CA system is already in use for services to Continental Europe, whereas the News Datacom system is still under development. BDB expects satellite and terrestrial digital TV broadcasters to transmit CA information for both systems simultaneously, a process known as simulcrypt, to enable different types of decoder to be used. It admits that there is not going to be 100 per cent compatibility between the systems initially. Users wishing to add satellite to DTT (digital terrestrial TV) reception could buy an adaptor, which might cost about £80, to plug into their BDB set-top boxes. It seems that the main problem relates to the inability of a BDB box to handle BSkyB's electronic programme guide, which is designed to help viewers find their way around its 200 or so digital TV channels.

Both broadcasters claim to be on course for the launch of their services, BSkyB in June and BDB in the final quarter of the year. Representatives of UK broadcasters and television regulators however have met the Radio Communications Agency to voice concern about delays in negotiations over the right to use international frequencies for DTT. The broadcasters had already complained to Margaret Beckett, the trade and industry secretary, about slow progress in negotiations with France and Belgium.

There has also been dispute about the provision of interactive services (home shopping etc.). British Interactive Broadcasting (BIB), which is to provide interactive services for BSkyB, had planned to use a video-based technology known as Open TV. Other broadcasters are planning to use an internet-based technology such as Microsoft's WebTV. It seems that BIB is now opting to use a compatible standard. Carlton and Granada, joint owners of BDB, have been working with WebTV on TV viewer access to the internet. The WebTV system has been on sale in the USA for over a year and has atttracted some 200,000 subscribers.

The Independent Television Facilities Centre predicts that digital TV will result in a huge increase in the demand for subtitling for deaf and hard of hearing viewers.

California-based video specialist 8x8 has launched its ViaTV phone in the UK at around £400. All you require is the unit, a standard phone line and TV set to plug into – and someone with the same equipment at the other end. Other models, one of which uses a comcorder, are to follow.

BREMA Highlights Sterling Threat

The House of Commons trade and industry committee. which is investigating Japanese investment in the UK. has been told by the British Radio and Electronics Manufacturers' Association (BREMA) that the strong pound and high UK interest rates are threatening the UK's position as the leading manufacturer of TV sets in Europe. Ten of BREMA's fourteen full members, including Sony, Matsushita, Toshiba, Mitsubishi Electric, Hitachi and Sanyo, are Japanese owned. Last year the industry produced over six million sets worth about £2bn at retail prices. This is about a third of European production. The UK had a TV set trade surplus of some £500m last year.

BREMA points out that further inwards investment in the industry is being discouraged. It would also like to see an early decision on UK entry into European economic and monetary union.

Cable and Satellite Exhibition

The 11th Cable and Satellite Exhibition will be held at Earl's Court 2, London on May 18-20th.

Digital TV Coverage

The ITC has laid down a three-phase strategy for the start of digital TV services in the UK. Transmitters in the Phase 1 list must start broadcasting from the digital TV commencement date. This is expected to provide coverage of about 70 per cent of the population. Transmitters in Phase 2 must start within eight months, while those in Phase 3 must start within sixteen months. This will bring the coverage up to 90 per cent. Here's the list:

Phase 1: Belmont, Bilsdale, Black Hill, Caldbeck, Caradon Hill, Craigkelly, Crystal Palace, Divis, Durris, Emley Moor, Freemont Point, Hannington, Mendip, Moel-y-Parc, Oxford, Pontop Pike, Rowridge, Sandy Heath, Stockland Hill, Sutton Coldfield, Tacolneston, Waltham, Wenvoe and Winter Hill.

Phase 2: Main stations Angus, Beacon Hill, Blaenplwyf, Bluebell Hill, Carmel, Darvel, Dover, Heathfield, Limavady, Llanddona, Midhurst, Presely, Ridge Hill, Rosemarkie, Selkirk and Sudbury. Relay stations Bristol I.C., Fenham, Guildford, Hemel Hempstead, Idle, Kilvey Hill, Lancaster, Nottingham, Saddleworth, Sheffield and Whitehawk Hill.

Phase 3: Main stations Bressay, Brougher Mountain, Chatton, Eitshal, Huntshaw Cross, Keelylang Hill, Knock More, Redruth, Rumster Forest, The Wrekin and Torosay. Relay stations Aberdare, Brierly Hill, Bristol K.W., Bromsgrove, Chesterfield, Fenton, Hastings, Keighley, Lark Stoke, Malvern, Olivers Mount, Pendle Forest, Plympton, Pontypool, Reigate, Rosneath, Salisbury, Storeton and Tunbridge Wells.

Business News

In announcing record profits last year Philips has made clear that its policy will be to increase marketing expenditure and focus on high-volume consumer electronics, from TV sets and audio systems to mobile telephones and also some business electronics products. Chairman Cor Boonstra wants the company "to become a leading force in the digital revolution". Profits reached Fl5.7bn (£1.7bn) against a loss of Fl590m (£175m) in 1996. Sales increased ten per cent to Fl76.5bn (£22.77bn).

Philips TV Test Equipment has been acquired by Panta Electronics of the Netherlands. Its name has been changed to ProTeleVision Technologies A/S, or PTV. Panta Electronics has announced its intention to invest in PTV to strengthen product development and human resources. PTV's products mainly serve studio, transmission and TV set manufacturing requirements.

Microvitec has sold its monitors/displays division to Conrac Technology of the USA, a former marketing partner. The division made an operating loss of £2.4m on turnover of £11.4m in the six months to the end of June 1997, its worst result in seven years.

Satellite equipment supplier Longreach Group plc has bought Electrotech Distribution, giving it exclusive distribution rights to the Maspro brand in the United Kingdom and Ireland.

The Analogue TV Switch-off

The government has refused to announce a cut-off date for analogue TV transmissions but has ruled out a five year after the start of digital broadcasting option as not being practical. It plans a period of public consultation, and has accepted a National Economic Research Associates (NERA) recommendation to study the take-up of digital TV for two years before announing a cut-off date. The NERA study suggests a close down in 10-15 years' time.

Chris Smith, the Secretary of State for Culture, Media and Sport, has said "I would not wish to switch off analogue broadcasts until digital receivers are as universally installed in households as analogue ones are now." TV sets are replaced on average every eight years.

JBC has introduced the Advanced Series range of soldering stations. Temperature fluctuations of 70°C with conventional irons are reduced to 30°C, cutting job completion times by half. As the maximum working temperature is 350°C compared to 450°C, the risk of damage to adjacent components and the PCB is substantially reduced. Automatic rest-state registration leads to a dramatic temperature drop, thus avoiding tip oxidation – tips are claimed to last up to five times longer than with conventional irons. The integral stand enables tip cartridges to be changed quickly with the station fully operational – the working temperature is reached within two seconds.

For further details contact JBC Soldering Solutions Ltd., Marshall House, 255 Wellington Road South, Stockport, Cheshire SK2 6NG – phone 0161 474 0299, fax 0161 474 0288.

Digital Digest

Intel, Hitachi, Matsushita, Sony and Toshiba have developed a digital encryption technology to prevent illegal copying of digital information in recorded, transmitted or software form. It's applicable to CDs and DVDs, and can be used to prevent digital pay-TV transmissions being copied. The format is based on public and symmetric key cryptographic techniques. A code would have to entered before copyright material could be transferred from one device to another.

Subscribers to the French pay-TV service CanalSatellite can use a new interactive system called Zapfoot, which has been designed for viewers of French First Division football games. While one game is being watched, on-screen messages appear announcing significant events in other games: by pressing an OK button on the handset the viewer can automatically switch to the game relevant to the message.

Nokia has taken out a licence with internet pioneer Spyglass Inc. to use its Mosaic web technology in a new generation of set-top boxes. These will offer interactive services such as e-mail, internet access and home shopping. The Mosaic browser technology has been designed specifically for non-PC applications such as set-top boxes and internet phones. While most PC browsers require at least 10Mbytes of RAM, Mosaic requires only 3Mbytes.

John Edwards' Casebook

Ferguson 59P7 (ICC5 Chassis)

I've heard many disaster stories about repairing these sets, but the problems I've had to date have been quite straightforward – I bet I'll pay for saying that! This set for example was dead. One of the four BY255 mains bridge rectifiers was short-circuit, also the S2000A3 chopper transistor TP24. As usual the power supply area was full of dry-joints. It has been my experience with these sets that the best way to avoid bounces is to sit down, make myself comfortable and resolder all the power supply joints carefully, even the ones that look good – and don't forget the posistor in the degaussing circuit. After doing this and replacing the faulty components I powered the set via the variac. As all was well, a direct connection was made to the mains supply. Again the set worked correctly.

When the set had performed faultlessly on soak test for eight hours I phoned the customer and collection was arranged within the hour. The instant I put the phone down the set went dead – including the channel indicator. I bet you know that sinking feeling well. With the set back on the bench, I removed its back and switched on. It came to life straight away, without any hint of trouble. I tapped this and prodded that but the set behaved faultlessly. "Oh dear" I thought, "now what?"

Lady Luck was with me however, or most likely felt sorry for me. As I brushed against the mains lead the set went dead again. It could be switched on all right, so I wiggled the mains lead and heard a faint arcing noise in the mains plug. I felt mixed emotions when I removed the mains plug's top cover and gazed inside. Stupid of me – surely by now I've learnt always to check customers' plug wiring. This one was potentially lethal. The live and neutral screws were very loose, and the insulation on both wires had been stripped back to the cable grip. How on earth they didn't touch each other is beyond me.

As I finished making good the plug and refitting the set's back cover the customer arrived. He paid up cheerfully and, as he departed with his set, he glanced back and said "do you fix hairdryers – ours keeps going off and on".

"Did you put the plug on?" I asked.

He nodded to indicate that he had.

Smiling politely, I suggested that he should check the wiring.

Toshiba 21417B

This was an interesting fault. The customer complained that there was no sound. In fact I could just hear very faint sound with my ear close to the speaker. The volume can be adjusted by a rotary control beneath the control flap – this was turned to maximum – by the handset's up-down buttons and, of course, the mute button.

A finger and screwdriver blade hum test at the input to the TDA1015 audio output chip IC621 proved that it was OK. So I connected my scope to the TA7680 IF chip's audio output pin 2. There was plenty of audio here. Thus encouraged, I traced the print to pin 15 of the TDA1524 chip IC620. This is a stereo or two-channel tone control chip that should provide a mono output at pin 11. There was no output here. To prove that IC620 was faulty, I checked that its input and output were AC coupled then linked pins 11 and 15 together. Sound blasted from the speaker. A new TDA1524 chip restored normal, controllable sound.

Hitachi CPT2176 (G6P Chassis)

This set was dead apart from a faint squeal that came from the power supply. When I disconnected one end of L795 to isolate the line output stage the power supply delivered the correct 110V output. From the outset I suspected the line output transformer, which in fact tested faulty. But with the transformer removed the power supply refused to work at all. I decided not to worry about this until a new transformer had been obtained and fitted. The following day I fitted the new transformer, reconnected L795 and switched the set on. Apart from the need to adjust the first anode and focus controls all was well.

Looking at the circuit diagram, I noticed that the winding connected to pins 1 and 2 of the LOPT provides feedback to the power supply. I assume that it provides pulses to synchronise the operation of the line output stage with that of the power supply, and that this is the reason why, with the transformer missing, the power supply didn't work.

Mitsubishi CT2525

The fuse and the 4·7Ω, 5W surge limiter resistor R901 were open-circuit. The 2SD1887 chopper transistor Q901 and the 3V zener diode D909 were short-circuit. I read somewhere that if you get a low resistance reading across D908 and D907 the TEA2164 chopper control chip is suspect. I did, so I replaced the chip as well as the other parts. I then resoldered numerous suspect joints in the power supply area. It was finally switch-on time. As usual, I brought my trusty variac into operation.

The set fired up normally and produced a good pic-

ture and sound. But after a few minutes I sniffed something cooking. After switching off I checked the chopper transistor with my finger to see if it was being asked to pass too much current. It was far too hot. I decided to check its 47µF base drive coupling capacitor C906. A multimeter resistance check suggested that it was OK, a reading of 32µF was obtained with the capacitance meter, but a scope component tester display showed that it was definitely very leaky. When I fitted a replacement, rated at 105°C, the power supply operated at normal temperature.

Ferguson FV62LV

In either the E-E or the record mode the picture would intermittently disappear into snow, as if the aerial had been disconnected. The cause of the problem was immediately obvious once the top cover had been removed, or so I thought: the tuner connections to the PCB were all badly dry-jointed. Almost open-circuit in fact. But resoldering them made little difference.

Closer examination revealed that the aerial socket's centre conductor had broken off inside the tuner module – because the customer had been frantically wiggling the aerial and RF leads in the hope of getting his picture back. Another job for MCES.

Orion D3100VP

The owner of this centre-mounted deck machine (I'm not keen on them either, Jeff) complained that the playback picture would disappear into snow for a few seconds then right itself. The machine could work for days without the fault putting in an appearance. "Oh dear" I thought, looking at the four VCRs and two TV sets on the soak test bench. Fortunately the fault appeared within minutes of my selecting play. One thick, snowy noise bar developed across the centre of the picture: it spread out to fill the top and bottom of the screen, then retracted to the centre again. This display was repeated three more times, with the sound pitch varying. Then, as the customer said, everything was back to normal. I thought about the possibility of missing or low-amplitude control pulses and cleaned the audio/control head. Then the machine joined the others on the soak test bench.

I connected a monitor, inserted a tape and prepared myself for a long wait. In order to start at the beginning of the tape, I selected rewind. The nature of the problem then became immediately obvious. The capstan rumbled then emitted an ear-piercing, high-pitched squeal as its speed increased. I though it was going to disintegrate, and hurriedly pressed the eject button.

Accessibility above and below the deck is, fortunately, good with this machine. Once the capstan shaft circlip, the three retaining bolts and the bottom cover have been removed, the capstan flywheel can be gently withdrawn away from the stator PCB. If you get this problem you will see a brown stain on the shaft where lubricant was once present. I used a cotton bud and methylated spirits to return the shaft to its original shiny finish, then lightly greased the base of the shaft and reassembled the machine. I was rewarded with quiet reel functions and no more capstan speed variations.

NEI 2891 (CE25 Chassis)

To say that this set was dead was an understatement. Its power supply had suffered a severe headache, and I wondered whether it was going to pass this on to me. As I peered down at the lifeless power supply section of the chassis I noticed the charred remains of two resistors and a bulging electrolytic capacitor that was just waiting to burst.

Some quick resistance checks seemed to indicate that there were shorts and open-circuits everywhere. It looked as if it was a nightmare. As the customer was there in front of me I decided to warn him. "It's not a while-you-wait job" I said, "you'll have to be prepared to spend £80 or £90" – hoping that he would take the set away. But no. "OK", he replied. "when will it be done? It's the wife's only pleasure you see."

I decided that the best plan was to check every component in the power supply individually, either by lifting a leg and measuring the resistance or, with capacitors, the leakage. Transistors were checked by desoldering two legs and checking for shorts. This method enabled me to draw up a list as I progressed. It sounds like a long and laborious approach to fault finding, but took only about a quarter of an hour.

The list of definitely failed parts was as follows: Tr100 (SGSIF344) chopper transistor, D104 5·1V zener diode and TDA8380 chopper control chip all short-circuit; IC100 (TCTD1101) optocoupler diode section leaky; R102 (0·22Ω) and R109 (13·7kΩ) both burnt out; and C122 (22µF, 100V) very leaky. I replaced these items then powered the set via my variac. I was delighted when it burst into life and all was well.

Philips G110 Chassis with S-VHS

The customer complained that there was no sound when the input connection was made via the two S-VHS phono sockets. Audio connected via the scart socket was OK. I had visions of spending the day carrying out scope checks in complicated switching circuitry, so I decided to have a cup of tea to clear the head then go about the job logically. Well, it might start off that way, before frustration and guesswork took over.

The basic circuitry involved is shown, in simplified form, in Fig. 1. Audio input via pins 2 and 6 of the scart socket is presented to pins 2 and 12 of the HEF4053 audio switching chip IC7905. The S-VHS audio inputs go to pins 1 and 13 of this chip. The selected output appears at pins 14 and 15 and is then passed to pins 18 and 20 of the TDA8425 audio processor chip IC7260.

I disconnected the scart plug to view the S-VHS audio conditions. Signals were present at pins 1 and 13 of IC7905, but there were no outputs at pins 14 and 15. So pins 2 and 12 were permanently connected to the outputs. Fortunately the switching control inputs at pins 10 and 11 were OK. This meant an internal fault within the chip, which was confirmed when a replacement restored correct switching and S-VHS sound.

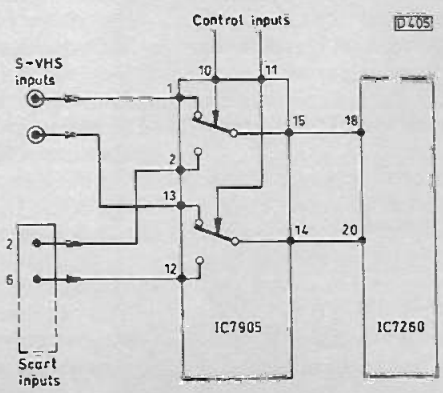
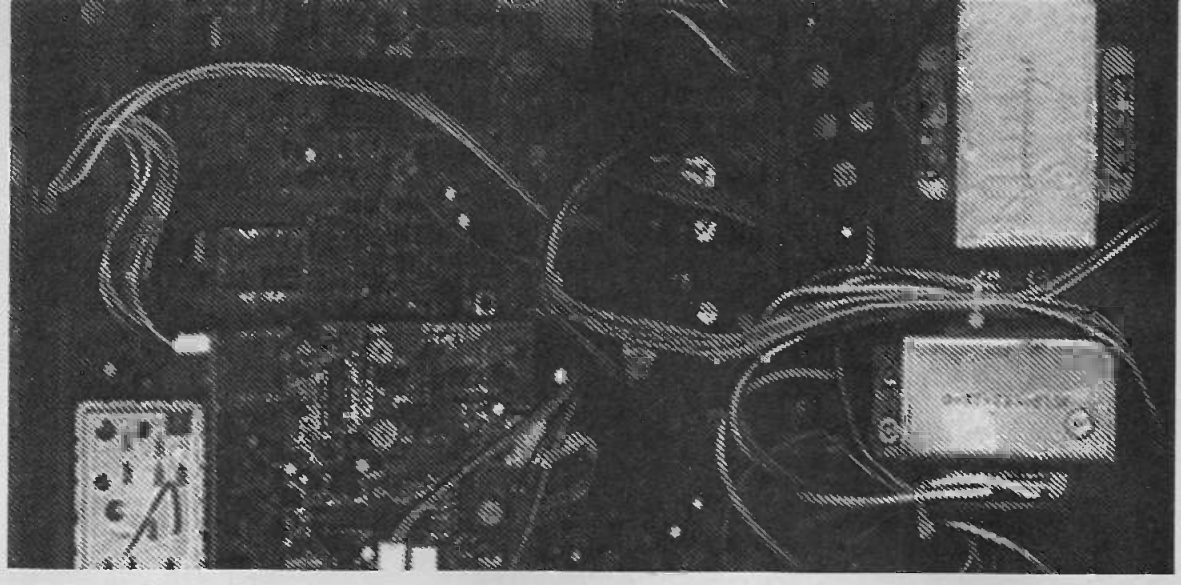


Fig. 1: The audio switching arrangement used in versions of the Philips G110 chassis with S-VHS provision.



Satellite Notebook

Reports from Hugh Cocks and Chris Watton

Pace SS9200 Power Supply

You find that the BUT11A chopper transistor Q1 has gone short-circuit and replace the usual components, especially C9 (1µF). If you then find that the receiver fails to work and the LEDs blink on and off faintly, check the value of the 0·22Ω current-sensing resistor R13. It usually goes open-circuit when Q1 fails, but can go high-resistance instead. In once case recently R13 read in excess of 4Ω, though it did not look distressed.

The clue with this fault is the fact that the LEDs blink on and off with no noise from the power supply. If they blink on and off and a distressed 'pinging' sound comes from the power supply, the cause of the trouble is more likely to be a short across one of the LT lines.

In view of the service that these receivers have now provided, the mains bridge rectifier's reservoir capacitor C7 (47µF, 400V) should be replaced whenever one of these receivers comes in for repair. If C7 is open-circuit the receiver may refuse to start or fail again within a very short time. A common symptom is a 50Hz buzz from within the box with a hum bar on the screen. You will often find that C7 is bulging at the top and maybe has a split plastic covering as well. A neaby lightning strike can finish it off, leaving the rest of the receiver intact.

When a customer brings one of these receivers in for repair I ask, wherever possible, for the mains lead – if it's of the detachable Pace type – to be brought in so that the condition of the mains plug can be checked. Any poor contact here can result in sparking and early failure of the power supply.

There are lots of dubious two-pin, three-way adaptors in this part of the world (Portugal). To confuse matters they are called "triplers". Some have the same habit as their TV namesakes, internal sparking, which is unfortunate for any chopper power supplies that happen to be connected to them. We supply a known good-quality three-way adaptor to those in need of one because they lack mains outlets. But this has to plug into the mains socket, which may also have bad habits – especially if elderly! **H.C.**

Off-air Software

Off-air software downloads for the Pace DVR500 receiver used with the Dutch Multichoice package started some months ago – mainly for changing the menus from English to Dutch and adding the Canal Plus logo (formerly Filmnet).

Further downloads are now available. They take about eleven minutes. With the latest one the receiver will provide teletext operation (previously not possible). The free-to-air channels, which were previously blocked, also become available together with a selection of ten 'Home Channels'. These can be set individually for default frequency, symbol rate and error correction values: for example 12.012MHz frequency, 27,500 symbol rate and 3/4 error correction is the Home Channel for Multichoice. By going into the installation menu the user can scroll through the home channels and reprogram them if required.

You can normally find whether a software upgrade is available via the installation menu. You are then asked if you wish to proceed, the process taking about eleven minutes.

One or two DIY customers have had problems and have managed to 'crash' the receiver during the upgrade process. On-screen menus are not available to restart the process, but the receiver can be forced to take a new download via the front-panel buttons. The procedure is as follows.

Power up the DVR500. When dL starts to flash on the front panel, press the standby button. The d then stops flashing but the L continues. Next press the – button. The d will start to flash again then stop. At this point press the + button. There will then be a continuous dL display and the mail message LED, which is labelled with an envelope symbol, should light for five seconds.

The upgrade should then start. Its completion is indicated by rA showing in the front display, which is a sight to behold during the upgrade, with all manner of wondrous seven-segment LED display combinations!

Don't start an upgrade during bad weather, when there is a likelihood of signal attenuation or a power cut, as you may have to do it all over again. **H.C.**

Cambridge LNBs

We've had problems recently with two new Cambridge universal LNBs. They both produced the same symptoms. For a few minutes they would work normally, then the signals would gradually become weaker with lots of on-screen patterning. Torque screws hold the inner screening cover in place. In both cases tightening the

screws cured the fault. The patterning no doubt arises as the LNB warms up and the case expands slightly.

The cover serves two purposes. It provides the cavity area for the local oscillators – high- and low-band with a universal LNB – and screens the low-noise amplifier section. The latter is prone to instability should the individual stages not be properly screened, as output signals will feed back to the input stages.

Tightening the cover down does not affect the LNB's output frequency (the space between the tuning screw and the resonator disc in the local oscillator cavity sets the exact output range). I've checked this with both pretuned analogue and digital receivers: after tightening the cover down the output has been spot on – even with the receiver's AFC switched off.

Do the tightening carefully: tighten the screws gradually, in turn. Don't overtighten one while the rest are still semi-tight, as the cover may not sit properly over the PCB.

Previous (non-digital) models didn't require the cover to be so tightly fastened, though the same problem could arise with early Continental Microwave (CMW) LNBs – especially in the summer months when the case expanded because of increased temperature.

Some non-digital Cambridge LNBs, both the larger- and smaller-cased models, suffer from intermittent output after quite a long period of trouble-free operation. The cause is normally a dry-joint between the F socket's pin and the PCB assembly. The pin seems to loosen from the original soldering: again, case expansion and temperature possibly play a part in this. **H.C.**

UHF Interference

A Philips-branded four-output LNB (Astra low/high band at any port) produced spurious signals across the UHF band, right down to 470MHz. Normally this would not have mattered, but a UHF distribution system was in use and some of the mess coincided with one of the local UHF channels.

The customer had brought the LNB from Holland. As a mixture of analogue and digital receivers was in use throughout the house a four-output LNB had to be used. But we didn't have a replacement, and a cure was required.

The interference occurred with only the high-band feeds, when the local oscillator runs at 10·6MHz. The Astra analogue band is from 10·7GHz upwards, so I suspected that the frequency difference was coming down the cable.

Four IF/RF diplexers were fitted near the dish (ignoring the diplexers' 'RF' side), one at each output, to act as 950-2,150MHz bandpass filters. This solved the problem – by removing signals below 950MHz from the IF lines. **H.C.**

Pace Apollo 120

One of these units was reported to be dead. In fact the red LED at the front was pulsing slowly and there was a noise from the chopper transformer. The cause of the trouble was low HT at the primary side of the power supply because the mains rectifier's 47µF, 400V reservoir capacitor was faulty. To be safe rather than sorry I also replaced C59/60/61. **C.W.**

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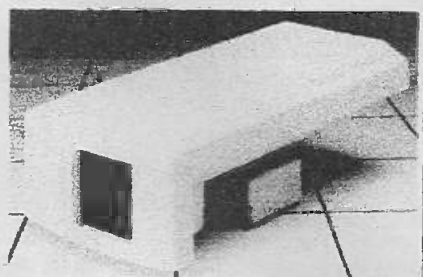

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INFRA RED POWERBEAM Handheld battery powered lamp, 4 inch reflector, gives out powerful pure infrared light! perfect for CCTV use, nightsights etc. £29 ref PB1

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Could be adapted for laser listener, long range communications etc. Double beam units designed to fit in the gun barrel of a tank, each unit has two semi conductor lasers and motor drive units for alignement. 7 mile range, no circuit diagrams due to MOD, new price £50,000? us? £199. Each unit has two gallium Arsenide injection lasers, 1 x 9 watt, 1 x 3 watt, 900nm wavelength, 28vdc, 500hz pulse frequency. The units also contain an electronic receiver to detect reflected signals from targets. £199 for one. Ref LOT4

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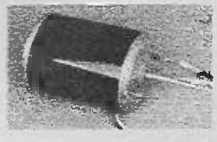
HIGH POWER DC MOTORS, PERMANENT MAGNET

12 - 24v operation, probably about 1/4 horse power, body measures 100m x 75mm with a 60mm x 5mm output shaft with a machined flat on it. Fixing is simple using the two threaded bolts protruding from the front



£22ea REF mot4

Monitors

Reports from
Gerry Mumford
Adrian Spriddell
D.H.E. King and
I. Field

Commodore JD144C

Apart from the fact that the front LED was lit this monitor appeared to be dead. The power supply was OK however and there was EHT. A check at the tube's first anode (G2) produced a very low voltage reading, about 20V. The associated decoupling capacitor C938 (10nF, 2kV) was leaky. G.M.

Apple Performa Plus M9102Z/D

If one of these monitors comes in dead except for the front LED blinking very slowly, check the BY239-1200 diode D6513 in the line output stage. It tends to become leaky.

If, apart from four-five scattered lines, the height is reduced to about 1cm at the bottom of the screen, replace the TDA4860 field output chip IC7402.

You also come across these monitors with Philips and RM-Nimbus badges. G.M.

GoldStar CQ440

There was very low contrast. R749 (270kΩ, 0·125W) in the contrast potential divider network was open-circuit. G.M.

Compaq Presario 14SV, Model 476

This monitor powered up all right. But there was no line sync and it squealed loudly. A clue was provided by the fact that the front LED was out. This led to a check on the main 5V supply, which was low. The cause of the trouble was dry-joints at the 7805 regulator IC202 – despite the fact that it was securely glued. G.M.

AST LR14

These monitors always seem to have the same fault – they come in dead because the 2SC3885A line output transistor Q312 is short-circuit. The cause of this is the associated 6·8nF, 2kV tuning capacitor C322, which is sometimes dry-jointed but more often short-circuit and burnt up. As this capacitor has such a bad failure rate it should always be replaced. G.M.

Action Electronics SVGA

This monitor was dead. We found that the following components in the power supply had failed: C105 (100µF), C111 (1µF), R102 (270kΩ). R103 (820kΩ), Q101 (BUZ90A), BD101 (RS205) and, of course, F101 (2·5AT). We also had to replace C522 (47µF) on the CRT base panel. A.S.

Philips 4CM2789/22T

The cause of this monitor's failure was traced to ring cracks around the power supply feed plug pins on the line output panel. A.S.

Taxan SV787LR

Another dead monitor. The 2SC4742 line output transistor and C828 (47µF) in the power supply had failed. Once we'd replaced these items and got the monitor powered up safely we were confronted with the field collapse symptom. The TDA1675A field timebase chip had to be replaced as well. A.S.

Amstrad PC14M39 (Tatung Y2 Chassis)

There was no raster. To check whether the power supply or the line timebase was responsible I broke the print track between the line output transistor (TR407) and transformer and added a 40W bulb as a dummy load. There was no improvement, and checks in the power supply failed to reveal any faulty components.

When I removed thyristor D821 in the start-up circuit, as suggested in Russ Philips' article (December), the power supply and lamp pulsed. This suggested an overload somewhere. I decided to check by feeding in external supplies. When an input to the 21V supply reservoir capacitor CE820 was increased to 9V the current was over 2A. This didn't produce any smoke, but my finger was blistered when I checked the TDA8146 pincushion correction chip IC405.

A new TDA8146 chip and reconnection of TR407 and D821, followed by a soak test, proved that all was now well. D.H.E.K.

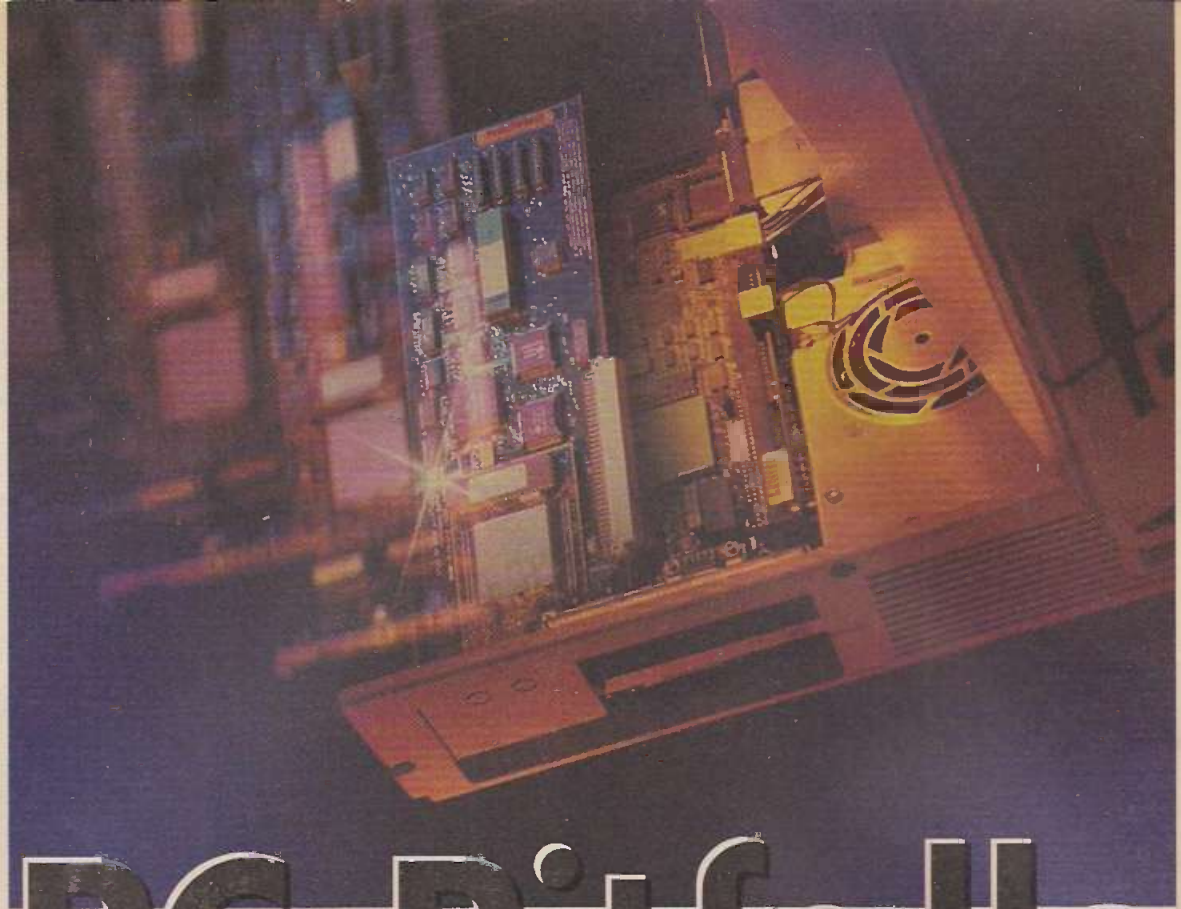
Sordata CMC1412ADE

The problem was field collapse – a horizontal line across the screen. As this monitor is very awkward to work on, I decided to carry out a full run of cold checks, starting with the field flyback boost diode and capacitor. They are clearly marked, which makes it easy to identify the LA7830 field output chip's supply pin and then check back to the voltage source. No problems here. So I replaced the flyback boost diode – this device can check OK but still not work! Again no luck. On closer examination however I noticed that there was a dark ring around every soldered connection to the LA7830 chip. The joints were therefore remade.

This monitor is even more of a pain to put back together, so I was relieved to discover that the fault had been successfully repaired. I.F.

NESS – Club Model 500A

The job sheet said "no mains". In fact the TDA4605-type power supply was making a very quiet but brisk wheezing noise. The cause of the trouble turned out to be a tiny pinhole in the silicone-rubber insulating washer beneath the line output transistor. I had to polish the surfaces of both the heatsink and the transistor to avoid the pitting marks on them leading to a new weak spot on the replacement washer. I.F.



PC Pitfalls

Colin McCormick on the problems that can arise when assembling or upgrading an IBM-compatible PC

In Part 1 last month I dealt with processors, motherboards and memories. We now move on to the various cards etc. required.

Video Cards

Pentium class motherboards and some later 486 boards have PCI as well as ISA slots. Earlier 486 motherboards may be fitted with a VESA (Video Electronics Standards Association) local bus (VLBUS) slot instead or as well. Video cards that plug into either PCI or VESA slots run much faster than those that fit into an ISA slot, but VESA ones are now obsolete. Don't even consider using an ISA card if you have an alternative – even text applications will suffer from poor performance.

Video cards are often the cause of problems unfortunately. It's quite common to plug a perfectly good video card into a perfectly good motherboard and find that it works badly, not at all or crashes on some applications. Updated video card drivers that may or may not resolve the problem are sometimes available on the internet. Often the only solution is to try a different type of card.

If a PC fails to boot up after it has been physically moved, I would start by checking that the video card is properly seated in its PCI, VESA or ISA slot. The monitor cable is often fairly heavy: the forces it can impose on the video card can make this flex and fail to make proper contact. For this reason if no other, I don't recommend moving a PC around the desk while it's switched on.

Even a cheap PCI video card will nowadays be supplied with 2Mbytes of RAM on board. This will provide a reasonable selection of resolutions and colours with Windows. 4Mbytes will provide very high resolution, such as 1,600 by 1,200 pixels. This is suitable for a larger monitor. It's best to get all the memory you require at the time of buying the video card, since obtaining the correct type of memory to update the card at a later date can be difficult and expensive. Some cards take decidedly strange types of memory.

To get the best from a video card, particularly with Windows, be sure to install the drivers that come with it. I would also recommend installing Quickres in Windows 95. It comes in the Powertoys freebie add-on that can be downloaded from the Microsoft web site and allows for resolution changes without restarting Windows 95.

Many video cards, some with pretty sexy sounding names, are available from hundreds of manufacturers. Some of the biggest names in video cards, such as Cirrus Logic, S3, Trident and Tseng, may not make any cards themselves. They make the chip sets, which are built into video cards by companies all over the world. This makes product support pretty hopeless. The chip set manufacturer's web site will usually carry the latest driver software, but the manufacturer will make it clear that support for video cards cannot be provided. A video card from a well-known manufacturer such as Diamond, Matrox or Hercules may be just as prone to compatibility problems as any others. In fact they sometimes use the same chip sets as the cheaper no-brand cards, though you might suppose that better technical support will be available should problems occur.

I use a 4Mbyte video card made by an unheard-of company. It's based on the 128-bit Tseng ET6000 chip set. The price was modest at £60, there are no crashing problems that I am aware of and the performance standard is very high. It's quite long however, so there could be col-

lisions with components on some motherboards. Video cards based on this chip set (ET6000) work fastest when fitted with at least 2·25Mbytes of memory – in practice 4Mbytes is best.

Floppy Drives

Compatibility problems with floppy drives are rare nowadays: for many years 1·44Mbyte, 3·5in. drives have been the norm. 2·88Mbyte floppy drives were available for a time, but they never caught on.

LS120 (or A:) drives have appeared on the market recently: by using special discs, they provide 120Mbyte capacity and higher data-transfer rates than conventional 3·5in. discs. They can also read/write standard 3·5in. discs at an improved speed. It looks as if these drives will become the future standard format. For back-up work they certainly seem to offer more functionality than the Iomega 100Mbyte ZIP drive.

Motherboard manufacturers seem to have been a bit slow on the uptake however. Many motherboards will not work with them, or won't allow the machine to be booted up from one. If the system cannot be booted from an LS120 drive, a standard 3·5in. drive will also be required – otherwise you face the prospect of much hassle should booting from the hard disc fail. Bear this in mind before deciding to fit such a drive.

Tape Streamers

I know of a small business that asked a national PC supplier for a computer quote and was given quotes for all sorts of extras such as high-power speakers and 3D video cards. What was really required was a tape drive (tape streamer) so that if the hard disc crashed or the PC was stolen there would be a back-up to enable the firm to get running again quickly. Only a tape drive can back-up an entire machine at an affordable price. One should be fitted as standard to all but games machines. The most common type uses QIC (Quarter Inch Cassette) tape: an extended version is known as Travan. More expensive units may use 4mm and 8mm data tape.

The motherboard section in Part 1 last month touched on a common problem when fitting a tape drive: most tape units use a floppy interface and require a data rate of at least 1Mbits/sec in order to work. So fitting such a drive might call for the addition of a tape accelerator card, which can be expensive and will occupy one of the ISA slots. Although this is a common problem, some units such as the Iomega 2Gbyte drive do not even provide a sensible error message. If you do fit a tape accelerator card, it will provide improved performance over most floppy interfaces. Alternatively you could use an external tape unit connected to the PC's parallel port.

A few tape streamers use the hard disc IDE interface or an SCSI (Small Computer System Interface), but these tend to be costly. Older tape streamers with less than around 1Gbytes capacity may be able to use a slow floppy interface, but units of this type are now virtually obsolete and are difficult to obtain. If you can find them the Iomega Ditto 800 and HP Colorado T1000 are suitable.

Incidentally the Iomega 2Gbyts drive uses ouly pre-formatted tapes. If you want to format one later, because errors are building up, you can't – you must buy another special tape. I would avoid this particular drive. The HP Colorado 3·2Gbyte drive is a better deal.

A unit called a Danmere Backer enables a computer to back-up data on video tape using a VCR. I have to say that because of potential DMA (Direct Memory Access) channel clashes with sound cards and scanner units I cannot recommend it. In addition it makes high demands of the VCR – at top data rate Betamax VCRs seem to work better than VHS ones. If you do decide to use one of these units, use only top-quality tapes – otherwise the data will deteriorate with time.

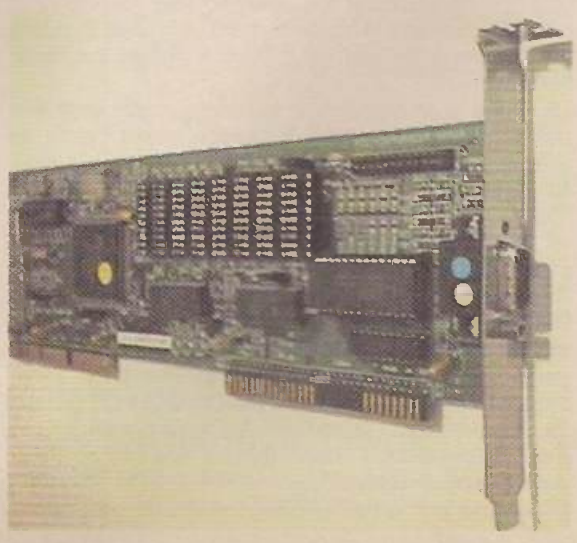
Some people view Iomega Zip drives as a back-up system. They are not really suitable for this purpose. The 100Mbyte drive is too small for some back-ups and uses special discs that are likely to become expensive as LS120 drives take this market over. The 1Gbyte drive is fine but is very expensive in comparison with a tape drive. Iomega Zip drives are more suitable for use when you need to move data from one PC to another: an external Zip drive can be plugged into a PC's parallel part to get a lot of data moved quickly. So they are more relevant to specialist business use than for domestic back-up purposes, where a tape drive offers batter value for money.

Hard Discs, CD-ROMs

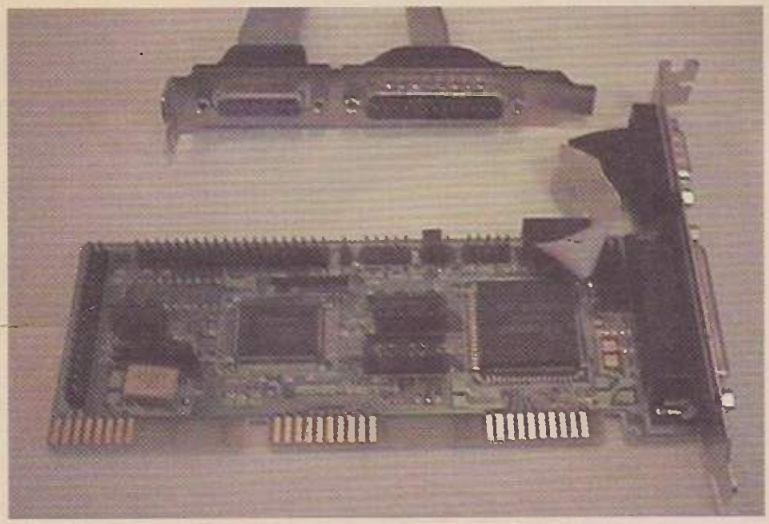
Old 486 and earlier motherboards may not be able to support larger drives, over 528Mbytes, properly. A Pentium class board will not have this limitation. Software patches to overcome the problem are available on the internet or sometimes from the hard disc supplier. The IDE interface will almost certainly be built on to the motherboard, so installation is usually as simple as allowing the motherboard's BIOS to auto-detect the drives.

With Pentium class motherboards there are typically two IDE channels, each supporting up to two drives, allowing four in total. Some 486 motherboards have the same arrangement, though many require an IDE or I/O port card to be plugged in via an ISA (slow) or VESA/PCI slot. The latter will work faster only when the driver software for the IDE interface is correctly loaded – yet many so-called professionals neglect this vital step when setting up a machine. The impact on performance can be dramatic. Motherboards with a built-in IDE interface do not usually require driver software to make full-speed use possible, but there may be some exceptions.

Be wary of fitting a very old IDE drive (as a slave for example) to the same IDE cable as a modern IDE drive (as master). Modern drives all use extensions of the original IDE specification – they are sometimes referred to as EIDE (Enhanced IDE) or ATAPI (AT Attachment Packet Interface). Older drives do not work with these, so connecting one via the same cable as an EIDE drive will result in the newer drive dropping this function, becoming much slower. In addition an older drive might not be correctly auto-detected by the BIOS, with the



A VESA video card.



Typical I/O card for an ISA slot.

result that you would have to enter the drive parameters (cylinders, tracks, sectors) into the BIOS set-up screen manually. If you have fitted one to the second IDE channel you are unlikely to have even this option.

Newer motherboards such as those with TXPro and Intel TX chip sets support Ultra DMA/33, which is a new, higher-speed version of the IDE interface giving improved access with an Ultra DMA/33 hard disc.

Most hard discs come in a 3·5in. form factor to fit in the same sized bay as a 3·5in. floppy disc. Quantum Bigfoot drives have a larger, 5·25in. form factor. If space permits, they represent fantastic value for money.

Incompatibility problems with hard discs are relatively rare but not unknown. The sort of thing that can occur is a 386 machine failing to run Windows 3.1 in enhanced mode when one particular type of hard disc is installed, or that a particular hard disc won't master or slave with another on the same cable. Another problem can be that the machine starts to boot then announces that there's "no basic ROM, system halted", leaving you nowhere!

Links on the hard disc enable each one to be set as master or slave, so that two can be fitted to the same cable. Sometimes you will see a link labelled CS (Cable Select). In practice I've found that this tends to put the drive into the slave mode, but this may vary.

I don't intend to go into detail with software related issues here, but will mention that hard discs with greater than 2Gbytc capacity are causing problems. Most versions of Windows 95 require such a drive to be partitioned as smaller drives. A very new version of Windows 95 may work but some applications, particularly disc management ones, may become confused and either fail to work or trash the hard disc data! It seems that Windows 98 will solve these problems (or make them worse?).

A common arrangement is to have a master hard disc and slave CD-ROM. But be careful about fitting an older IDE CD-ROM in this way: it can seriously slow down hard disc data transfer. If you are using an older IDE CD-ROM, such as a double-speed one that's not ATAPI compliant, it would be better to connect it to a sound card that has a CD-ROM IDE connector rather than the hard disc cable. CD-ROM connectors are not fitted to many modern sound cards however, and you need to be aware that as well as (or instead of) the IDE connector there may be connectors for Panasonic, Sony, Mitsumi or SCSI CD-ROMs. Modern CD-ROMs and sound cards have connections for analogue audio and direct digital links. Connect these if you can obtain or make a suitable cable.

Many modern motherboards can detect the presence of an IDE CD-ROM automatically. This gives the option of booting the machine from CD-ROM. The driver software that comes with the CD-ROM should still be installed. A new CD-ROM drive will usually be despatched with the links set for slave mode operation, on the assumption that it will be connected to the same channel as the PC's main hard disc. If you already have two IDE hard discs, you will be connecting the drive to either a sound card or the secondary IDE channel, in which case the CD-ROM links need to be set to master mode. Set to slave mode if you have three hard discs and the CD-ROM is the fourth IDE device.

Most hard discs have links for master (often labelled DS or C) and slave mode (maybe labelled D or a C with a bar over the top) operation as well as cable select (CS), and perhaps a place to put a spare link (SP). There should not be a single-drive only link position, but some manufacturers manage to confuse the issue by including one.

I/O Ports, Modems

Modern motherboards have their serial and parallel interfaces on board. Older ones require I/O cards (usually with the hard disc and floppy interfaces included) to be plugged into an ISA. VESA or PCI slot. Perversely, only the very old ISA type interface cards are now readily available. So if you blow up a serial or parallel port on your motherboard you may be as well to buy a new motherboard. ISA cards often have a slow serial port that will run at only up to 19,200 baud, which is way below what's required for effective connection to a modern high-speed modem. For several years now the standard has been to fit serial ports that are compatible with the 16550A Fast UART (Universal Asynchronous Receiver/Transmitter) standard.

All recent motherboards and interface cards have parallel ports that can work in the bi-directional mode. This is vital for connection to many modern printers as well as other external parallel devices such as scanners, tape streamers and the type of PIC chip programming interfaces commonly used to program decoder cards for D2-MAC satellite receivers. Some ISA cards may have only a uni-directional parallel port. Extensions of the original parallel-port specification are EPP (Enhanced Parallel Port) and ECP (Enhanced Capability Port). The latter may require the use of an IRQ (Interrupt ReQuest) vector and/or DMA channel.

I am not a great internal modem enthusiast. For one thing you can't see the lights, so you don't know when the device is active. And complicated wiring may be needed to connect the telephone. In theory an internal modem prevents tying up a serial port, but in practice it may be difficult to use the freed serial port since the modem will use the same IRQ vector as the serial port. Because of the lack of IRQ vectors, getting more than two serial ports to work in a machine is generally very hard work.

The central processor uses interrupts to stop processes. Since the processor has only one interrupt, expansion is required. A pair of Programmable Interrupt Controllers (PICs) can handle up to eight interrupt channels which are connected together in a master/slave configuration. A typical set of IRQ vectors is shown in Table 1.

You may need to juggle this about somewhat if you add ISA cards, such as tape streamer accelerator cards or scanners, that require IRQ vectors. Windows 95 would like to do all this for you – and if you have the latest PnP (Plug 'n' Play) motherboard and cards it might just do so! Very often you can spend hours juggling IRQ links when adding hardware.

Some devices require DMA channels. The only one normally used by DOS is DMA2 for the floppy disc. There are seven usable DMA channels, with DMA4 employed for cascading. A typical PC uses DMA1 for the sound card, but DMA channels can, like IRQs, be in short supply when several ISA cards are plugged in – particularly as 8-bit cards have access to only DMA1-3. Some devices will share DMA channels and IRQ vectors successfully. Experimentation may be the only way to find out.

The latest thing in motherboards is the USB (Universal Serial Bus), which is intended to overcome the shortfalls of using serial ports. When the manufacturers of peripherals finally get their fingers out, it will be possible to connect your mouse, keyboard, scanner, modem and a host of other external items to these connectors. You will even be able to fit and disconnect them without rebooting the PC. Most modern motherboards have a connector or two for this, though you may have to buy the cable to make the connection out to the case. I cannot tell you what kind of sockets are used as I still haven't seen one!

Conclusion

This article may have put you off the idea of building or upgrading a PC. That was not the intention. The great strength (and weakness!) of the IBM compatible PC is that it lends itself to home building and upgrading – unlike the Apple Mac and other types. But incompatibility problems do arise, so if you are thinking of building a PC try to get all the parts from one source. Even better, get the supplier to confirm that they all work together.

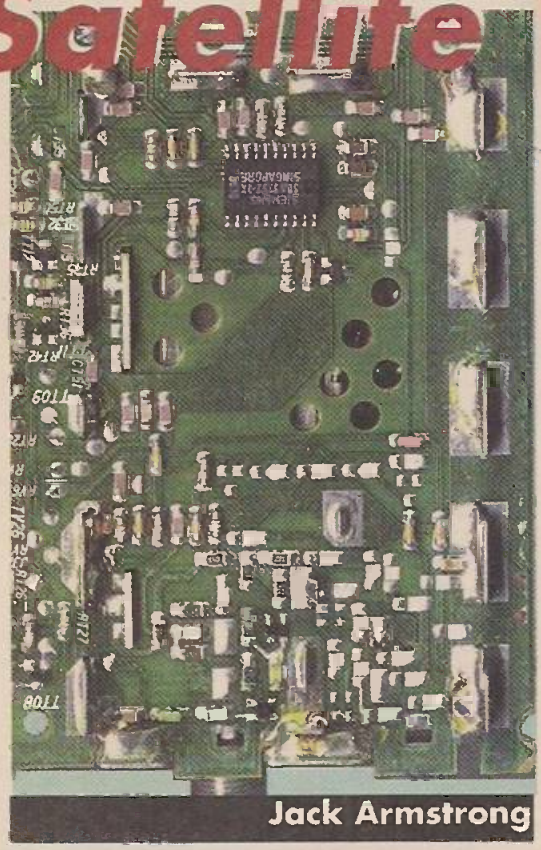
You can find a great deal of information on this subject by using a good internet search engine such as www.excite.com to look up particular keywords. A site I can particularly recommend is www.sysdoc.pair.com which is full of detailed upgrading information in plain language.

When upgrading a PC there is almost no way of knowing whether your intended upgrade will work perfectly, though it usually will. If it doesn't work correctly it may not be your fault – so try not to take it personally!

Table 1: IRQ Vectors

IRQ-0	System timer
IRQ-1	Keyboard
IRQ-2	Cascade interrupt to slave PIC
IRQ-3	COM 2
IRQ-4	COM 1
IRQ-5	LPT 2 if fitted. Often used for sound card
IRQ-6	Floppy disc
IRQ-7	LPT 1
IRQ-8	Real time clock/calendar
IRQ-9	Cascade interrupt from master PIC
IRQ-10	Unassigned
IRQ-11	Unassigned
IRQ-12	PS/2 mouse if fitted
IRQ-13	Math co-processor
IRQ-14	Primary IDE controller
IRQ-15	Secondary IDE controller if fitted

Satellite Workshop



Jack Armstrong

Ferguson SRD4

This old model gave sterling service in its day. But, not being Astra 1D compatible, it is hardly worth spending money on an SRD4 nowadays. Some customers have more money than sense however (fortunately for me!). The nice old lady merely grinned at my suggestion "to use it as a door stop" while handing me a crisp fifty pound note.

Armed with this incentive, I decided that the SRD4 was worth saving after all and connected it up to see the fault for myself. The symptom was two test bars and the words "no signal" on the screen. There was no sound or picture on any channel, though the LNB voltage was correct. I've known a broken F connector solder joint to be the cause of this fault, also failure of the pnp transistor TP71, but with each of these conditions there's no LNB voltage.

Another common cause is failure of the SDA3202 IC, which handles the frequency synthesis operation for the tuner. It's a surface-mounted device which is beneath the board, behind a screening can. Unless you have the proper equipment, some patience is required to remove it successfully. Fortunately I have the equipment – and I also still have quite a few of these ICs in stock, though the device is now obsolete. You can always rob one from an old Ferguson BSB receiver, or order one from SatCure (01270 753 311).

A quick check on the voltages around the chip convinced me that it really was the cause of the fault, so I fitted a replacement. This produced pictures that were far from perfect. Unfortunately, once the electrolytic capacitors in an old receiver have cooled down they tend to give up the ghost. The result is usually severe picture interference, which seldom disappears when the receiver has warmed up again. The only answer is to replace the electrolytics. With this particular receiver I had to fit a dozen new capacitors before acceptable picture quality was achieved. I think I'd earned my fifty quid!

Pace MSS508-IP

Two of these units arrived from a local dealer with precisely the same symptoms, "intermittent 'motor error' and broken diagonal lines that swim around the picture". It didn't take me long to see that the top of C263 (1,000µF, 63V) was bulging. This electrolytic capacitor supplies the positioner board voltage in the 508-IP and the Dolby board in the MSS1000.

Replacement with an ultra-high reliability type capacitor is recommended, and that's what I used. The original interference had now been cleared, but in its place there were more diagonal lines with soft edges. I fitted the complete RELKIT10 (01270 753 311 for details) without curing this fault and was close to jumping up and down on the receiver when a customer walked in with an Amstrad model.

"Think me LNB's dud, but can you just check this fer me to be certain, ta?"

Obligingly, I disconnected the MSS508 and connected up his Amstrad receiver. It worked perfectly but, curiously, precisely the same interference was present on the screen! Think. Ah. I'd been using my PaceLink system to download the MSS508's memory contents and the computer monitor was next to my TV. The interference lines were coming from that! A whole hour had been wasted! Thank goodness the customer had arrived when he did.

"Why weren't you here an hour ago?" I asked, grinning.

"Sorry" he said sheepishly, "I had to do the shopping fer the missus." With that he grabbed the receiver, slapped a fiver on the counter and ran.

"Oh" I began, "I er didn't mean to . . ." But he'd gone. I only wanted to apologise. Now I'll have to spend his fiver!

Pace Prima

Every once in a while I get a visit from my rival repairman, Wossname, who has a shop up Church Street. He used to call in more often, then I stopped giving him cups of tea. Now he appears only when a receiver has him well and truly stumped and his customer is threatening legal action.

"Blue screen, no signal" he announced as he handed me a Prima PCB assembly. He knows I hate it when people bring me unprotected boards like this, so he does it on purpose. The problem of course is that the assembly is very easily damaged by static electricity or by knocks. I much prefer to have a complete unit with its case for protection.

"Saves you taking the screws out" he grinned. "Keeps costs down too."

"Leave it with me" I said. I can't work with him looking over my shoulder.

"Busy are we? OK, see ya later."

There was plenty of evidence of his meddling. Brown flux everywhere, hiding a multitude of dry-joints. I cleaned the board and tidied up the soldering before testing it. Then, sure enough, most channels produced just a blue screen.

The factory-reset doesn't alter the individual channel tuning with this model, but it can sometimes clear corrupted bytes in the 24C16 EEPROM. So I pressed the relevant

handset button sequence – menu 0 store > <. The receiver then produced good pictures and sound. Too easy. The EEPROM chip was actually quite hot to touch, though its 5V supply was correct. I decided to replace it as a precaution.

As an excuse to charge more I fitted a preprogrammed 24C32. This provides 250 channels instead of 125. It wouldn't do to undercharge old Wossname!

Fidelity SR950

The model that replaced the Amstrad SRD545 was the SRD700. It also appeared as the Fidelity SR950 Plus. The customer's complaint with one of these receivers was of "poor pictures". She was right. When the channel was changed the screen remained blank for several seconds before a semblance of a picture appeared. There were sparklies and wavy lines everywhere. In fact the display looked like VCR playback when the tracking is wrong or the heads are worn. Scrambled channels remained unwatchable.

As there was some improvement when I used my hairdryer to heat the tuner assembly I decided to investigate this first. It contains all the video and audio processing circuitry: some surface-mounted devices and a few electrolytics are hidden inside. The service manual includes a circuit diagram. But as there are few component designations on the PCB it's not too helpful. A new tuner costs more than £50, so this wasn't an option!

I had another, non-working tuner, so I used this as a reference A start was made by connecting electrolytic capacitors in parallel with those in the faulty tuner to see the effect. This could be done without desoldering the tuner from the board, a daunting task! When another 10µF capacitor was soldered across C41 there was a dramatic improvement: the sparklies disappeared, leaving a reasonably crisp but dull picture. There were still no decoder messages, and I could see that the video level was too low.

Turning RV901 on the decoder board to the fully clockwise position provided a temporary cure – decoder messages appeared, and I was able to get a Channel 5 TV picture and also Sky programmes with a card inserted. But all encrypted pictures had horizontal white lines scattered across the centre two thirds of the screen. These disappeared when another 10µF capacitor was connected across C68, while the video was brought back up to the correct level by soldering a 10µF capacitor across C69.

To remove the tuner module is a tedious job at best, with the risk of damage to tracks and pads. So I left my parallel capacitors in place and, with a sigh of relief, screwed the receiver back together. The capacitors don't look very tidy, but they will probably last twice as long as the originals and it minimises the cost to the customer.

Jack Armstrong is willing to try to sort out readers' satellite TV receiver problems via e-mail. You can reach him via the internat 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.

Test Case 424

How much easier and simpler workshop life would be if there were no intermittent or spasmodic faults! Come to think of it, many more of our problems would disappear if there were no customers, just equipment. The customers pay our wages however, so we have to accommodate ourselves to their foibles and failings . . .

Our subject this month is a certain Hitachi VCR, Model VTF770, which had a very nasty intermittent fault. On rare occasions it would run at the wrong speed – "sometimes fast, sometimes slow" we were told, and at the same time the speed indicator would flip between SP/LP. That was as good as any user description is likely to be. No sample tapes were provided to give us any clues. We put the machine on an extended soak test: during many long hours the fault wouldn't put in an appearance, which is a not unusual situation.

Now Hitachi capstan motors can give both mechanical and electrical trouble, so TechnoCrat took out the motor, separated its rotor and stator/board components and cleaned, polished then lubricated its shaft and bearings. Once the motor had been reassembled and reinstated it ran very freely. So TC, fingers crossed, sent the machine on its way.

It came back with the same fault of course, but took three weeks to do so, such was the fault's shyness. This time it came with a sample tape that had been recorded while the fault was present, and a better fault description from the user. TC had primed the user when he had returned it after its first visit. We now had a sample faulty recording and also knew that the machine would sometimes play a rented tape at fast speed, with noise bars across the picture and a fast, high-pitched sound accompaniment. Capstan going too fast perhaps?

There was nothing fast about the sound on the sample recording when it was played back by the machine or another one: indeed the sound reproduction was 'slow'. There was also a slow-motion effect with the picture, which was just visible on the monitor screen through the waves of snow caused by mistracking. The tape was now moving at the normnal speed: it was plain that at the time of the recording the tape had been moving a great deal faster. This accounted for the "sometimes fast, sometimes slow" report: in both cases the tape was running too fast, the effects seen depending on whether the machine was in the record or playback mode when the fault put in an appearance. The user could observe record performance only in the playback mode.

TechnoCrat tried to instigate the symptoms, which seemed to be caused by capstan speed runaway. He assaulted the motor and the servo chip with freezer and blasts of hot air, and attacked the same areas with heavy blows from a screwdriver handle. He also checked the capstan FG pulses and their path to the servo chip. Finally he approached top technician Sage, a gentler soul, who put the sample recording in the troublesome machine and then, using a screwdriver as a lever rather than a weapon, did something on the deck. The sound and vision returned almost to normal, with just a bit of instability and mistracking, but the speed was correct. This provided the vital clue! What did Sage do, and what was the faulty component? Figure it out for yourself, then turn to page 443 to confirm.

The concluding instalment in Mark Paul's reference guide to the terminology of digital TV

The Language of Digital TV

Part 2 last month provided definitions for digital TV terms arranged alaphabetically from A to M. This final instalment takes us through to zigzag scanning.

Node In IEE 1394 terminology this means a participant connected to the bus.

Non-uniform Quantising Method of quantising an analogue signal using unequally separated quantisation levels.

Orthogonal Sampling Use of a clock locked to the line frequency to sample a video signal, so that the samples obtained have fixed positions on a rectangular grid.

Orthogonality Property of a digitally-modulated multiple-carrier system when the spacing between consecutive carriers is equal to the inverse of the period of the modulating frequency. When this condition is met, the spectrum of any one carrier is at zero at the maximum value of its neighbouring carriers. This is the situation with OFDM.

P Frame/Picture A frame/picture which is coded using motion-compensated prediction from past I (reference) fields or frames.

Packet Consists of a header followed by a number of continguous bytes from an elementary data stream.

Padding The addition of non-significant bits, sometimes referred to as padding bits, to adjust the duration of an audio frame. Or the addition of a non-significant bit stream. sometimes referred to as a padding stream, to adjust the bit rate of a bit stream.

Payload The useful 184 bytes following the header in a 188-byte MPEG-2 transport packet.

Phasor The electrical equivalent of a vector. An electrical quantity which is obtained by combining two other electrical quantities of identical frequency but different phase and amplitude.

Pixel Abbreviation for picture element, which is the smallest element that can be produced by an imaging or display device. A picture element is defined as the size of the scanning spot at rest, i.e. one line high and one line wide. In digital TV, a pixel is the samllest picture area that can be described by the bit stream.

Prediction-in-picture Coding When a pixel signal value is estimated on the basis of the values of neighbouring pixels.

Presentation Time Stamp A packet header that may be included in a PES (packeted elementary stream) to indicate when a presentation unit should be displayed or made audible.

Presentation Unit A decoded MPEG picture or audio frame.

Profile With MPEG-2, the 'toolbox' used for video encoding.

Programme Clock Reference Transport stream time stamp from which the decoder timing is derived.

Programme Specific Information Data included to make it possible to demultiplex transport streams and regenerate programmes.

Progressive Scanning System used by computer monitors: the lines are scanned out successively within a frame instead of being interlaced.

Puncture Technique used with DVB-S/T transmissions. To reduce redundancy, only some of the bits generated by the convolutional coding are used.

Quantisation Conversion of an analogue signal value to one of a limited number of digital signal values.

Quantisation Noise Distortion that's introduced by the quantisation process. Usually has the appearance of superimposed noise. Also known as **Quantising Distortion.**

Read To extract data from a memory device.

Reed-Solomon Coding A code used for error detection and correction. With DVB it's the 'outer' part of channel coding. Sixteen parity bits are added to the 188-byte packets, enabling up to eight bytes per packet to be corrected. This is refered to as RS (204,188,8).

Reset Circuit action to remove any data left behind by previous processing.

Reversible Coding Coding system that enables the exact information to be recovered by applying the reverse process. Same as lossless compression, opposite of lossy compression.

Roll-off Factor Steepness of the filtering applied to a signal to limit its bandwidth.

Run-length Coding Where a code is used to represent a relatively long series of identical bits instead of transmitting each bit idividually.

Sampling Measuring an analogue signal at regular intervals prior to quantisation.

Scalability A decoder's ability to decode an ordered set of bit streams to produce a reconstructed sequence. Useful video is obtained when subsets are decoded. The first bit stream of the subset is known as the base layer, which provides the basic video information. Each of the other bit streams in the set is known as an enhancement layer. The base layer bit stream precedes the enhancement layer. This is an MPEG-2 technique that makes standard/high definition possible or improved reception in difficult signal conditions.

Scalability Profiles MPEG-2 layers, see Scalability. A spatially scalable profile gives improved resolution, an SNR scalability profile gives an improved signal-to-noise ratio.

Scaling Factor With MPEG audio, a 6-bit multiplying factor that's applied to each sub-band coefficient for the duration of a frame.

Scrambling With digital TV, alteration of the characteristics of the signal to prevent its unauthorised reception as clear information.

Simulcast Simultaneous transmission of a programme in two or more standards, e.g. PAL and DVB.

Simulcrypt Sending entitlement control messages and entitlement management messages for more than one conditional access system to provide reception with different types of decoder.

Slice With MPEG, a portion of the picture made up of horizontally consecutive macroblocks (see Fig. 1, page 330 March) – it's generally a complete row. Is used for intra-frame addressing and resynchronisation.

SNR Scalability Where the enhancement layers (see Scalability) contain coded refinement data relating to the DCT coefficients in the base digital video layer. This refinement data is used to improve the signal-to-noise ratio.

Source Coding Means compression. The coding operations involved reduce the quantity of data transmitted.

Spatial Capability Use of an enhancement layer to improve resolution. The enhancement layer contains predictions from the data in the base layer without using motion vectors. Layers can have different frame sizes, frame rates or chrominance formats.

Spectral Efficiency Ratio in bits/sec per Hz of a bit stream's bit rate to the bandwidth of the RF signal modulated by this bit stream.

Square Pixels Pixels obtained when the sampling results in the same resolution along the two axes of the picture, for example 640 x 480 pixels with a 4:3 aspect ratio picture.

Statistical Coding Digital signal coding that exploits the statistics of the signal to reduce the bit rate required for transmission.

Sub-band Coding Where the data stream representing a signal is split into a number of sub-bands by a bank of filters, with each sub-band individually coded.

Sub-band Sample With MPEG audio, the output from one of the 32 sub-band filters. The duration is 32 pulse code modulated samples, corresponding to 1 msec at a sampling rate of 32kHz.

Symbol With digital transmission this is the modulating information element. The number of bits per symbol depends on the type of modulation, for example 2bits/symbol with QPSK, 6bits/symbol with QAM.

Symbol Rate Number of bits transmitted per second.

System Clock Reference Time stamp, from which the decoder timing is derived, in an MPEG data stream. Synchronises the decoder and system clocks.

Table List of the information required to decode DVB transmissions or make decoding easier. Relates to MPEG-2, PSI and DVB-SI.

Thresholding With video compression the elimination of values below a given threshold to reduce the amount of information transmitted.

Time Stamp When a specific action, e.g. the arrival of a byte or presentation of a presentation unit, occurs.

Transform Coding Source coding (compression), where each picture is divided into sub-pictures, a linear transform is carried out on each sub-picture signal and the resulting signal is converted to digital form.

Transport Packet Packet of 188 bytes made up of four header bytes plus 184 payload bytes. Forms the basic block in an MPEG-2 transport bit stream, to which error correction is added.

Transport Stream MPEG-2 programme data stream.

Transport Stream Packet Header Data used to provide information about the transport stream payload.

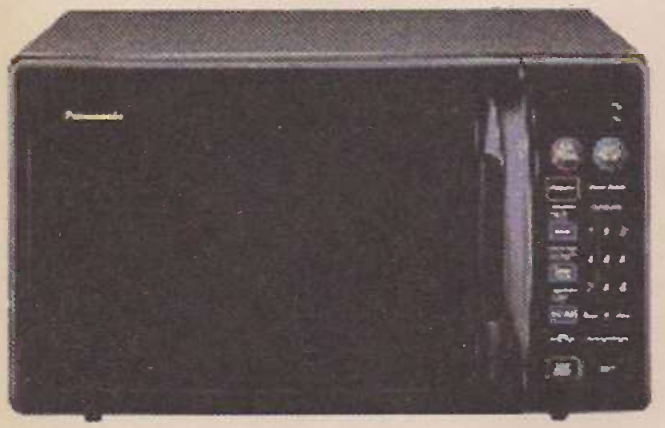
Variable Bit Rate Where the bit rate varies with time. Occurs during the decoding of a compressed signal.

Variable-length Coding Form of coding in which short code words are used for signal values that occur frequently while long code words are used for signal values that occur infrequently. One example is **Huffman coding**. Also known as **entropy** coding.

Video Sequence With MPEG, an uninterrupted series of groups of pictures that have the same basic parameters. The highest layer in the MPEG video data hierarchy. See Fig. 1 page 330, March.

Write Store data in a memory device.

Zigzag Scanning The DCT (discrete cosine transform) carried out in video compression results in a matrix of 64 coefficients. This matrix has to be scanned to convert it to a serial bit stream. Carrying out the scan in a zigzag manner, starting with the lowest frequency (DC) coefficient and ending with the highest, provides a data flow that is best suited to the next compression steps, run-length and variable-length coding.



What's Cooking?

J. LeJeune takes a look at the operation and servicing of microwave ovens, including the vital safety considerations

Technically the microwave oven occupies a place between domestic electronic and electrical equipment. It relies on an electronic device, the magnetron, to produce the microwave energy, and usually has an electronic control system. It also requires mechanical switches and cutouts and motors. The microwave oven is an immensely popular appliance, and thus represents a good business opportunity for service departments wishing to extend their field of activities.

The heart of the oven is of course the magnetron, a form of thermionic valve that was first developed in the Twenties. In its earliest form it consisted of a diode with a coaxial anode and filament which were mounted between the poles of a magnet. Operation of all magnetrons relies on crossed electric and magnetic fields. The more modern form, the resonant-cavity magnetron, was developed in the UK in the early Forties. As a source of high-power pulses for radar equipment, it made a substantial contribution to Allied military success during World War II.

In a microwave oven the food to be cooked is bombarded with RF energy at frequencies between 2,450-2,458MHz (12cm) and powers ranging from 650-1,000W. Bombardment of the food makes the atoms of which it is made vibrate and collide with each other, thus generating heat. This kind of cooking, like conventional heating, works from the outer surface of the food inwards. RF cooking, using frequencies at around 60MHz and the induction principle, heats food from the inside outwards. Both methods are very efficient and rapid. The results differ from those obtained with radiant heating because there is no browning of the food – unless special containers are used in the oven to convert the RF energy into radiant heat.

Fig. 1 shows in block diagram form the basic microwave oven arrangement.

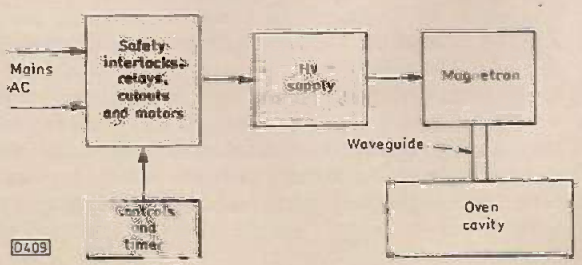


Fig. 1: Basic microwave oven block diagram.

Warning

The first important point to note is that microwave ovens are hedged around with safety devices. They should, therefore, not be interfered with by anyone who does not understand their operation. Such interference may well introduce a health hazard. This fact means that the competent, qualified electronics engineer is the ideal person to undertake any repairs and maintenance required, including safety checks. We will return to the vital matter of safety later.

The Magnetron

The magnetron is a highly efficient generator of microwave energy. Fig. 2 shows the basic resonant-cavity magnetron configuration. The device's cylindrical cathode is mounted inside a cylindrical anode block that contains a ring of cavities. Each cavity is identical, and is the equivalent of a parallel tuned circuit resonant at

the operating frequency. A strong magnetic field is applied, in parallel with the anode and cathode. As a result, the electrons emitted by the cathode follow a helical path as they move towards the anode instead of moving across radially.

There are helical current flows within the cavities as well as between the cathode and the anode block. The currents are all in phase. As the electrons in the cathode-anode path pass the cavities, they create an unstable condition, i.e. oscillation. A small magnetron of this type can generate high-power radiation: one that can easily rest in the palm of your hand can produce an RF output of 1kW. But because of the device's small size, forced-air cooling is required.

The RF energy for the oven is obtained by inserting a pick-up loop in one of the cavities. This loop feeds the oven cavity via a waveguide – a short stub 'aerial' links the loop to the waveguide.

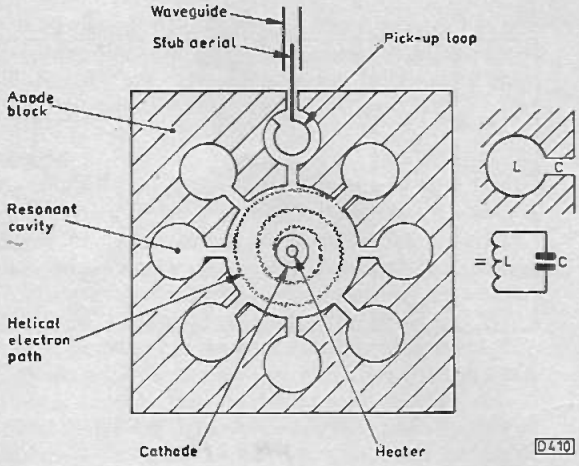


Fig. 2: Basic resonant-cavity magnetron arrangement.

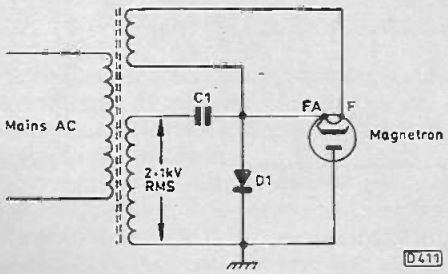


Fig. 3: Basic magnetron power supply circuit. D1 charges C1 negatively during the positive-going half cycles. When the voltage across the transformer's secondary winding reverses it adds to the charge across C1.

Basic Oven

The basic elements of a microwave oven are thus an oven cavity, a magnetron, its power supply and a control system. To make cleaning easy, modern ovens have a stainless steel cavity.

The magnetron has a combined heater-cathode assembly which is normally operated at about 3·3·6V, 10A. External links are usually made by spade connectors. You will probably find them marked F and FA. Since the cathode potential is at approximately –4kV DC, the terminals are contained within a ceramic insulator. The anode block is at chassis (positive) potential.

The magnetron power supply is a simple transformer plus rectifier and capacitor arrangement but looks unconventional, see Fig. 3: it's basically a half-wave-voltage-doubling circuit without a reservoir capacitor. The magnetron acts as a second rectifier. On the positive-going half-cycle of the AC waveform produced by the transformer's secondary winding diode D1 conducts, charging C1 negatively. During this half-cycle the magnetron (M) is reverse biased – and is shunted by D1. So it's held non-conductive. On the negative half-cycles the magnetron conducts, doubling the charge across C1. The average DC produced by this arrangement is somewhat less than the peak voltage as there is no reservoir capacitor. Its level depends on the capacitor's value and the AC waveform developed across the transformer's secondary winding. The transformer also has a heater winding for the magnetron.

Control of the cooking time is normally carried out by an electronic timer which might have several programs of varying degrees of usefulness. Early models used a clockwork timer which pinged a bell at the end of the cooking period.

The control system incorporates a comprehensive arrangement of safety interlocks, with a microswitch to cut off the power if the oven door is opened while the magnetron is in operation. Thermal trips in the oven cavity and on the body of the magnetron cut off the power should the temperature be excessive. We've come across several HV circuit protection arrangements, see later.

Safety

Microwave emissions are known as ionising radiation. A strict maximum level of allowable radiation leakage from a microwave oven is specified. People also have to be protected from themselves, so a microswitch operated by the oven door latch is an essential part of the safety system. This microswitch interrupts the supply to the HV transformer and stops the timer simultaneously. In most ovens the timer operation is simply interrupted: its count-down continues when the door is closed and cooking recommences.

A cutout mounted on or close to the magnetron's anode block is rated to go open-circuit at between 100-130°C. Another one in the oven cavity, to cater for overheating in the appliance, is normally rated at between 20-30°C higher than the magnetron cutout.

Spade connectors are mostly used, even in the HV area. Most are fitted with PVC boots to provide a degree of insulation.

Typical Oven Arrangement

Fig. 4 shows a simplified circuit of a typical microwave oven. Mains voltage is always present at the control panel, to power the timer clock, the timer itself and the control unit. This generally uses a microcontroller chip to supervise the application of power to the magnetron and run preset cooking programs and other features.

The application of power to the cooling fan, turntable motor and magentron is also supervised by the microcontroller chip, with relays to apply the mains voltage to the relevant areas.

In some ovens the 20W lamp used to light the oven cavity is wired in series with the turntable motor to provide a more mellow illumination and slow down the motor. The motor itself is not much larger than the type used in past times in synchronous electric clocks and mechanical timers. It incorporates a gearbox. A small device inside the gearbox stalls the motor and makes it run in opposite directions alternately.

The Power Supply

The HV capacitor has a value of 0·75-1·2µF and is rated at 2,100-2,250V AC (50Hz). It should be discharged before you dive into the interior of the oven with metal tools or bare fingers – a 1µF capacitor with a charge of 2kV can hurt! I use a discharging tool for the purpose. It contains a 33kΩ, 2W resistor in a PVC sleeve with crocodile clips at either end. When this is connected a

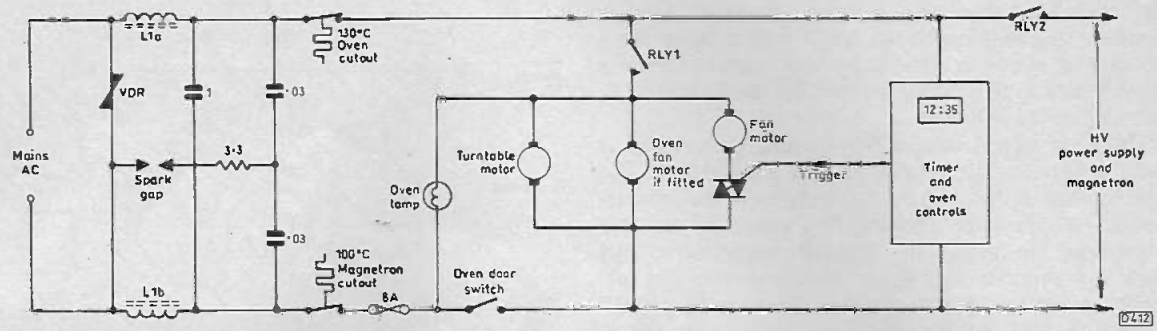


Fig. 4: Typical microwave oven circuit.

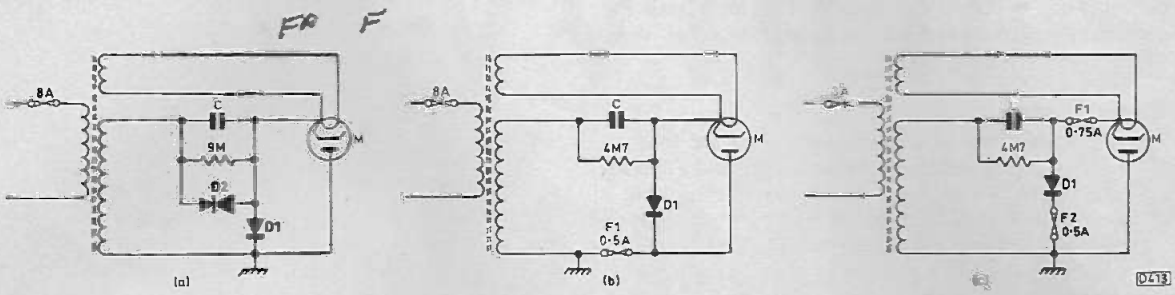


Fig. 5: HV fuse arrangements.

small spark is seen: I leave it in place for a few seconds to ensure complete discharge.

The magnetron's heater/cathode terminals are usually designated F and FA: the negative supply is connected to the FA terminal to avoid the anode current passing through the heater.

Fig. 5 shows various HV circuit protection arrangements. The one shown at (a) is widely used in Japanese oven brands. D2 is an asymmetric device that consists of two diodes connected back-to-back. Should an excess voltage condition arise in the transformer circuit one diode will go short-circuit and the other will conduct on alternate half-cycles. The excessive current flow will rupture the fuse on the primary side of the circuit. The alternative arrangements shown use an in-line fuse which is heavily shrouded in an insulating sleeve. Remember to discharge the capacitor before attempting to handle the fuse! The arrangement shown at (c) could be tricky if only F2 goes open-circuit, since the magnetron will continue to act as a rectifier and C could be charged to a considerable voltage should its shunt resistor have retired! The important point is: don't trust a thing.

Precautions

Do not operate the oven unless the door is closed, its hinges are OK, the RF seal is undamaged, the door itself is not distorted and the whole appliance shows no visible signs of damage. Your aim is to avoid exposure to microwave radiation.

Ensure that all internal connections are sound and that the waveguide flanges are properly gasketed and secure. The oven cavity should be spotlessly clean, and the oven should never be operated without a load – a jar of water will do. Never look into the waveguide when the magnetron is powered. You may be tempted to do this is you hear sparking from the magnetron's stub aerial. Such sparking is usually caused by standing waves in the waveguide because the oven cavity is empty.

One final tip may sound simple: to avoid heartache, remove your mechanical or quartz wristwatch before handling the magnetron – it may stop!

Testing

Testing and proving is a very important part of a microwave oven service.

A magnetron's output power can be checked simply by measuring the temperature rise in °C of one litre of water during an 87-second period of full power output from the magnetron. A magnetron usually reaches full power about four seconds after the clock button has been pressed, so the timer should be set for about 91 seconds of cooking time.

To determine the correct time lag from switch-on to full power, insert in the oven cavity a small neon lamp with its wires cut off close to the pinch seal – along with the pot of water. The type of neon indicator used in TV touch-tuning selectors will do. It will glow brightly at full power. Don't leave it in the cavity for very long – it may shatter. Experienced engineers know by the 'grunt' from the transformer just before the magnetron takes current. This noise is caused by the unidirectional current that flows in the secondary winding for a few seconds until the magnetron's heater reaches its operating temperature and the magnetron starts to conduct: the transformer's core becomes heavily polarised, with the result that the metalwork around it vibrates at mains frequency.

The power output is given by the temperature rise in °C multiplied by 50. Thus if there's a 14°C rise in the temperature of the litre of water over an 87-second period the output power is 50 x 14 = 700W.

The oven should be run at full power for over a minute before the test. The water used should not start at a temperature less than 17°C.

Another method, which is claimed to be more accurate, is to place two 500ml beakers of water at equal temperatures in the oven. Run the oven at full power for thirty seconds, then check the temperature rise in each beaker. Take the average of the two readings, then multiply this by 70 to get the power output figure.

For the perfectionist, the formula is

$P = (4{\cdot}187 \times V \times \text{the temp rise})/t$

where P is the power in Watts, V is the volume of water and t is the time during which the magnetron is on at full power. This test conforms to IEC 705 (1988).

The limit for microwave leakage is specified as a power of 5mW/sq cm at 5cm. I have yet to find a leaking oven! Use a calibrated meter and probe to carry out the test for this. Several instruments that fulfil the requirements laid down in the safety regulations are available from microwave oven spares suppliers.

It is important to check oven safety and power output after repair work has been carried out, before returning the oven to the customer. You can offer a leakage checking service to the public – this will form a useful addition to the services you provide. Impressive stick-on labels which say that the oven has been checked for radiation and output power are also available from component suppliers.

Control Circuitry

The control circuitry is usually microcontroller based. In the simplest ovens there is merely a timer to set the total cooking period and adjust the microwave power level. This involves switching the magnetron on for varying lengths of time depending on the average power required. A magnetron always operates at full power, but switching it on for three seconds in every ten amounts to 30 per cent power, and so on.

More sophisticated ovens have a humidity sensor that senses the steam which rises from certain ingredients to be cooked. This auto-cook facility works with only some foods – what they are is usually stated in the user's handbook. This feature is also supervised by the microcontroller chip. The sensor elements for the auto-cook facility are fairly expensive. Fortunately they don't often fail.

Spares

Like all active devices, magnetrons come in a bewildering variety of sizes and arrangements. However a 'smaller one' will satisfy most replacement requirements, while some component suppliers' catalogues include equivalents lists. Most magnetrons are reasonably priced, but for some reason the Brother AM730 seems to be priced at six to seven times the average.

The less reliable mechanical items are the interlock switches, door latches and the occasional relay.

Sparks inside the oven cavity usually mean the end of the cover at the mouth of the waveguide: it's a sheet of fireproof material which is transparent to microwaves and is included to prevent steam and food particles getting into the waveguide. It is usually made of a mica-based material.

Control panels that use a membrane keypad are prone to failure. So are the ribbon cables that connect them to the microcontroller panel. Eventually the membranes collapse and fail to operate.

Because of the high voltages and the unusual voltage and current waveforms in the magnetron power supply, there don't seem to be any meters that will provide useful checks in this area. The best indication you can get is to use an electrostatic EHT meter, but the measurements are not accurate and the needle barely moves from the rest position. I intend to see if I can develop a suitable meter.

What a Life!

The man from the hills with his 12V VCR, a miscellany of Hitachi CTVs and other problems. Donald Bullock gets them all

Our Spanish pad is supposed to be a refuge, an escape from our busy life over the years. It doesn't always work out like that.

No sooner had we settled to our after-dinner drinks the other day than Hillbill Shagg payed us a visit. He's a thin, bright-eyed and craggy-faced builder who grafts like a horse to earn his simple living and wears a multicolour, knitted tea-cosy hat. He'd come to lay a path, and brought with him an ancient 12V portable VCR.

"E's blowed up, I think" he rasped.

I opened it up while he watched. All the fuses were blackened.

"How did you manage this?" I asked.

I smokes the 'appy stuff.

"Generator trouble" he replied.

I set about fixing it while Hillbill talked. He told us about the remote spot where he lives, in the mountains. Someone had given him a tiny wing of an old country farmhouse. As there's no mains electricity he uses a moody petrol generator that delivers 12V for his lighting, his VCR and TV set. He has no TV reception, so the VCR is important to him.

Much to my surprise I managed to repair his VCR. But he brought it back a few days later, this time with his regulator. A spot of luck that, as this time the 12V regulator had failed. It uses a pair of 39Ω, 2W wirewound resistors which had been reduced to coke.

"What do you do out there when you can't watch your tapes?" I asked him.

"I smokes the 'Appy Stuff" he replied.

Cuthbert's Gadgets

Son James, who is just seventeen and studying for higher things, does a few repairs here in Spain. One of his more regular customers is Cuthbert Lord, an old-fashioned man who has dozens of electronic gadgets. Playing with them is his life, so they have to be all right. He calls James often, and pays him well.

His latest trouble has been with a Pace PRD800 receiver-decoder. "Every few days it goes 'suh', then 'bzzzz'" he complained. "Now that can't be right, can it?"

James brought the receiver in and carried out the usual power supply service. After giving it a good soak test he took it back.

A week later Cuthbert called him again. "Last night it went 'cha' just once. At twenty past eight. Can you come and look at it again?"

James did as requested. While listening for the noise he noticed Cuthbert's cat arch its back. Then it sneezed. 'Cha.'

"That's it!" cried Cuthbert, pointing to the Pace. "Take it in and get it absolutely right."

A few days later we saw Cuthbert at Tony's store. He was returning an electronic mosquito-killing machine he'd bought the day before.

"A mosquito flew into it at five past seven last evening. Then flew out and bit me."

Seeing whom it was, the shopkeeper bundled a replacement into his arms and led him to the door.

"Some mosquitoes around here are very tough" he said, "try this one."

Some Hitachis

When I returned to the UK I found that Steven was having trouble with an Hitachi C2118T (G7PS Mk 2 chassis). It had been in before with the same complaint – intermittent field collapse. On the previous occasion the cause had been the LA7835 field timebase chip IC601. This time the problem was worse when the set was hot.

When replacement of likely components failed to cure the trouble Steven decided on some prolonged voltage checks. The field timebase chip has two supplies, 9V for the generator section and 25V for the output section. The 9V supply comes from an MC7809 regulator, IC703. A check at the output from this regulator revealed the answer. As its temperature rose, the output dropped to zero. A new one put matters right.

Steven reckons that this device always runs hot in these sets. He fitted an extra large heatsink.

Paul was working on another of these sets. It was dead, and a check on the 82kΩ start-up resistors

revealed that one was open-circuit while the other read 100kΩ.

When they'd been replaced the set came on then died as the EHT rustled up. The cause was excessive HT. R909 (39kΩ) in the voltage-sensing circuit had risen in value to 43kΩ. A replacement restored normal operation.

Then Mr Cruddock brought in another Hitachi set, an older CPT2224 (NP81CQ chassis). I put it on the bench and powered it. There was a picture, but it was too bright on the left-hand side and a thin white line travelled up the screen. I had to start somewhere, and decided to check the field output stage in the hope of clearing the white-line fault. Just as well. The field output device (M601) sported a fine drop of dry-joints. Remaking them removed the line but left the uneven brightness. The cause of this fault was simply the reservoir capacitor for the HT supply to the RGB output stages – C715, 4·7µF, 250V.

When the set was given a soak test some spluttering was noted. Close examination revealed a dry-joint at one of the line output transformer's pins – the offset one that earths the body of the transformer.

Meanwhile Steven had yet another G7PS on the bench, this time a C2119T. Once again the fault was field collapse. In this case the 9V regulator's output pin had never taken to its solder blob. Resoldering put that right.

A Satellite Receiver

Our next customer was Ethel Smallbone. She had with her a satellite receiver-decoder.

"Up he went. Then my old man said 'Right, I'm off to the pub.'"

"Right" I said.

The front panel said Finlandia. Underneath a notice said Granada M/N92LR1/A. In fact it was a Pace PRD800 and the problem was the usual power supply blow up.

We replaced the TEA2018A chopper control chip, the BUT11A chopper transistor, the 4·7Ω surge-limiter resistor R1 and the 1A fuse, then the three electrolytics C5 (22µF), C7 and C8 (both 10µF). Note that you have to use 105°C, low-ESR capacitors in these positions.

This restored the receiver to life and Mrs Smallbone was happy to hand over a couple of blues.

Flemings

The door opened and a Panasonic TX2 (Alpha 1 chassis) came through on a pair of trotting legs. We then saw that they belonged to Norman Nutmeg, who stood there panting like a steamroller.

"If this 'un was full of Flemings I'd mend 'im myself" he told us. "Used to know my Flemings, I can tell you."

"Flemings?" asked Steven.

"Ah, you'd be one of the newer fellows" said Nutmeg. "Flemings – valves – after Sir Ambrose Fleming who invented the thermionic diode. Anyone could mend a set in those days, when you could pull out a Fleming and plug another one in. We mended our own sets then."

The Panasonic set was dead though alive – its display came on but the power supply didn't do anything. Paul dealt with this one. It didn't take him long to discover that the two 2SD965/R transistors Q801 and Q802 were both leaky. Q801 provides excess-current protection while Q802 provides stand-by switching.

No Colour

Another customer slid in and started to stroke the counter. I looked at him. He smiled and clasped his long fingers together.

"Could you possibly repair my set?" he asked.

I looked about him. "We could try" I said, "if we could see it."

"Oh, silly me!" he gushed. "it's in the car."

Paul went out and brought it in. Another Hitachi, this time a CPT1474 (NP84CQ Mk 4 chassis).

I pulled over a job card. "Name?" I asked.

He brought his face down to me. "Kenny" he said.

"Trouble?" I asked, "er, the set, I mean?"

"No colour" he replied, "but a perfect monochrome picture."

Steven tackled this one – said he'd had it before. He checked the supply to the colour control and found that it was correct and stable (12V). The voltage at the slider is smoothed and is then fed to pin 5 of the colour decoder chip IC501, where it should vary between 1·6-3·5V as the control is adjusted. In fact the voltage here was low at 0·6V.

When pin 5 of IC501 was disconnected the voltage rose. So Steven replaced the chip which made no difference. A check on the other voltages around the chip produced a low reading at the brightness control pin 11, which is decoupled by C511 (2·2µF, 50V). This capacitor tested all right, but a replacement cured the fault and restored the voltages.

A Dead VCR

Our final customer that day was an old, grey, stooping man though he sounded sprightly. He was carrying a Toshiba V204B VCR.

"Is Don Bullock still about?" he trilled.

"That's me" I said.

He stepped back, looked me over and drew his breath in sharply. "Good God" he muttered, then he straightened up.

"Remember Arthur Chickweed?" he asked, "that's me."

I looked at him in amazement. "Must be thirty years, how do I look?"

Arthur shuffled a bit, then pointed to the VCR. "Half dead and ticking" he said.

I looked at him sharply.

Paul tackled this one. He went straight to the power supply where he yanked out CP007. This 10µF, 50V electrolytic is part of the chopper transistor's base drive circuit. When a replacement had been fitted the VCR sprang to life.

"Here, you can't fit one of those things to me, can you?" Arthur asked as he paid up. Then he looked at me. "While you're at it, you might fit one to the old man."

I straightened up and took a keen interest in the cloud formation outside the shop.

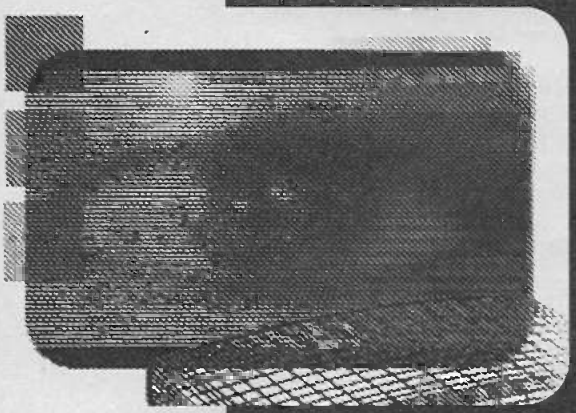
Requests

I've referred before to this magazine's many, many wonderful regular readers. When the editor kindly popped a Help Wanted request of mine into a recent issue, two came to my aid. Gerald May of Abertysswg, Rhymney, Gwent sent me a boxful of copies and asked for only the postage. James Lynch of Western Isles Electronic Services, Balivanich, Benbecula provided me with others.

James has the following issues available free to good homes: June, July, November and December 1987; January, February and April 1988; February 1989; July 1993; July, September and October 1994.

He needs the following issues: January, July, August and September 1989; March, April, July and August 1990. His telephone number is 01870 602 035.

And I need only the April 1985 issue to complete my collection. If you have one, please send it in care of the Television editorial office, Room L302, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.



TV Fault Finding

Reports from
Philip Blundell, AMIEEIE
Denis Foley
Adrian Spriddell
Eugene Trundle
Maurice Kerry
Stephen Leatherbarrow
Keith Evans
Michael Dranfield and
Giles Pilbrow

Ferguson ICC9 Chassis

There was no sound or picture. The set would come out of standby, try to power up three times then go back to standby. In the standby mode the HT supply to the line output stage (USYS) is 90V. Each time the set tried to power up the HT increased to 152V for one second then returned to 90V.

Checks in the line output stage showed that the HT was present but there was no drive. So checks were made at the relevant pins of the STV2160 chip IV01, which incorporates the timebase generators. Everything was normal here. When I followed the path of the horizontal drive output from this chip (pin 32) I came to transistor TL63 (BC848B) which was open-circuit. A replacement restored the set to life. **P.B.**

Grundig CUC5361 Chassis

"Picture shakes" was the complaint with one of these multi-standard sets. There was intermittent picture rolling, and when the picture rolled the colour intensity seemed to increase. If the colour was then adjusted using the remote control the on-screen bar graph changed from "colour" to "tint". I thought that maybe the set was going into the NTSC mode (60Hz field frequency).

The TDA8214A timebase generator chip IC520 should sense the signal's field frequency. If this is 60Hz, the state at pin 8 should change to let the microcontroller chip know. It wasn't changing, so my first guess was ruled out.

Two other possibilities sprang to mind. First, the remote control receiver can become noisy – the usual result of this is no remote control operation, though I have known the result to be front control lock-out or spurious channel changing. The other possibility was voltage or ripple problems with the microcontroller chip's supply.

The voltage was correct (incidentally the microcontroller supply is not always 5V – check which type of chip is fitted), but there was a ripple problem. So time was spent bridging electrolytics and replacing the 5V regulator IC686. I then noticed that the amplitude of the ripple measured at any point varied when the scope's chassis connection was moved from one place to another. This led to the conclusion that there was ripple on the set's chassis line.

The cause of this will be obvious to old-timers who can remember ITT CTV sets. The metal strengthening frame on which the main PCB is mounted is used as an earth path. There were dry-joints where the frame is soldered to the print. After a few minutes spent resoldering with a high-wattage iron the rolling had gone. **P.B.**

Philips K40 Chassis

There was sound but no picture: the EHT rustled up, the contrast and brilliance settings were not at minimum (as can happen when the Nicad battery is flat), and a field buzz could be heard coming from the scan coils.

Coloured rasters were produced when I injected a signal at the output pins (12, 14 and 16) of the TDA3561A colour decoder chip. The chip's 13V supply was present at pin 1, but there was no sandcastle pulse at pin 8. This pulse is produced by the TDA3576B sync chip. A new TDA3576B IC restored the picture. **P.B.**

Sharp 59CS03H (CS Chassis)

This chassis will come as a surprise to any engineer who has not seen one before. The PCB is very compact, being packed with surface-mounted components. For this reason Sharp offers an exchange service: you can buy a complete chassis at a fixed price as long as the PCB to be returned has not been damaged by inexpert attempts at repair. Sadly this option was not open to me: a neighbouring dealer had tried to repair the power supply, leaving the print in a sorry state.

A new chopper MOSFET plus R706, D718 and a couple of BC338 transistors got the power supply working with a dummy load. But the line output transistor was short-circuit, so there was still work to be done.

A new line output transistor failed to restore the picture – and there was a burning smell. The set was hastily switched off. DC checks in the line output stage revealed that the 13V supply rectifier D601 was short-circuit. With a new 1N4935 fitted in this position the picture came on, but was pincushion shaped – and the sound from both channels was distorted. Oh dear! The price of an exchange chassis was beginning to look very reasonable.

To reduce the dissipation, the field, audio and EW output stages all operate in class D. So a switching pulse fault seemed a possibility. D619 and D621 were both short-

circuit – but D621 was not shown on the circuit diagram. A phone call to Sharp technical revealed that later versions of the 59CS03 are fitted with the same chassis as the 59CS05. A look at the 05 manual supplied provided the correct diode types, and with replacements fitted the sound was OK and the picture a lot better. But the grey scale had a red tint.

The grey scale was perfect in the service mode. In the normal mode the picture was red. This was easy to deal with. The customer has a tint adjustment on the second page of the picture menu. It was set to warm. When this adjustment was restored to the centre position the final 'fault' had been corrected. **P.B.**

JVC C14ET1EK (Onwa Chassis)

There was no sound or picture, with field scan lines separating along the bottom of the screen. The 12V zener diode was short-circuit. It's a common fault with this chassis, which also appears in Alba, Bush and other models. I'd had the problem before, and also knew that C909 and C911 in the power supply have to be replaced to reduce the HT to a safe level. Otherwise the set will come back with the same fault after a week or two. It came back nevertheless.

"After a couple of days" the customer said, "there was a line wriggling along the bottom of the picture." I felt that this must be something to do with the previous problem, and measured the voltage on the 12V line. It was low at 11V. The fusible safety resistor R434 in the relevant rectifier circuit had increased in value from the correct 0·68Ω to 6·8Ω. It must have been rather stressed by the initial fault. Another item to replace as a matter of course! **D.F.**

Panasonic Alpha 1 Chassis

There was no sound or vision, either off-air or via the scart socket. The M51320P AV switching chip IC2601 was faulty. To check, remove the chip and connect a jumper lead across the input/output pin connection points – the set won't work at all with a leaky chip still in position. **A.S.**

ITT Digivision B Chassis

Various symptoms – dead or intermittently dead, reverting to standby or flashing on the picture – can be caused by the same problem. Check the mains input choke for cracks in the soldering around its pins. You'll find it next to the mains switch on the front control PCB. **A.S.**

Sony KVM2531U (AE1 Chassis)

There was lack of height with cramping at the centre of the screen. A check on the +27V supply to the field output chip showed that it was low at 20V. The usual cause of this, as here, is that R802 (0·47Ω) has gone high because D801 is leaky or possibly short-circuit. We have used an RGP15J diode as a replacement. **A.S.**

Ferguson 51J8 (TX99 Chassis)

If the problem is intermittent flashing and sparking, which looks as if the mains plug is loose, check for dry-joints at the bank of 1kΩ resistors (R254-8 and R234) at the bottom of the TACS board. They provide the feed to the ZTK33 tuning voltage regulator. **A.S.**

Fidelity CTV140 (ZX4010 Chassis)

There were four horizontal black bars across the picture. They became worse as the colour, contrast and brightness were increased. C45 (10µF, 50V) in the beam limiter circuit was leaky. **A.S.**

Hitachi C2114RE

Video playback via one of these sets was marred by bent verticals at the top of the picture. The problem occurred with bought or rented cassettes – the VCR's own recordings were OK. On Hitachi's suggestion C104 was changed to 22µF, 16V and C205 to 4·7µF, but this made no difference. I found that reducing the value of C701 to 3·3nF and C702 to 0·47µF, 50V solved the problem, but must emphasise that this is an unofficial modification of my own devising! Model C1415R uses the same circuit. **E.T.**

Sony KVM2171U (BE4A Chassis)

This set appeared to be dead. But the HT rail was at 144V, so the power supply was OK. The line timebase wasn't running however, because PS603, an N25 circuit protector, had gone open-circuit. Fitting a replacement cured the fault, and no cause for its failure could be found.

Sony has issued a modification, as follows, to prevent this failure: change PS603 to type N75 and fit two 5·6V zener diodes across IC603, one between pins 1 and 9 with its cathode to pin 1, the other from pin 9 to chassis with its cathode to pin 9. **M.K.**

Toshiba 2539D

Intermittent loss of sync and no remote control operation were the complaints with this set. Toshiba suggests that if the text PCB is a PB4600 the 27MHz crystal should be replaced. If the panel is not a PB4600, fit a 27MHz crystal. **M.K.**

NEI C25F1FXN

There was a blank screen though a rustle of EHT was heard at switch on. When the first anode control was turned up there was a blank raster with flyback lines. A check on the sandcastle pulses showed that there was a slow rise of the 0V DC level by about 1V between pulses. I eventually found that R121 (270kΩ) was open-circuit – it's near the line output transistor. **M.K.**

GoldStar CIT2168 (PC04A Chassis)

There was no sound or raster with the HT low at 50V instead of 118V. Replacing the 47µF, 160V HT reservoir capacitor C806S cured the fault. **M.K.**

Hitachi C2114T-311

If there is front panel control lock-up after half an hour or more, or the picture disappears when the set has warmed up, leaving a noisy raster with the controls locked, fit the updated microcontroller kit part number A523217. Links have to be changed and diodes removed – instructions come with the kit.

Note that the 4·194MHz crystal X001 can be responsible for the controls locking and the sound gradually breaking up and then disappearing when the set is hot. **M.K.**

Philips G110 Chassis

There were two faults with one of these sets (a Philips 28GR9772), poor field linearity and width variations. C2509 (2·2µF, 50V) was the cause of the first fault: it's in the field linearity feedback network. The second fault was caused by an intermittent width control (R3525, 10kΩ). When this preset was removed and checked it was found to have risen in value to almost 40kΩ. **S.L.**

Ferguson ICC8 Chassis

The problem with this set was poor focus, which improved somewhat during the course of an evening's viewing. When a new focus control

unit and even a complete CRT base panel failed to cure the fault we began to suspect the tube.

Fortunately a set with an identical chassis arrived in the workshop, so we were able to swap over the chassis temporarily. This proved that the CRT was OK. The cause of the fault turned out to be the line output transformer. An Orega 40308-11 was fitted, curing the problem. **S.L.**

Sanyo E4-B21 Chassis

There was no remote or front panel control. We checked the 5V supply to the M34300N4-627SP microcontroller chip IC701 and its 4MHz oscillator. No problems here. Pins 22-30 are the relevant address lines, and this is where the cause of the fault lay. Pin 22 was being held low by a leaky 6·2V zener diode, D743. It had reverse leakage, producing a reading of some 1·5kΩ. With the fault present the address line voltages were somewhere between 0V and 5V. When the fault had been repaired these lines were at either 0V or 5V, the correct situation. **S.L.**

Ferguson ICC6 Chassis

There was sound but no sign of a raster. Voltage checks on the CRT base panel revealed that there was something amiss with transistor TB11, via which the emitters of the RGB output transistors are returned to chassis. It proved to be short-circuit base to collector.

We've had to replace a number of line output transformers in both this and the ICC8 chassis. **S.L.**

Philips CP110 Chassis

The cause of intermittent low output from the power supply with pulsing, usually from cold, was traced to C2690 (100µF, 50V) which is mounted on a small subpanel. **S.L.**

Ferguson ICC5 Chassis

There were two complaints with this set (Model 51K7), intermittent failure to switch on and "lines at the top of the picture". The lines turned out to be a very expanded scan over the top four inches or so of the screen. Two components give a lot of trouble in the thyristor-type field output circuit used in this chassis, a 1·5kΩ resistor (RL22) and a 4·7nF capacitor (CL22). They are mounted next to the thyristor (DL21), being connected in series across it. This time they were OK.

The field output stage uses a winding on the line output transformer, while the field scan coils are connected to a 21V supply that's derived from this transformer. A scope check on this supply showed that lots of line-rate pulses were present. When checked, the reservoir capacitor CL52 had a value of around 1µF instead of 1,000µF. A replacement cured both faults. **S.L.**

NordMende F17 Chassis

The problem with one of these Thomson sets was intermittent start up. It was a very random fault. We eventually traced the cause to CL33 (10µF, 50V), which is associated with TL17 in the safety circuit. It's connected to pin 28 of the TEA2029C chip IL14, and had fallen in value. The chassis is similar to the ICC5. **S.L.**

Grundig CUC2600 Chassis

It was a relief to find that this dead Grundig set didn't require a major power supply rebuild. Some quick checks showed that there was HT at the collector of the BU546 chopper transistor though there were no outputs from the power supply. Before replacing the TDA4600 control chip we decided to check C631 (100µF) which couples the drive to the base of the chopper transistor. Its value had fallen dramatically. **K.E.**

Ferguson TX98 Chassis

"Would sometimes go off" the customer said. When the set eventually did switch off a quick check in the chopper power supply revealed that everything worked up to what, according to the circuit diagram, should have been the TDA8138 5V/12V regulator chip IC11. Instead, in this set there was a subpanel with separate 5V and 12V regulator chips. Close inspection showed that the 5V regulator was dry-jointed. **K.E.**

Toshiba 175T9B

Several key components in the power supply had failed, namely the STRD4420 chopper chip Q801, the R2M avalanche diode D808 (overvoltage protection), and the 6·2Ω, 7W surge limiter resistor R801. The cause of their failure was one of the line output stage tuning capacitors, C646 (680pF, 2kV), which was short-circuit. **K.E.**

Philips CF1 Chassis

There was reduced height with cramping at the bottom. Electrolytic capacitors are always favourite for faults of this type in sets of this age. After eliminating the two 100µF scan coupling capacitors I replaced the 4·7µF feedback capacitor C2403, which is connected to the slider of the height control. This cured the fault. **K.E.**

Ferguson ICC7 Chassis

I replaced a faulty mains on/off switch and then found that the set would die after thirty seconds to two minutes' operation. When checks on the major components in the chopper circuit were fruitless I carried out a close examination of the PCB and discovered a dry-joint at CP29, which is in the snubber network. The mains switch had failed because the customer had been repeatedly stabbing at it in frustration when the set kept switching itself off. **K.E.**

Toshiba 213R4B

The job card said "no sound". When I listened close to the speakers I detected some life in the audio stages, though the signal wasn't getting through. So it was a matter of tracing the signal path back from the audio output stage. This brought me to the TDA1524A chip IC620 which controls the audio signal level. A replacement restored the sound. **K.E.**

Philips GR1-AX Chassis

This set was allegedly dead, but I noticed that a low-level buzz came from the loudspeaker. The 95V HT and 5V LT supplies were OK, but the 9V supply was low at 5·5V. This supply feeds the audio output chip and also provides a start-up supply for the line preamplifier/driver transistors, via D6523 and L5524. This small choke had a crack along its body and turned out to be open-circuit. **K.E.**

Philips G110 Chassis

If the set is very slow to come on (about one minute) and won't switch off to standby, with the sound muting but a pulsating picture still present, replace R3617 (220Ω). It's on the primary side of the power supply providing, in conjunction with a parallel zener diode, the isolated chassis return path. You will usually find that this surface-mounted resistor has gone open-circuit when there has been a major power supply blow-up. **M.Dr.**

Sharp 66CS03H

This fairly new set (less than twelve months old) wouldn't come

out of standby. The cause of the fault was traced to ripple on the 5V supply to the digital ICs. C714 (1,000µF, 10V) was the culprit – it had gone low in value. Personally I would have liked to see a low-ESR, 2,200µF capacitor in this position.

A replacement cured the fault. But when the set is still under guarantee Sharp likes to have the faulty chassis back, supplying a complete replacement. So we had to refit the faulty capacitor and order a replacement chassis. Is this how Sharp intends to build up a fault pattern with this relatively new chassis? **M.Dr.**

Bush 2064NTX

If the fault is field collapse, carry out a scope check at pin 42 of the TDA8361 multifunction chip IC100. If there is no field-rate sawtooth waveform here, replace R149 (3·3MΩ). **M.Dr.**

Tatung 180 Chassis

There was very low sound and no line or field sync. The composite video signal was present up to pin 27 of the SAA5231 teletext chip, but there was no output at pin 1. This problem was cured by replacing the MAB8441P-T049 teletext microcontroller chip.

I now had correct sync, but there was still no sound. The TDA1524A volume/tone control chip on the sound PCB was faulty.

As the area around the tube's anode cap was very dirty, it seemed that the basic cause of the problems could have been EHT flashover. **M.Dr.**

Hitachi G7PS Mk II Chassis

High HT at switch on, with the result that the over-voltage protection diode ZD903 fails, is usually caused by the fact that R909 (39kΩ) has gone high in value. Exactly the same thing happens when C906 (4·7µF) dries up. It's best to replace both these items at the same time. Use an 0·75W metal-film resistor in the R909 position. **M.Dr.**

Ferguson ICC9 Chassis

The power supply blipped at switch on, i.e. the voltages at the secondary side of the circuit came up then the set died. The cause of the problem was the TDA8172 field output chip IF01: pin 5 had shorted to chassis. With the chip removed the set would cycle between standby and on – presumably the same symptom would be produced by failure of the field timebase. **M.Dr.**

GoldStar CIT4785 (PC08X8 Chassis)

The symptoms were a dark picture with slight field non-linearity at the top of the screen. I found that the HT reservoir capacitor C820 (10µF, 160V) had dried up. The chassis uses a TDA4601 type power supply. **G.P.**

Hitachi C25-P819 (G7P Mk II Chassis)

The picture would intermittently become a mass of lines at the centre of the screen. This could be instigated by flexing the deflection board. The cause was a dry-joint at C702, which is glued to the rear of the board near the timebase generator chip IC701. **G.P.**

Sony KV2756UB

The picture was shifted over to the left and was stretched towards the extreme right of the screen. I found that C805 (15nF, 400V) and R517 (27kΩ) were both open-circuit. **G.P.**

Letters

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, Television, Room L302, Quadrant House, The Quadrant, Sutton, Surrey SM2

Service Manuals

There have been several letters in recent months complaining about the high cost and poor quality of the service manuals provided by some manufacturers. On many occasions I've parted with considerable sums of money for the supply of a barely readable photocopy. There are other serious problems however.

Twice during the past month I've ordered a service manual which, on arrival, has turned out to have no circuit diagram. In both cases I was told, when I enquired, that the circuit is available as a separate item. But a circuit diagram is the most basic and essential piece of information in a service manual: what is the sense in selling a manual without one?

I find that many video manuals now omit mechanism timing information, which is again basic and essential. It seems that some manufacturers prefer to make us shell out for a mechanism as well as an electronics manual. Surely one basic manual with a couple of pages that cover the timing marks etc. is not too much to expect?

A further serious problem is that some manufacturers no longer include a full parts list in their manuals, possibly listing only the main parts and safety components. This can make it very difficult to order parts and saves only a few pages.

The poor quality, over-priced manual is a part of the poor customer service provided these days by many manufacturers, whose only concern seems to be with turnover and market share. But it must be a short-sighted attitude, as brands can soon get a reputation for inadequate back-up service. The public gets to know about this, especially when it leads to repair delays. It then affects their future buying decisions.

Shane Humphrey, LCGI, Bideford, Devon.

Back Injury

Many engineers in our industry have suffered back injury as a result of carrying TV sets single-handedly. I can supply a copy of the report by the Robens Institute on the dangers involved in lifting and carying TV sets. It runs to 18 A4 pages and the cost is £2.50. Anyone who wants a copy should send me a large stamped, addressed envelope and a cheque for £2.50.

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Doming

In the February issue (page 285) Jim Littler raised the question of shadowmask doming and the relevance of beam-current limiting circuits to this. Doming was a common enough problem with delta-gun tubes in days gone by, and all colour TV sets suffered from it to a greater or lesser degree. The problem has largely been eliminated with the advent of various types of slot-mask in-line tubes and improved manufacturing/design techniques for the shadowmask frame and suspension.

The effect is caused by heat, and a few simple calculations show why it occurs. Suppose that the EHT is around 20kV and the peak beam current is 1mA per gun for a white area of the picture. The beam limiter circuit can be expected to come into operation to restrict the tube's operation to a safe level when conditions of this sort are reached. But the DC power will be some 20W per beam, or 60W for the three of them. From memory I recall that some 60-70 per cent of beam energy is absorbed by the shadowmask. So this will be about 40W.

When this amount of energy is applied to a piece of metal little thicker than a razor blade it's obviously going to heat up rather rapidly. As a result it will expand. The trick with a shadowmask is to get it to do so linearly and in one direction, so that it will have minimal effect on beam landing. Careful choice of the type of metal used, precise manufacturing of this to control thickness and purity, and careful design of the shadowmask suspension frame within the CRT ensure that in general these conditions are met.

During an average-brightness scene, with beam currents of say 0·5mA per gun, the shadowmask will heat fairly smoothly and evenly. Expansion will be taken care of by the mask suspension system. As a result, if there is any change in beam landing accuracy it will be fairly minimal and spread over the whole screen face. It will not be noticeable with an average colour scene.

If a small area of the picture, say ten per cent of the total, is at peak white this section of the shadowmask will be subject to rapid heating in comparison with the surrounding area. The result will be non-linear expansion of the shadowmask material, with a 'bulge' at the peak white point. The bulge is dome-shaped, hence the term 'doming'. It results in pronounced beam mislanding: the white area takes on a 'dirty', hollow look after only a couple of seconds. With normal operation, in-line tube technology and modern design techniques minimise the effect.

– continued on page 427

LINEAR ICs/JAPANESE TRANSISTORS

Part	Price
TA8164P	100p
TA8184P	350p
TA8189P	130p
TA8200AH	325p
TA8201AK	300p
TA8205	220p
TA8207K	175p
TA8210	260p
TA8211AH	200p
TA8214K	260p
TA8215	300p
TA8216H	300p
TA8217P	120p
TA8220AH	500p
TA8221AH	600p
TA8225H	475p
TA8225L	475p
TA8227	250p
TA8229K	200p
TA8400P	200p
TA8410K	200p
TA8410P	200p
TA8432	200p
TA8605N	350p
TA8606N	350p
TA8607P	320p
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TA8646	375p
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TA8659AN	900p
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TA8701AN	275p
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TA8720	525p
TA8739P	450p
TA8872N	450p
TAA550	25p
TBA120S	40p
TBA396	70p
TBA520	120p
TBA530	100p
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TBA990	80p
TC5020	200p
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TC5082P	170p
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TC9125BP	410p
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Part	Price
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Part	Price
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TDA6612-2	900p
TDA7000	170p
TDA7010T	120p
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TDA8360N3	800p
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TDA8362N3	1200p
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TDA8380	200p
TDA8385	275p
TDA8390A	650p

Part	Price
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TL083	55p
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UC3842N	80p
UC3843	125p
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UPC20C	220p
UPC554	130p
UPC555	60p
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UPC571	220p
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Part	Price
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UPC1018	170p
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UPC1023	60p
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UPC1025	230p
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2SA684	25p
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2SA706	140p
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Part	Price
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Part	Price
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Part	Price
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2SB601	60p
2SB605	25p
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2SB632	45p
2SB633	80p
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2SB703	90p
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2SB707	200p
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2SC647	300p
2SC681	250p
2SC683	35p
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2SC710	15p
2SC711	15p
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Part	Price
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2SC783	85p
2SC790	60p
2SC792	380p
2SC805	225p
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2SC1624	60p
2SC1626	55p
2SC1627	15p
2SC1628	75p
2SC1634	50p
2SC1667	450p
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JAPANESE TRANSISTORS

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
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2SC1678	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	50p	2SD1765	70p	2SK320	120p
2SC1684	30p	2SC2271	25p	2SC2738	200p	2SC3270	50p	2SC3811	80p	2SD313	25p	2SD892A	75p	2SD1347	70p	2SD1769	110p	2SK323	130p
2SC1685	30p	2SC2274	15p	2SC2749	350p	2SC3271	75p	2SC3831	250p	2SD315	75p	2SD894	36p	2SD1348	65p	2SD1773	100p	2SK332	175p
2SC1729	900p	2SC2275	50p	2SC2750	300p	2SC3277	280p	2SC3832	136p	2SD325	30p	2SD895	100p	2SD1350	150p	2SD1776	70p	2SK359	40p
2SC1730	10p	2SC2278	70p	2SC2751	270p	2SC3279	30p	2SC3833	250p	2SD330	65p	2SD896	200p	2SD1376	60p	2SD1783	70p	2SK363	50p
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2SC1740	10p	2SC2290	1800p	2SC2767	300p	2SC3281	200p	2SC3852	80p	2SD350	320p	2SD900	400p	2SD1379	100p	2SD1789	210p	2SK367	40p
2SC1741	35p	2SC2291	40p	2SC2769	400p	2SC3284	600p	2SC3853	220p	2SD357	40p	2SD905	450p	2SD1380	100p	2SD1796	120p	2SK369	30p
2SC1755	90p	2SC2298	35p	2SC2773	700p	2SC3293	85p	2SC3855	220p	2SD358	40p	2SD916	130p	2SD1382	60p	2SD1802	75p	2SK373	40p
2SC1756	35p	2SC2307	300p	2SC2774	500p	2SC3298	50p	2SC3857	500p	2SD359	50p	2SD917	300p	2SD1384	50p	2SD1806	75p	2SK374	45p
2SC1758	30p	2SC2308	10p	2SC2785	40p	2SC3299	120p	2SC3858	550p	2SD361	100p	2SD921	320p	2SD1390	350p	2SD1812	45p	2SK386	600p
2SC1760	70p	2SC2312	300p	2SC2786	20p	2SC3300	400p	2SC3866	275p	2SD362	100p	2SD923	360p	2SD1391	250p	2SD1815	50p	2SK389	115p
2SC1775	10p	2SC2314	70p	2SC2787	10p	2SC3303	100p	2SC3868	100p	2SD371	240p	2SD946	120p	2SD1392	85p	2SD1825	60p	2SK400	700p
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2SC1810	250p	2SC2328A	50p	2SC2808	40p	2SC3310	125p	2SC3884A	200p	2SD386	70p	2SD957A	520p	2SD1398	120p	2SD1847	275p	2SK423	75p
2SC1815	10p	2SC2310	25p	2SC2810	360p	2SC3316	280p	2SC3885	250p	2SD388	150p	2SD958	60p	2SD1399	300p	2SD1849	280p	2SK427	60p
2SC1819	70p	2SC2315	175p	2SC2812	40p	2SC3317	350p	2SC3885A	290p	2SD389	60p	2SD965	35p	2SD1400	280p	2SD1850	325p	2SK430	200p
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2SC1827	60p	2SC2330	300p	2SC2824	75p	2SC3327	60p	2SC3890	150p	2SD401	50p	2SD972	40p	2SD1403	225p	2SD1856	40p	2SK513	325p
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2SC1833	27p	2SC2333	200p	2SC2826	200p	2SC3330	20p	2SC3893	225p	2SD414	45p	2SD973A	70p	2SD1406	60p	2SD1858	40p	2SK531	350p
2SC1834	50p	2SC2334	80p	2SC2827	130p	2SC3331	25p	2SC3895	325p	2SD415	55p	2SD982	90p	2SD1407	60p	2SD1863	35p	2SK534	700p
2SC1841	12p	2SC2335	55p	2SC2832	300p	2SC3333	120p	2SC3896	400p	2SD424	350p	2SD985	120p	2SD1408	125p	2SD1864	85p	2SK537	900p
2SC1844	50p	2SC2336A	125p	2SC2834	280p	2SC3345	100p	2SC3897	400p	2SD426	150p	2SD986	120p	2SD1409	170p	2SD1877	175p	2SK538	350p
2SC1845	15p	2SC2344	150p	2SC2837	250p	2SC3346	130p	2SC3907	250p	2SD427	350p	2SD998	70p	2SD1411	85p	2SD1878	160p	2SK539	1100p
2SC1846	35p	2SC2347	35p	2SC2839	40p	2SC3352	200p	2SC3927	250p	2SD438	35p	2SD1010	40p	2SD1412	75p	2SD1879	275p	2SK544	30p
2SC1847	45p	2SC2353	120p	2SC2853	70p	2SC3353	280p	2SC3940	40p	2SD467	15p	2SD1012	40p	2SD1413	60p	2SD1880	350p	2SK552	250p
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2SC1856	25p	2SC2361	150p	2SC2877	120p	2SC3356	120p	2SC3944	80p	2SD471	20p	2SD1021	120p	2SD1417	75p	2SD1884	300p	2SK555	320p
2SC1865	700p	2SC2362	50p	2SC2878	20p	2SC3358	60p	2SC3950	120p	2SD476	100p	2SD1022	250p	2SD1425	260p	2SD1886	300p	2SK556	500p
2SC1870	700p	2SC2365	280p	2SC2879	3200p	2SC3376	300p	2SC3953	50p	2SD525	50p	2SD1024	850p	2SD1426	135p	2SD1887	225p	2SK557	400p
2SC1871	425p	2SC2369	100p	2SC2882	60p	2SC3377	50p	2SC3955	60p	2SD526	70p	2SD1027	850p	2SD1427	160p	2SD1894	300p	2SK559	600p
2SC1875	220p	2SC2371	25p	2SC2883	60p	2SC3378	120p	2SC3964	100p	2SD545	18p	2SD1030	75p	2SD1428	180p	2SD1895	225p	2SK560	580p
2SC1881	70p	2SC2373	210p	2SC2898	200p	2SC3379	1200p	2SC3972	250p	2SD549	120p	2SD1031	70p	2SD1430	280p	2SD1910	175p	2SK566	475p
2SC1890	15p	2SC2383	50p	2SC2899	50p	2SC3381	130p	2SC3973	210p	2SD551	300p	2SD1036	600p	2SD1431	200p	2SD1911	300p	2SK606	70p
2SC1895	500p	2SC2389	45p	2SC2909	60p	2SC3383	80p	2SC3975	210p	2SD554	225p	2SD1046	200p	2SD1432	400p	2SD1913	50p	2SK612	80p
2SC1904	125p	2SC2407	110p	2SC2910	25p	2SC3393	80p	2SC3987	160p	2SD555	500p	2SD1047	180p	2SD1433	300p	2SD1929	50p	2SK684	950p
2SC1906	15p	2SC2408	120p	2SC2911	80p	2SC3397	20p	2SC3996	600p	2SD556	225p	2SD1051	130p	2SD1438	60p	2SD1930	50p	2SK685	1150p
2SC1907	20p	2SC2412K	50p	2SC2912	120p	2SC3399	50p	2SC3997	1250p	2SD558	200p	2SD1055	60p	2SD1439	165p	2SD1933	45p	2SK699	100p
2SC1909	250p	2SC2440	200p	2SC2921	650p	2SC3400	35p	2SC3998	800p	2SD560	50p	2SD1060	130p	2SD1441	220p	2SD1939	60p	2SK719	300p
2SC1913	90p	2SC2458	10p	2SC2922	480p	2SC3401	50p	2SC4006	100p	2SD571	20p	2SD1062	150p	2SD1442	80p	2SD1941	350p	2SK724	500p
2SC1914	30p	2SC2459	50p	2SC2923	75p	2SC3402	40p	2SC4020	150p	2SD575	530p	2SD1063	200p	2SD1445	200p	2SD1944	50p	2SK725	550p
2SC1921	15p	2SC2466	55p	2SC2928	550p	2SC3405	130p	2SC4023	325p	2SD592	25p	2SD1064	250p	2SD1446	300p	2SD1958	80p	2SK726	425p
2SC1922	175p	2SC2486	275p	2SC2929	280p	2SC3409	400p	2SC4029	350p	2SD596	25p	2SD1065	160p	2SD1450	60p	2SD1959	210p	2SK727	475p
2SC1923	10p	2SC2492	50p	2SC2934	75p	2SC3416	30p	2SC4043	45p	2SD600	30p	2SD1069	150p	2SD1451	200p	2SD1978	50p	2SK739	400p
2SC1929	180p	2SC2470	65p	2SC2937	250p	2SC3417	90p	2SC4046	40p	2SD601	40p	2SD1073	350p	2SD1452	275p	2SD1984	60p	2SK758	300p
2SC1940	110p	2SC2481	120p	2SC2939	400p	2SC3419	120p	2SC4056	200p	2SD602	60p	2SD1088	150p	2SD1453	140p	2SD1991	50p	2SK760	500p
2SC1941	27p	2SC2482	20p	2SC2944	300p	2SC3420	80p	2SC4059	400p	2SD612	50p	2SD1094	375p	2SD1455	250p	2SD1994	200p	2SK769	500p
2SC1942	350p	2SC2483	120p	2SC2958	50p	2SC3421	45p	2SC4064	140p	2SD613	70p	2SD1110	225p	2SD1457	165p	2SD1998	45p	2SK777	475p
2SC1944	350p	2SC2484	185p	2SC2962	800p	2SC3422	75p	2SC4106	150p	2SD617	300p	2SD1111	20p	2SD1458	50p	2SD2006	75p	2SK780	500p
2SC1945	350p	2SC2485	400p	2SC2979	160p	2SC3423	60p	2SC4107	175p	2SD633	70p	2SD1113	225p	2SD1459	60p	2SD2010	250p	2SK781	500p
2SC1946	1500p	2SC2491	200p	2SC2987	250p	2SC3425	65p	2SC4123	230p	2SD636	10p	2SD1128	200p	2SD1468	40p	2SD2011	60p	2SK782	500p
2SC1947	450p	2SC2498	50p	2SC2988	150p	2SC3446	150p	2SC4124	200p	2SD637	15p	2SD1133	65p	2SD1487	225p	2SD2012	60p	2SK783	500p
2SC1953	45p	2SC2500	25p	2SC2995	60p	2SC3447	130p	2SC4125	275p	2SD638	15p	2SD1135	75p	2SD1494	150p	2SD2018	65p	2SK786	200p
2SC1957	70p	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	175p	2SC2512	20p	2SC3019	320p	2SC3459	180p	2SC4157	400p	2SD659	18p	2SD1142	350p	2SD1497-02	350p	2SD2066	250p	2SK792	300p
2SC1967	1300p	2SC2517	120p	2SC3020	1450p	2SC3460	130p	2SC4159	100p	2SD661	60p	2SD1145	25p	2SD1505	90p	2SD2125	180p	2SK793	300p
2SC1969	160p	2SC2519	60p	2SC3022	1850p	2SC3461	275p	2SC4161	125p	2SD666	25p	2SD1148	175p	2SD1506	50p	2SD2136	85p	2SK794	315p
2SC1970	100p	2SC2527	300p	2SC3025	500p	2SC3466	225p	2SC4169	60p	2SD667	20p	2SD1153	30p	2SD1508	60p	2SD2144	35p	2SK796	600p
2SC1971	400p	2SC2534	150p	2SC3026	450p	2SC3468	70p	2SC4195	400p	2SD669	35p	2SD1159	65p	2SD1509	100p	2SD2151	175p	2SK809	850p
2SC1972	600p	2SC2535	300p	2SC3030	300p	2SC3481	300p	2SC4204	60p	2SD673	350p	2SD1160	150p	2SD1511	75p	2SD2255	175p	2SK812	150p
2SC1973	160p	2SC2538	100p	2SC3037	125p	2SC3482	275p	2SC4231	250p	2SD676	250p	2SD1163A	220p	2SD1519	250p	2SD2331	250p	2SK817	325p
2SC1975	120p	2SC2540	1900p	2SC3038	125p	2SC3486	275p	2SC4235	300p	2SD717	180p	2SD1164	75p	2SD1521	70p	2SD2333	150p	2SK851	550p
2SC1980	30p	2SC2542	300p	2SC3039	80p	2SC3502	50p	2SC4236	450p	2SD718	85p	2SD1168	270p	2SD1525	450p	2SD2340	225p	2SK872	650p
2SC1983	75p	2SC2545	55p	2SC3040	260p	2SC3503	50p	2SC4237	500p	2SD722	240p	2SD1169	280p	2SD1526	100p	2SJ48	425p	2SK875	475p
2SC1984	150p	2SC2546	25p	2SC3042	300p	2SC3504	120p	2SC4242	120p	2SD725	200p	2SD1173	350p	2SD1541	350p	2SJ56	700p	2SK903	500p
2SC1985	100p	2SC2547	65p	2SC3052	30p	2SC3505	240p	2SC4278	175p	2SD726	275p	2SD1185	280p	2SD1545	275p	2SJ74	60p	2SK904	500p
2SC1986	100p	2SC2550	50p	2SC3057	150p	2SC3506	250p	2SC4288A	650p	2SD731	250p	2SD1186	400p	2SD1546	350p	2SJ76	220p	2SK951	275p
2SC2001	15p	2SC2551	70p	2SC3068	60p	2SC3507	650p	2SC4300	200p	2SD732	250p	2SD1189	55p	2SD1548	400p	2SJ77	350p	2SK952	275p
2SC2002	15p	2SC2552	60p	2SC3070	35p	2SC3509	750p	2SC4301	300p	2SD734	15p	2SD1191	120p	2SD1554	170p	2SJ79	225p	2SK955	450p
2SC2003	20p	2SC2553	200p	2SC3071	25p	2SC3514	170p	2SC4304	225p	2SD741	120p	2SD1192	90p	2SD1555	150p	2SJ103	75p	2SK956	400p
2SC2004	20p	2SC2555	120p	2SC3073	100p	2SC3518	120p	2SC4313	600p	2SD743	130p	2SD1196	150p	2SD1556	225p	2SJ109	200p	2SK962	700p
2SC2022	110p	2SC2562	90p	2SC3074	200p	2SC3519	250p	2SC4381	150p	2SD757	120p	2SD1197	150p	2SD1565	75p	2SJ113	1050p	2SK1023	550p
2SC2023	180p	2SC2563	200p	2SC3075	150p	2SC3526	45p	2SC4382	200p	2SD760	70p	2SD1198	60p	2SD1571	170p	2SJ114	1150p	2SK1036	450p
2SC2026	30p	2SC2568	120p	2SC3077	120p	2SC3528	750p	2SC4386	275p	2SD762	100p	2SD1207	40p	2SD1572	100p	2SJ116	1200p	2SK1037	600p
2SC2027	200p	2SC2570	30p	2SC3086	150p	2SC3531	225p	2SC4387	425p	2SD763	140p	2SD1210	280p	2SD1575	200p	2SJ117	550p	2SK1057	600p
2SC2036	50p	2SC2571	350p	2SC3089	130p	2SC3549	200p	2SC4408	50p	2SD768	180p	2SD1211	120p	2SD1576	150p	2SJ119	700p	2SK1058	800p
2SC2037	50p	2SC2577	110p	2SC3101	750p	2SC3552	270p	2SC4429	275p	2SD772	200p	2SD1213	220p	2SD1577	250p	2SJ162	680p	2SK1081	700p
2SC2053	120p	2SC2578	170p	2SC3112	35p	2SC3568	200p	2SC4431	90p	2SD773	20p	2SD1218	75p	2SD1579	80p	2SJ175	200p	2SK1082	450p
2SC2055	150p	2SC2579	110p	2SC3114	40p	2SC3577	275p	2SC4466	325p	2SD774	30p	2SD1223	75p	2SD1589	60p	2SJ182	150p	2SK1102	375p
2SC2058	20p	2SC2580	175p	2SC3116	75p	2SC3584	200p	2SC4467	175p	2SD777	400p	2SD1225	70p	2SD1590	100p	2SJ200	625p	2SK1103	250p
2SC2060	40p	2SC2581	225p	2SC3117	120p	2SC3591	200p	2SC4468	250p	2SD784	650p	2SD1227	40p	2SD1591	310p	2SJ307	175p	2SK1104	250p
2SC2061	75p	2SC2588	600p	2SC3122	50p	2SC3595	220p	2SC4517	200p	2SD786	100p	2SD1229	250p	2SD1593	125p	2SK19	45p	2SK1117	250p
2SC2068	60p	2SC2590	40p	2SC3148	145p	2SC3597	75p	2SC4517A	225p	2SD787	20p	2SD1237	300p	2SD1595	70p	2SK33	40p	2SK1118	225p
2SC2071	140p	2SC2591	50p	2SC3149	180p	2SC3599	140p	2SC4531	450p	2SD788	30p	2SD1238	300p	2SD1608	210p	2SK40	50p	2SK1120	550p
2SC2073	40p	2SC2592	200p	2SC3150	100p	2SC3600	175p	2SC4532	1000p	2SD789	20p	2SD1244	25p	2SD1609	45p	2SK55	100p	2SK1190	350p
2SC2075	60p	2SC2603	10p	2SC3151	175p	2SC3606	100p	2SC4542	400p	2SD792	400p	2SD1246	20p	2SD1632	320p	2SK68	100p	2SK1191	800p
2SC2078	95p	2SC2610	60p	2SC3152	130p	2SC3607	150p	2SC4742	275p	2SD794	33p	2SD1247	40p	2SD1637	50p	2SK73	75p	2SK1217	700p
2SC2085	100p	2SC2611	30p	2SC3153	175p	2SC3608	65p	2SC4744	350p	2SD795A	140p	2SD1251	180p	2SD1647	40p	2SK97	200p	2SK1221	200p
2SC2086	80p	2SC2621	70p	2SC3156	350p	2SC3616	45p	2SC4745	550p	2SD798	175p	2SD1254	55p	2SD1649	280p	2SK106	40p	2SK1275	275p
2SC2092	100p	2SC2625	190p	2SC3157	200p	2SC3636	280p	2SC4747	375p	2SD799	150p	2SD1263	90p	2SD1650	150p	2SK107	40p	2SK1296	350p
2SC2094	1200p	2SC2626	600p	2SC3158	260p	2SC3642	225p	2SC4757	200p	2SD809	45p	2SD1264	55p	2SD1651	150p	2SK109	150p	2SK1299	450p
2SC2097	2300p	2SC2630	1600p	2SC3159	200p	2SC3657	400p	2SC4762	300p	2SD811	450p	2SD1265	75p	2SD1656	250p	2SK117	60p	2SK1317	900p
2SC2099	2500p	2SC2631	20p	2SC3164	270p	2SC3659	600p	2SC4769	220p	2SD819	300p	2SD1266	180p	2SD1663	350p	2SK118	50p	2SK1338	250p
2SC2118	1100p	2SC2632	35p	2SC3169	150p	2SC3668	120p	2SC4770	250p	2SD820	250p	2SD1267	55p	2SD1666	50p	2SK125	100p	2SK1341	500p
2SC2120	10p	2SC2634	10p	2SC3170	300p	2SC3675	100p	2SC4820	225p	2SD821	550p	2SD1271	55p	2SD1667	120p	2SK133	650p	2SK1342	500p
2SC2122A	300p	2SC2636	40p	2SC3173	180p	2SC3678	280p	2SC4826	70p	2SD822	290p	2SD1271A	225p	2SD1668	90p	2SK147	160p	2SK1350	200p
2SC2131	560p	2SC2637	120p	2SC3175	150p	2SC3679	140p	2SC4891	800p	2SD826	30p	2SD1272	200p	2SD1669	85p	2SK152	40p	2SK1356	225p
2SC2141	60p	2SC2640	1800p	2SC3178	125p	2SC3680	380p	2SC4923	400p	2SD829	375p	2SD1273	50p	2SD1677	200p	2SK161	30p	2SK1357	350p
2SC2153	40p	2SC2653	100p	2SC3179	70p	2SC3685	450p	2SC4924	250p	2SD836	50p	2SD1274	80p	2SD1680	225p	2SK163	40p	2SK1358	400p
2SC2166	80p	2SC2654	180p	2SC3180	175p	2SC3687	300p	2SC4927	500p	2SD836A	50p	2SD1275	50p	2SD1683	45p	2SK168	40p	2SK1377	150p
2SC2168	120p	2SC2655	50p	2SC3181	200p	2SC3688	550p	2SC5002	300p	2SD837	55p	2SD1276	60p	2SD1684	70p	2SK170	50p	2SK1399	250p
2SC2188	70p	2SC2656	550p	2SC3182	120p	2SC3692	150p	2SC5003	350p	2SD838	500p	2SD1277	190p	2SD1706	325p	2SK184	35p	2SK1400	250p
2SC2200	250p	2SC2660	100p	2SC3198	30p	2SC3715	480p	2SC5027	100p	2SD841	110p	2SD1279	600p	2SD1707	400p	2SK192	45p	2SK1404	290p
2SC2209	50p	2SC2665	200p	2SC3199	40p	2SC3717	120p	2SC5048	300p	2SD844	200p	2SD1288	175p	2SD1708	375p	2SK193	40p	2SK1461	220p
2SC2216	50p	2SC2668	10p	2SC3202	25p	2SC3729	450p	2SC5044	250p	2SD850	170p	2SD1289	250p	2SD1710	200p	2SK195	150p	2SK1462	425p
2SC2221	650p	2SC2671	100p	2SC3209	120p	2SC3746	100p	2SC5086	250p	2SD856	48p	2SD1291	280p	2SD1718	275p	2SK197	140p	2SK1487	250p
2SC2228A	80p	2SC2681	170p	2SC3210	550p	2SC3747	120p	2SC5129	300p	2SD858	250p	2SD1292	60p	2SD1729	230p	2SK212	35p	2SK1507	300p
2SC2229	15p	2SC2682	70p	2SC3211	220p	2SC3748	100p	2SC5148	300p	2SD863	23p	2SD1293	70p	2SD1730	275p	2SK214	170p	2SK1529	700p
2SC2230	80p	2SC2688	27p	2SC3212	260p	2SC3752	250p	2SC5149	300p	2SD864	200p	2SD1297	300p	2SD1732	250p	2SK216	200p	2SK1537	400p
2SC2233	100p	2SC2690	60p	2SC3225	50p	2SC3781	150p	2SC5250	300p	2SD866	120p	2SD1302	20p	2SD1739	180p	2SK223	50p	2SK1544	900p
2SC2235	60p	2SC2694	3500p	2SC3242	30p	2SC3782	75p	2SD188	350p	2SD866A	140p	2SD1306	45p	2SD1740	125p	2SK240	140p	2SK1567	275p
2SC2236	20p	2SC2705	40p	2SC3244	45p	2SC3783	300p	2SD198	140p	2SD867	350p	2SD1308	80p	2SD1748	90p	2SK241	30p	2SK1644	900p
2SC2237	540p	2SC2706	250p	2SC3246	50p	2SC3787	100p	2SD199	195p	2SD868	260p	2SD1309	140p	2SD1756	275p	2SK246	30p	2SK1767	275p
2SC2238	45p	2SC2710	50p	2SC3259	350p	2SC3788	60p	2SD200	180p	2SD869	150p	2SD1310	140p	2SD1758	60p	2SK300	25p	2SK2038	295p
2SC2240	15p	2SC2712	20p	2SC3260	220p	2SC3789	75p	2SD201	260p	2SD870	140p	2SD1311	65p	2SD1760	80p	2SK301	40p	2SK2039	750p
2SC2258	30p	2SC2714	20p	2SC3261	230p	2SC3790	120p	2SD213	250p	2SD871	260p	2SD1313	1000p	2SD1761	60p	2SK303	40p	2SK2134	225p
2SC2259	80p	2SC2716	50p	2SC3262	280p	2SC3795	140p	2SD234	90p	2SD879	60p	2SD1326	200p	2SD1762	50p	2SK304	25p		

REPLACEMENT VIDEO HEADS

Model	Price
AKAI	
VS105, 112, 115, 116, 120, 125, 126, 201, 202, 205, 220, 240, 244, 245, 247, 248, 250, 301, 303, 304, VSP8, VSP82	1000p
VP7100, VS9300, VS9500	650p
VP7200, VS9700, VS9800	1200p
VS1	1250p
VS2	1200p
VS3	1350p
VS10	1350p
VSP1	2100p
VS33,35, 37, 38, 38EOG MKII, 53, 55, 66, 765, 766, 767, 768, 865, 867.	
VSF30, 33, 4, 400, 410, 420, 430, 440, 441, 450, 455, 480, 490, 497,	
VSG51, 54, 55, VXS450, VXS470	2250p
VS512, VS515, VS516	2250p
VS462, 465, 467, 467EOG2, VSF12, 15EK, 15EOH, 300, 301, 310,	
VSF320, 330, 340, 350, VSG30, 33, 34, 35	2300p
VS11, VS12	1200p
VS6, VS8, VS9	2400p
VSX9	2250p
VSA1100, 1110, 650, VSF500, 510, 550, 560, 580, 590, 600, 650,	
VSG60, 64, 65, VSG70, 73, 74, 75, VSX560, 580	3600p
VS155, VS165	2300p
VS20, 22, 23, 24, 25, 26, 27, 422, 425, 426, 427, 485, VSF10, 11, 180, 190	
VSF200, 210, 220, 221, 222, 230, 240, 260, 261, 262, 265, 270, 275, 280,	
VSF290, 510, 550, VSG20, 204, 205, 206, VSG21, 211, 212, 215,	
VSG217EOG, 23, 24, 25, 405, 411, 415, 417, VSP 100, 100EM, 110,	
VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSX400	1250p
VSR9	1300p
VS 109, VS603, VS606, VS607	2500p
VS75	2500p
VS965, VC967	3450p
VSF400, 410, 420, 430, 440, 441, 450, 455, 480, 490, 497, VSX450, 470	2850p
VSG20, 204, 204, 205, 206, 20, 21, 211, 212, 215, 217, 225, 23, 24, 25,	
VSP100, 110, 88, VSR100, 110, VSX400	1950p
VSG415, VSG415EA, VSG425	2800p
VS75, VSA77	3500p
VSF1000, VSF1010, VSF1030	5800p
ALBA	
VDR3000, VCR4000, VCR5000, VCR6000	1650p
VTV10	1000p
VCR7000, 7800, 8000, 8800	1100p
AMSTRAD	
VCR4500, VCR5200, VCR9000, TVR1	900p
VCR7000	1000p
VCR1000, 2000, 6000, 61000, 62000, 8600, 8602, 8700, 9005, DD8900, DD8904, TVR4	1100p
TVR2, TVR3, VCR4600, VCR4600 MKII, VCR400	1100p
VCR8800, VCR8804, VCR9340	2100p
VCR8603, VCR8604, VCR8704, VCR8714	1350p
VCR9140, VCR9142	2550p
VCR9340	3650p
VCR9244	3450p
UF020, 22, VCR3000, 3002, 9500	1750p
FISHER	
FVHP420, 510, 520, 530, 615, 618, 620, 622, 710, 711, 715, 716, 720,	
FVHP721, 722, 730, 830, 905, 906, 907, 908, 910, 911, 915, 916, 918,	
FVHP5000, 5001, 5005, 5050, 5075	1100p
VBS3500, 7100, 7500, 7600, 9900, VBR330	1800p
VBS7000, VBS7100, VBS9000	2000p
FVHP500, 711, 715, 721, 722, 730, 830, 5100, FVHD720	1100p
FVHP725, FVHP830, FVHP980	2500p
FVHP990	2700p
FVHP975	2400p
FVHD407, FVHD140, FVHP1, FVHP10, FVHP20	1150p
FVHD230, FVHP1100, 1200, 130, 1340, 1410, 2000, 200, 210, 300,	
FVHP310, 410, 420	1800p
FVHD250, 270, 370, FVHP1500, FVHP250	2700p
FVHP132, 1400, 1440, 320, 440, 445	3550p
FVHP470S, FVHP475HV	4800p
FVHP1250, FVHP430S	950p
GOLDSTAR	
8000 3HSSDB, GHV121, RQ2011, 2031, 2051	1900p
GVH51, GVH122, VCP4000, VCP4100, VCP4200	1100p
GHV1232, 1233, 1241, 1242, 1243, 1244, 1245, 1246, 1266, 1290, 1291	
GHV1295, 1296, 1891, 8210, 8215, 1221, 1240, 1241, 1247, 1248, 2145	
VCP400, VCP4130, 4300, 4301, 4305, 4306, 4310, 4311, 4315, 4316,	
VCP4320, 4321, 4325, 4326	1100p
C211, GHV1392P, 1393P, 1900P, 1290, 1291PO, 1293IO, 1295P,	
GSE1295PQ, GSE1296, 1297, 1891, 1910, 20005, 2000, GSEC200,	
GSEC205, 211, 2301, GSEG2301,	
GSEQ12, 204, 20, 22, P416P, P500P	
QUISY22, QUISY24, RC205P, RG11P, RG20, RG2001, RG20,	
RQ204HP, RQ241, VCP100P, GSEG10	1600p
GHV4400, 4400, GSE Q404P, QUISY40, RC405P	2350p
GSEQ121, RQ2011, RQ2031, RQ2051	1950p
G.E.C.	
4000H, 4001H, 4002H	1200p
V4001H, V4004, V4100	1200p
V4005H	1500p
GRANADA	
CSL DS2	1600p
VHSAH1	1100p
VHSAH3	2400p
VHSAN3	800p
VHSAY3	1200p
VHSBH1, VHSCH1	2100p
VHSBP1	850p
VHSBY3	2600p
VHSD52	1600p
VHSEH2, VHSDH2	1600p
VHSEY1, VHSEY2	1400p
VHSFS1, VHSFS2	1300p
VHSFG2, VHSFG4, VHSF63, VHSFB3	1300p
VHSTJ1, VHSTJ2, VHSTJ3, VHSWJ3, VHSYJ2	700p
VHSVH4, VHSWH1, VHSXH1, VHSYH2	1600p
VHSWJI VHSXJ3	700p
GRUNDIG	
VS410, 415, 435, 450, 456, 460, 500, 505, 510, 520, 521, 530, 546	1600p
BARCELONA, MVS5400, 440, 500, 600, SE5100, 6100, 6110, 9100	
TVR4500, 4510, 5510, VS400, 440, 441, 500, 505, 510, 518, 600, 610,	
VS5180, VS6190, 700, 900, 901, 902, 9091, GV200, 201, 2092, SE2100, 5110	1400p
MADRID, SE5140, VS540, VS5480	3000p
MVS550, 620, VS550, 620, 630, 640, 790, 930, 940	2400p
VS120	2300p
VS680, GV280	4600p
VS160, VS740	4400p
VS170	4600p
MVS660, SE6160, VERONA, VS660, VS6690	3500p
GRUNDIG	
MVS710, 720, 910, SE7120, 9120, VS710, 716, 720, 800, 810, 910, 920,	
VS922, 9291, GV210, 211, 220, 2292, MV2105, 2115, SE2120	1700p
HINARI	
VXL2, 3, 4, 20, 25, 35	1000p
VXL5, V20H	1050p
VXL6	1200p
VXL7	1300p
VXL8, 9, 10, 11, 19, 90, VCR34H, VTV 100, 200	1100p
HITACHI	
VT11, 14, 15, 16, 30, 33, 34, 330, 340, 503, 640, 5030, VTP10, 30	1000p
VT7, VT17, VT18, VT19	2000p
VT35, VT350, VT38, VT39	2300p
VT100, 110, 111, 112, 113, 115, 118, 120, 125, 128, 220, 225, 400, 405,	
VT410, 413, 414, 415, 416, 418, 510, 515, 517, 518, 520, 525, 526,	
VTM625, 626, 725, 210, 211, 215, 726, 727, 728, 820, 821, 825, 920, 921	1400p
VT3000	650p
VT4000, VT4200, VT5000, VT5500, VT5600	1100p
VT77, 680, 6500, 6700, 6800, 7000, 8000, 8030, 8040, 8100, 8300, 8500	
VT8700, 9000, 9300, 9500, 9700, 9900	1000p
VT8, 9, 56, 57, 570, 575, 576, 580, 585, 588	3200p
VT65	2400p
VT130, 135, 138, 145, 250, 255, 258, 420, 425, 426, 428, 430, 431, 435	
VT438, 535, 536, VTL30, 301, VTM630, 635, 636	1900p
VT52, VT60, VT61E, VT62E, VT63, VT64, VT640	1100p
VT168, VT150, VT260, VT450, VT498 (4 HEAD)	2200p
VT530	2050p
VT522, VTM212, 620, 622, 720, 722, 822, 922, 925	1850p
VT660E	2600p
VT570, VT575, VT580, VT585, VT588, VTF70	3100p
VT540, 545, 546, 548, VTD660, 665, VTM598, 640, 645, 645,	
VTM730, 731, 735, 735, 740, 745, 746, 748, 753, 754, 830, 831, 835, 838, 840,	
VTM841, 845, 930, 931, 935	2600p
VTF770, 774, 775, 860, 861, 865	4100p
VT85, VT86, VT88	2600p
VTF780, VTF785	4800p
VTF180, VTF185, VTF280	8500p
VTF350, VTF351	5150p
VTM220, VTM220E, VTM220UK	5150p
VTS390E	5150p
J.V.C. & FERGUSON	
HR2200, 3300, 3320, 3330, 3350, 3360, 3660, 3750, 3860, 4100	
3292, 8900, 8901, 8902, 8903, 8906, 8922, 8928, 3V01, 3V06, 3V22	600p
HR3660, 7600, 7610, 7650, 7700, HRD110, 111, 120, 121, 220, 225,	
HRS100, 8904, 8923, 8924, 8925, 8929, 8935, 8941, 8943, 8944,	
3V16, 3V233V24, 3V31, 3V35, 3V36, 3V38, 3V39, 3V49	625p
BR1600, HRD140, 141, 142, 143, 150, 152, 156, 157, 158, 160, 5101	
HRS10, 8947, 8948, 3V42, 3V44, 3V45, 3V46, 3V47, 3V52, 3V54,	
3V55, 3V56, 3V57	1150p
HRD154, 170, 171, 210, 211, 217, 310, 320, 321, 350, 521, 522, 525, 526,	
HRD527, 540, 550, 560, 590, 770,	
HRDX20, HRDX22, 8950, 8951, 3V64, 3V65, FV10, FV11, FV20, FV21, FV26	1300p
HRD565, HRD566, 3V48	2200p
HRD725, HRD755, 3V43, 3V53	2850p
8930, 8931, 8933, 8940, 3V29, 3V30	700p
8945	2400p
3V00, 8902, 8903, 8909, 8912, 8922	1000p
FV31, FV41R	1500p
FV37, FV43H, HRD860	3100p
BR7000E, BR7000S, BR7030, BR7030/40H, BR7040	2600p
HR7200, 7300, 7350, 2650, BR6200	700p
HRD455	2000p
HRD520	1400p
HRD300, 400, 580, 600, 620, 640, 650	2000p
HR4100	1000p
HRD750, HRD830, HRD860	3300p
HRD250, HRD257	2300p
3V32, 8942, HR7655	2200p
HRD180, 190, 230, 610, 3V59, FV12L, FV20B, 26, 30, 32, 33, VC141L	2050p
HRD370, HRD430, HRD470, 3V58, FV13H	2300p
HRD530, HRD700, HRD840, HRD870, HRD910, FV14T, FV57H	3100p
GRC1, GRC2, 3 V41	2800p
BR9060, HRD330, 337, 440, 441, 637, 641, 660, 670, 720, 730, 740, 820	
HRFC100, SR3300MS, FV44L	2100p
HRD950, HRD960, HRD980, FV46	5000p
HRS5000, HRS5500, 5800, 9000, FV395 BRS600, SRS368E	6550p
FV22L	1400p
FV42	2600p
VR182LV, VR202LV	1950p
FV67HV, FV68TX, FV77	3800p
R2000 SERIES	4500p
FV61LV, FV62LV, FV67HV	4000p
FV42L	£101.00p
VP160L, VR172L	1950p
HRJ200, HRJ205	3300p
HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100p
HRJ300, HRJ305, HRJ315, HRJ316EG,HRJ319E	3750p
HRJ615, HRJ715, HRJ815	9200p
HRJ400, HRJ405, HRJ407MS, HRJ41 OEK, HRJ415, HRJ416	5850p
MATSUI	
VX500E, 800A, 810A, 820, 80A, 7708, 7738	1200p
VCRL3, VX730, VX750	1450p
VX735, VX755, VX990	1500p
VX735A, VX765, VX850	1750p
VX600	1100p
VX900	2650p
MITSUBISHI	
HS303, HS304, HS320, HS700	1400p
HS306, HS318, HS710	1400p
HS307	2300p
HS319	1900p
HS330	2300p
HS400	2800p
HS349, HSE27, 31, 32, HSB27, 31, 32, HSM33, 34, 35, 37G	2150p
HS411	1900p
HSE30, HSB30	2000p
HS338	1900p
HSE10, HSE11, HSE20, HSE21, HSE41, HSB10, HSB20	2100p
HS300, HS301, HS302, HS310, HS273, HS550Q	1350p
HS200	650p
HS337, HS347	1400p
HSB12, HSE12, HSE22, HSM16G, 18, 23, 25, 30, MX1	2100p
HS411EZ, HS411GZ	2600p
HSB11, HSB21	2000p
HSB52, HSE50, 52G, HSM36, 50, 54, 55, 57, 58, 60	3300p
HSE51	3000p
HS410	3250p
HS412, HS421GZ	4000p
HS5300, HS5424, HS5600	3050p
HSM20, HSM55	2250p
HSM40	2850p
HSM59, HSM68E	6050p
NV300, 322, 332, 333, 340, 390, 2000, 2010, 3000, 7000, 7200,7500, NV7800, 7850, 8170, 8200, 8400, 8600, 8610, 8620	625p
NV777, NV330	1150p
NV8050, NV8051	2800p
NATIONAL PANASONIC	
AG1000, 1050, NV250, 260, 280, 450, 460, 465, 470, 480, 650	1600p
AG6010, AG6015	2500p
AG6840	2400p
NV100, NV200, NV370, NV380, NV630	725p
NVD60, NVH65	3400p
AG5150, AG5250, NVF65, NVH75, NVH77	3200p
NVF51	4200p
NVG19	2300p
NVJ30, NVHJ33, NVL10, 20, NVL21, NVG30, 31, 40, 130, NVJ37, 40, 42,	
NVSD30, 10EE, 11, 2, 30, 35	1450p
NVJ35, NVG45	1700p
NVM1, NVM3, NVM5	4200p
AG2100, AG2200	700p
NV430, NV431, NV433, NVSD2, NVSD22, NVSD25, NVSD3	1000p
NV730, NV730E, NV770 4 HEAD	1450p
NV366	1850p
NV21 HQ, NV 180, NVD48	2000p
NV7881	2500p
NV810, NV8301	2400p
NV850, NV950	2750p
NV870, NV890, NV970	3200p
AG6024, NVG33, 45, NVL23, 25, 28, NVJ47,	
49, 700PX, NVSD20EE, 400, 44, 45	1450p
NVG10, 11, 12, 14, 16, 120, NV250, 280, 450, 455	1500p
NVG18	1800p
NVG20, 21, 22, 25, 28, 200, NVD48	1700p
NVG50, NVG300	2000p
NVG45	1450p
NVH70	3600p
NV688	2400p
NV600	1050p
AG6800, AH6810, AG6820	2600p
AG6100, AG6200, AG6300	2600p
NVG7, NVG9, NV230	1050p
NV780	2400p
NVG 15, NVG400	2600p
NVM7, NVMC20	3800p
NVF70	5200p
NVJ45, NVJ47	2000p
NVSD40	2250p
NVF75, NVF77	4750p
NVF55	4000p
NVFS200, NVFS88, NVSF90, NW8000	4600p
NVHD90, NVHD 100, NV HO 101, NVHF 100	3100p
NVSD1	1400p
AG7330, AG7350, AG7355, AG7450	5000p
NVFS 100	5000p
NVFS1	4850p
N.E.C.	
N9011, 9012, 9013E, 9014E, 9014G, 9015, 9016, 901A, 902A, 9033, N9034, 9040, 9053, 9054, 9055, 9056, 9063, 9065, 9066, 906, 9077,	
N9096, DX1000, 1600, PX1200	1150p
N911A, 914C, 915A, 916A, 917, 9110, 9120	2400p
PVC600, 740, 744, 754, 763E, 764, PV2300, 2400, 760, 794, 770, 774	1650p
N380, N381, N830, N831, N832, N833, N834, N835, N836	700p
82611AH1 (FOR MODEL DX3000), DX4000, N9610, NS7000	3000p
N895	3150p
N9052, N9530, DX2000	3400p
VCP1	1700p
PVC2300, 2400, 740, 744, 760, 764	1400p
DS6000	3500p
D5600	3500p
VH3, VH555, VH600, VH700, VH844, VH900,	
VH1000 (ALL MODELS)	1100p
VH1, VH2A	700p
D1000, D1100	1600p
D1000X, D1500X, D4500, VPCD100, D1200, D2000X, D5000	1600p
VR6460, VR6520, 64VR60, VR6420	725p
VR6711 4 HEAD	1800p
VR6440	2500p
VR6441, VR6540, VR6541, VR6640, VR6642	1300p
DV761, VR512, 522, 5229, 63SB7, VR6760, VR6761, VR6762, VR63SB7 7172	7200p
VR6920	2750p
41DV2, 4SB11BVR412, 415, 6485, 6490, 6880	1600p
VR6948	4850p
20DV1, 20DV2, 20RW7, 21DVI, 21DV2, 21DV3, 2SB01, 02, 11, 12, 30DV2, 31DVI, 31DV2, 31DV3, 3SB02, 03, 05, 11, 12, 13, 68SB4, 71SB4, 86SBI, 91SB2, 92SB2, DV186, 190, 291, 292, 468, 471, VR201, 202, 203, 2115, 212, 213, 223, 231, 232, 302, 303, 305, 311, 312, VR313, 3210, 3219, 322, 3229, 323, 501, 6180, 6182, 6185, 6290, 6291, VR6293, 6362, 6367, 6467, 6468, 6470	4600p
VR3260, 6349, 6442, 663, 6448, 6449, 6542, 6643	1250p
VR601	1800p
49SB6, VR6548, VR6648, VR6843	2750p
SAISHO	
VR100, 605, 705, 805, 905, 1000, 1100, 1200, 1600	1200p
VR3300X, VR3600X, VR3650X, VR3800	1400p
VR3200, VR3500	1400p
VR2000, VR3300, VR3600	1400p
VR2500	2850p
VRS5000X, VX5000A, VXL12X	1500p
SALORA	
6500, 6600	1600p
SV7300, SV8200, SV8300, SV9200	1500p
SV7400, SV8400	1600p
SV8100	1200p
SV900, SV9900	3450p
SV601, SV611, SV6910	1500p
SV800, SV810	2800p
SV6700, SV8710, SV8750	1500p
623N, SV6800, SV6900, SV8850, SV8870, SV8970	1750p
SV8810, SV8910	2650p
823N, SV8920	3500p
923N	4500p
SV8600, SV8700	1550p
SV8420	2400p
SV8620	2100p
SV9300	2500p
SV8830	2200p
SV8720	2250p
SV8520	1900p
SAMSUNG	
SV8500	1500p
SVX301, VB900, 910, VVT510, VT320, 5600, VX510, 511, 520,616. VX626, 627, 717, 614, 619, 629, 710, 712, 720, 730, 970, 971, 972, SV716, 717, SVX303, 305, VB510, 520, 610, 616, 617, 619, 620, 626, 627, 629, 710, 971, V1520, 616, 621, 626, 900, 910,	1200p
SVX319, VB770, V1710, 730, 731, 735, 750, 751, 770, VB750, VK8220, VX750, VX7330, VK770, VK8225, VR1730, 1735, XR20	1900p
V11560, VN1560, VN1561, VX1530, VX1560, VX1561, VX1580	2200p
PL30LR, PX3031, 31R, 32R, 990, 992, 991, PXP30, PXR30, VX 1260, SVX503, SX3230, 3231, 3260, 3261, VK30, 300, 1230, 1260, 1261,	
VK30R, 31R, 32R, VXK300, 301, 306, 320, 321, 326, 336	1900p
S11230, 1240, SVX600, SX1230, 1231, 1260, 1261, 7120, 7121, 7220, SX7221, 7230, 7301	1900p
SANYO	
VTC5000, 5400, 600, 6000, 6010, 6500, VPR5000, VTC 1500, VTCM 10, 11, 20, 21 VTCM25, VTC2000, 5100, 5150, 5300, 5400,	
VTC5350, 5370, VTCNX10, VTCNX15, 20, 30, VPR5800	1800p
VTC5500, 5550, 9100, 9300, 9350, 9355, 9455, 9500	1900p
VHR1110, VHR1150, VHR1300, VHR1700, VHR2300, VHR2370	1200p
VHR3200, 3270, 3100, 3110, 3150, 3300, 3400, 3310, VHRD500	1500p
VHR1500, VHR2500, VHR3330	2100p
VHR2700	2450p
VHR7900	3000p
VHR5700, VHR7700E, VHRD4710	2700p
VHR150E, 153, 154, 1501R, 240, 250, 251, 27, 350, 474, 5350E, 7500, VHR7530, 7540, 8500SP, 8800, VHRD5350E, 5450E, 6550	3850p
TLS1000P, TLS1001P, TLS1100	3100p
VHR120, 130, 14, 141, 143G, 14SP, 151, 15, 16, 171, 220, 23, 244, 274, VHR310, 330, 4100, 4105, 4200, 430, 4300, 4400, 4500, 5080, 5100,	
VHR5200, 5600, 6850, 7100, 7200, 7250, 7300, 8070, 8100, 8101, 8200, VHR7800, 7810, 8000SP, 8801SP, VHRD4400, 4410, 4500, 4600,	
VHRD4810, 6700, 4800	3100p
TLS2000	4250p
VHR5300, VHR6500, VHR7400	4500p
VHR3500EX	2150p
VHR16, 235, 335E, 4150, 4160, 4350, 7250, 7260, 8250	1950p
VTC3000	1400p
SHARP	
VC390, VC393, VC496	2750p
VC488	4200p
VC779	1800p
VC789, VC790	2900p
VC200, 220, 300, 381, 383, 384, 385, 386, 387, 388, 471, 477, 481, 482, VC483, 486, 3300, 8381, 9100, 9300, 9400, 9500, 9600, 9700	1100p
VC108, 208, 382, 402, 405, 408, 500, 550, 571, 573, 581, 582, 583, VC5W20E, 600, 651, 674, 681, 684, 6V3, 750, 780, 781, 683, 684, 402,	
VC500, 571, 573, 580, 584, 600, 682, 693, 700, 772, 7810, 782, 7822, VC783, 8481, 8581, VCA10, 100, 102, 103, 1031, 103, 104, 105, 106,	
VCA111, 113, 116, 131, 140, 202, 203, 211, 234, 244, 254, 255, 30, 35, VCA40, VCB311N, 320, VCD801, 802, VCM73, VCT212, 310, 410, VCT510, 72, VCT1314, VCTS313	1100p
VC6000, 6200, 6300, 7300, 7700, 7750, 8000, 8300	1800p
VC793	3000p
VC473, VC785, VC786	2200p
VC699, VCA501, VCA602	2800p
VC585, VC685	2000p
VC90ET	3900p
VFH815	2800p
VC800, VCH851, VCH852, VCH882	2700p
VCH80, VCH81, VFH815	2800p
VCA33, VCA36, VCA43, VCA44, VCA46, VCA49	1500p
VCA55, VCA63	2200p
VC570	2800p
SONY	
DSR-19R FOR SL-T 9ME	3100p
DSR-21 R FOR SLC 8-C9	2600p
DSR 35R FORC20, C30, C40, SLF1UB, SLF1E2 PIN, SLC24PS, 33E, 34, 44PS, SLF11, 30PF, 35, 60PS, SLK85, SL120ME, 30ME, SL100	1500p
DSR-43R FOR SLC7 RANGE. SL5000, SL5100, SL3000 1 PIN, SLC6E, SL36ES, SL37E	1300p
SL3000, SL8000, SL8080, SLC5E, SLT7ME	1600p
SLV201, SLV202	2000p
SLK95, SLT50ME	2900p
SLV275, SLV373VB, SLV410, SLV412, SLV427, SLV474	2200p
DSR49R, SLHF100P, SLHF100UB	3850p
SLV656, SLV715, 725, 727, 757, SLV777, SLV815, SLV825	4800p
SLV353UB	2600p
CCDF340E, CCDF500E, CCDV90E, CCDV95E, CCDSP5E	4800p
SLV801, SLV802	3550p
SLV310, SLV315, SLV325, SLV335	1600p
SLV210, SLV212, SLV270, SLV273, SLV285, SLV300	1150p
SLV125, 213, 225, 252, 255, 262, 280, SLVX1, 20, 3	1750p
SLV363, SLV416, SLVX50, SLVX55	2750p
SLVX75, SLVX90, SLVX95	3000p
SLV282, SLVX30, SLVX35	2025p
SLHF100P, SLHF100UB	3850p
SLVE7, SLVE8, SLVE9	6150p
SLVE90	5150p
SLV615, SLV625, SLVE600, SLVE700, SLVE800	3450p
TOSHIBA	
V63	1500p
V9680	3400p
V8600, V8650, V8700	3000p
V21, V31, V32, V33, V50, V51, V52, V53, V9600	1450p
V55, V57	700p
V71, V73, V74, V75, V77, V80, V81, V82, V83, V841V85, V86, V87, V88	1200p
DV90, 96, 97, NM3, V108, 109, 199, 200, 202, 205, 207, 209, 80, 93, 94	1450p
V5470, V5480	1300p
V600	2350p
V880MS	2600p
V700G	3700p
V500G, V509G	2500p
V9680	2900p
V300G, V301, V305, V306, V309G	2550p
V61, V63	1700p
V110, V120, V130, V140, V210, V211, V212,	
V220, V221, V222	1500p
V711, V880	3850p
VCP81E, VCP2C2	1200p
V65, V66, V6	1250p
V312, V322, V412	2600p
V91G	4600p
V609, V610V610B, V610UK, V611, V659F, V660, V660F	3200p
V312, V403T, V413G	9200p
V703W, V813G	5200p
V95G	8000p

ALL TV & VIDEO PARTS SOLD ARE REPLACEMENT PARTS

VCR BELT KITS

Model	Price
AKAI	
VP7100, VS9300, VS9500, VS9700, VS9800	120p
VS1, VS2, VS3, VS5, VS12, VS15, VP88	70p
VS10	65p
VSX9, VS105, 112, 115, 116, 120, 125, 126, 155, 165, 205, 220, VS24, 240, 244, 245, 247, 248, 250, 512, 515, 516	200p
VS22, VS23, VS25, VS35, VS37, VS38, VS53, VS55, VS66	80p
VS4, VS6, VS8, VS9	95p
VSA77	120p
VSS99	105p
ALBA	
VCR40000	130p
VCR5000, VCR6000	105p
VCR161, VCR222	100p
VCR3000X, VCR4000, VCR4000X	75p
VCR7000, VCR7800, VCR8000,VCR8800	110p
VTV10	105p
AMSTRAD	
TVR123, VCR4600, VCR4700.	
VCR5200	80p
VCR7000	80p
VCR1000, 2000, 6000, 6100, 6200, 8600, 8602, 8603, 8604,	
VCR8700, 8704, 8714, 8800, 8804, 9000, 9005, 9244, 9340,	
DD8900, DD8904, TVR4	100p
TX3650, UF20, 22 24, VCR3000, 3002, 4000, 9500	75p
VS1004	105p
BLAUPUNKT	
RTV100	200p
RTV200, RTV222, RTV224	90p
RTV202, RTX200	150p
RTV322, RTV248	100p
RTV306, 307, 309, 310, 311, 312, 328, 414, 434, 444, 707	135p
RTV211, RTV214	140p
RTV324, RTV32565p	
RTV315, RTV316, RTV319, RTV320, RTV317	50p
RTV301, RTV333, RTV338, RTV404, RTV424	85p
FERGUSON	
3292, 3V00, 3V01, 3V16, 3v22, 8900, 8901, 8902, 8903, 8904,	
8906, 8909, 8912, 8922	120p
3V23, 8923, 8924, 8929	50p
3V29, 3V30, 8930, 8931, 8933, 8940	65p
3V31, 3V32, 8941, 8942	80p
3V35, 3V36, 3V38, 3V39, 3V49, 8943, 8944	60p
3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V57,	
8945, 8947, 8948	45p
3V58, 3V43, 3V44, 3V59, 3V64, 3V65, 8950, 8951, FV10, FV11, FV12, FV13, FV14, FV20,	
FV21, FV22, FV26, FV32, FV39, VC141L	45p
FV31R	110p
FV61L, FV62, FV67, FV68, FV70, FV71, FV72, FV74, FV77	50p
FV43H, FV44L, FV46T, FV57H	125p
FV37H	80p
3V52	55p
FV41R, FV42L	100p
FIDELITY	
HQS200, VCR1000, 2000, 600, 6000. 6100	180p
VCR100	160p
VTR1000, VTR1001	100p
TX3650, VCR3000, VCR3002. VCR9500	75p
FISHER	
VBS7000	245p
VBS9000	120p
FVHP520, FVHP530, FVHP420	80p
FVHP615, 618, 620, 622, 710, 711, 715, 720, 721, 722, 725, 730.	
FVHP830, 840	60p
FVHP905, 906, 907, 908, 910, 911, 915, 916, 918	75p
VBR330, VBS7500, VBS7600.	
VBS9900	100p
VBS3500	75p
FVHD140, FVHD40, FVHD55, FVHP1, FVHP10, FVHP20	110p
FVHD230, 250, 270, 370, FVHP1100, 1200, 1250, 130, 132,	
FVHP1340, 1400, 1410, 1440, 1500, 2000, 200, 210, 250, 3, 300.	
310, 320, 2000, 410, 420, 430, 440, 445, 470, 475, FVSD2905	85p
FVHP5000, 5005, 5050, 5075, 5100, 975, 980, 990	95p
G.E.C.	
4005	150p
V4004	100p
V4007	80p
GOLDSTAR	
GHV1221, 1232, 1233, 1240, 1241, 1242, 1243, 1244, 1245,	
GHV1246, 1247, 1248, 1250, 1266, 51, 8000, 8200, 8210, 8215.	
VCP4100, VCP4130	80p
GHV1290, 1291, 1295, 1296, VCP4000, 4200, 4300, 4301,	
VCP4305, 4306, 4310, 4311, 4315, 4320, 4321, 4325, 4326	120p
GRANADA	
VHSH1, VHSAH3	100p
VHSVH4, VHSWH1, VHSXH1	60p
VHSYH2	50p
VHSBH1, VHSCH 1	150p
VHSBP1	135p
VHSAN3	110p
VHSDS2	125p
VHSAY3	125p
VHSBY3	100p
VHSEY1, VHSEY2	70p
VHSCC1	100p
GRANADA	
VHSDP1, VHSFV2	80p
VHSTJ1, VHSTJ2	150p
VHSTJ3	65p
VHSWJ1, VHSWJ2	120p
VHSXJ3	85p
VHSYJ2	80p
VHSFJ2	140p
VHSFS1, VHSFS2	130p
VHSFG1, VHSFG2, VHSFG3, VHSFG4, VHSF63	180p
GRUNDIG	
MVS400, 440, VS400, 410, 415, 435, 440, 441, 450, 456, 460	65p
VS180, 200, 220, 226, 262, 265, 267, 2X40800, 0850, 0880,	
1600, 2000, 2080, 2200, 2280,	
MVS200RC	90p
VS150	160p
VS310, 311, 315, 320, 326, 340, 345, 380, 385, 445	85p
VS150	75p
LC290N, LC295SN, SVS 180, VS 170	70p
VS 160, BARCELONA, FLORENZ, GV4000, 4000, 4001,	
GV4002, 400, 401, 4010, 402, 403, 404, 405, 406, 407, 4092, 410, GV411, 412, 414, 415, 418, 417, 4192, 4200, 420, 430, 434, 435,	
GV437, 440, 450, 4592, 460, 464, 470, 500, 501, 5050, 5095,	
GV5105, 511, 530, 5395, 540, 560, 5695,	
MV4005, 4105, SE4100, 4104, 4120, 5102, 5104, 5106, TVR37001	70p
HINARI	
VXL2	80p
VXL7, VXL8, VXL9, VXL10, VXL11, VXL19, VXL90, VCR34, VTV 100,	
200	100p
VXL4, VXL35, VTV300	70p
VXL5, VXL6	100p
VXL3, VXL20	90p
HITACHI	
VT11, 14, 16, 17, 19, 33, 330, 34, 35, 350, 38, 39, 88, 165, 5030	75p
VT5000, VT5500, VT18	120p
VT7000; VT8000, VT8030, VT8040, VT8300, VT8500, 8700	60p
VT680, VT6500, VT6800, VT9300, VT9500, VT9700, 9900	75p
VT52, VT57, VT61, VT62, VT63, 64, 65, 85, 86, 640	60p
VT3000	120p
VT100, 110, 111, 113, 115, 118, 120, 125, 128, 130, 135, 138,	
VT145, 150, 168, 170, 175, 220, 225, 250, 255, 258, 260, VTL30	60p
VM500 VM600	90p
J.V.C.	
HR3300, HR3330, HR3380, HR3660. HR4100	130p
HR7200, HR7300	80p
HR7350, HR7600, HR7610, HR7650, HR7655	60p
HR7700	50p
HRD110, 111, 120, 121, 220, 225, BP5000	60p
HRD140, 141, 143, 150, 152, 157, 158, 180, 190, 250, 257, 310, HRD455, 565, 566, 725, 755, HRP50	45p
HRD170, 171, 180, 210, 211, 217, 230, 300, 320, 321, 330, 337, HRD350, 370, 400, 430, 440, 441, 500, 530, 700, 750,950,	
HRS5000, 5500, 8000, 9000, BR9060, BRS600, 605, 920, 925	45p
HRD227, 520, 521, 522, 527, 600, 610, 620, 637, 641, 650, 830,	
HRD840, HRDX20, 22, HRJ200, 205, 300, 305, SR330, HRS10	125p
HRD840, 550, 560, 580, 590, 640, 660, 670, 720, 730, 740, 770, HRD820, 880, 870, 880, 910, 960, 980, HRDX20, 25, HRJ2 10,	
HRJ215, 315, 315, 318, 400, 405, 407, 410, 411, 415, 416, 507, HRJ6 10, 615, 715, 97,	
HRS4700, 5800, SR3200, SRS368E	60p
HRJ600	40p
LOGIK	
VR965	180p
MATSUI	
VX500, 730, 735, 750, 755, 765, 850, 6000, VS888	75p
VX1000, VX2000, VX2500, VX3000, VX6000	80p
VX800	70p
MITSUBISHI	
HS200	200p
HS300, 301, 302, 307, 310, 337, 338, 347, 349, 411, 412, 421, 450, HSB10, 20, 30, HSE10, 20, 30, 70	80p
HS303, HS304, HS306, HS307, HS330, HS400, HS700	110p
HS318, HS319, HS410	110p
HSM1000, 16, HSM23, 25, 33, 34, 35, 37, 54, 55, 57, 58, 59, 66	55p
N.E.C.	
N830, N831, N832, N833	100p
N895	80p
PVC2300, PVC2400	180p
DX1000, 1600, 1800, 2000, 3000, N9012, 9013, 9014, 9015, N9033, 9034, 9053, 9054, 9055, 9056, 9066, 9096, 9110, 9120,	
N9510, 9520, 9530, 9610	80p
NATIONAL PANASONIC	
NV300, NV330PX, NV332, NV333 NV340, NV366	100p
NV777, NV788	100p
NV2000, NV2010, NV3000	80p
NV7000, NV7200, NV7800	75p
NV8600, NV8610, NV862	145p
NV230, 250, 280, 430, 431, 433, 450, 460, 465, 470, 650, 730, NV770, 810, 870, 890, 970, AG 1000, 1050	85p
NV370, NV380, NV480, NV630, NV780, NV830, NV850	70p
NV600, NV688, AG6010, AG6015	85p
NVG7, 9, 10, 11, 12, 14, 15, 16, 18, 30, 130, 400, NVH70	50p
NVFV1, NVM10, 3000, 3300, 40, 7, 9000, 9900, NVMS1, 4	70p
NVM 1, NVM3, NVM5	70p
PHILIPS	
VR6460, VR6920	170p
VR6540	100p
VR6442, VR6542	70p
VR2025, VR2580	100p
DV186, 190, 286, 291, 292, 468, 471, 562, 571, 761, VR201, 202, 203, 211, 2115, 212, 213, 223, 311, 312, 313, 3210, 3219, 322, 32, 29, 323, 535, VR20DV1, 20DV2, 20RW7, 21DV1, 21DV2, 21D, V3, 25BQ1, 25BQ2, 11, 12, 302, 303, 305, 310V1, 31DV2, 31D, V3, 3SB11, 3SB12, 3SB13, 72SB8, VR30DV2, 35BQ2, 35B03, 63SB7, 71584, 71585, 71586, VR9582, 91582, 925B3, VR6180, 6182, 6185, 6285 6290VR6291, VR6293, 6362, 6367, VR6390, 6391, 6393, 6467, 6468, 6470, 6561, 8570, 6581, 6670, VR6676, 6710, 6750, 6761, 6762, 6870, 6970, 6975, VR68SB4, 86SB1, 92SB3	75p
VR4458, VR445B920, VR445B922, VR5443, 6843, 6843, VR6943	100p
VR3260, 6349, 6448, 6449, 6548, 6648, 49SB620, 64486S, 49SB6	110p
VKR6850, VKR6855	70p
VR501	110p
VKR6800, VKR6810, VKR6820	70p
SE4104, VR231, 2310, 2319, 231, 232, 2329, 237, 23, 241, 2410, 2419, 242, 243, 245, 2465, 247, 2479, 251, 252, 256, 257, 258, 33, 19, 332, 3329, 333, 337, 339, 3419, 342, 343, 3465, 347, 3479, 35, 1, 352, 357, 358, 422, 4229, 432, 437, 442, 4229, 432, 437, 442, 44, 5, 4465, 447, 4479, 451, 452, 457, 458, 459, 512, 522, 5229, 6379, 642, 647, 722, 7229, 723, 7379, 747, 8389, 948, 9489	70p
SAISHO	
VR2000, VHL3	90p
VR3800, 3200, 3300, 3500, 3600, 3650, VRS4400, 5000	75p
VR3400	100p
SAMSUNG	
5V716, 717, V1616, V-621, V1626, VX616, VX617, VX619, X626, VX627, VX629, VX714	75p
VB520, 510, 610, 616, 517, 619, 620, 626, 627, 629, V1510, 520, V1611, 616, 621, 626, VX510, 511, 520, VT320, 5600	80p
VB900, VB910, V1900, V1910	110p
PX880, 981, 982, SE9001, SV9001, SVX307, 319, 322, VB750, 770, 8220, 8225, VT775, 780, 8220, 8225, VK8220, VPX31, VX750, VX775, 790, 8220, 8225, SE9000, 9001	90p
SVX301, 303, 305, SX7301, VB710, 971, V1710, 730, 750, 970, VX710, 712, 720, 730, 970, 971, 972	100p
VX9880	110p
SX7121	95p
SANYO	
VTC5000, 5150, 6000, 6500, VTCM10, 11, 20, 21, 30, 31, 50	85p
VTC5300, VTC5350, VTC5400, VPR5800	80p
VTC5500	70p
VTC9100, VTC9300	140p
VTC1100, 1300, 1500, VHR1100, 1110, 1150, 1200, 1300,	
VHR1500, 2370, MVR220	80p
VHR2100, VHR2300, VHR2500. VHR2700	100p
VHR3100, 3110, 3150, 3300, 3310, 3400, 3500, 3700, 3800, VHRD500. 700, TLS1000, TLS1001	65p
VHR120, 130, 14, 141, 143, 14, 150, 151, 153, 154, 15, 16, 171, VHR194, 220, 23, 235, 240, 244, 250, 251, 274, 297, 310, 330,VHR335, 390, 4100, 4105, 4150, 4200, 430, 4300, 4350, 474, VHR4770, 5080, 5100, 5200, 5300, 5350, 5700, 6850, 7100, VHR7200 7250, 7260, 7300, 7400, 7500, 7520, 7530, 7550, VHR7540, 7700, 774, 7800, 7810, 8000, 8100, 8200, 8250, 8500,VHR8300, 8801, VHR0400, 4410, 4500, 4600, VHRD4610, 4710, 4890, 6700	60p
VMD66, VMD68P	80p
VTR1000	70p
VTC6010	75p
SHARP	
VC200, 381, 384, 385, 386, 388, 390, 393, 838, 9100, 9300, 9500, VC9700	80p
VC7300, VC7700, VC7750, VC7800. VC8000	110p
VC8300	115p
VC300, 387, 471, 473, 481, 482, 483, 486, 488, 496, 8481	80p
VC402, 500, 571, 573, 581, 582, 583, 584, 585, VCSF3, VC8581	80p
VC108, 405, 408, 550, 600, 651, 674, 681, 682, 682, 684, 685, 693	
VC700, 750, 783, VC8F3, VC8V3	70p
VC208, 671, 772, 779, 780, 781, 782, 785, 786, 787, 793, 800,VC7810, 7822, VCA100, 102, 103, 104, 131, 140, 170, 202, 03, VCA234, 501, 502, 602, 5011, VCB311, 361, VCD801, 802, VCH851, 852, 882, VCM73, VCT72	65p
VCA10, 103, 105, 106, 113, 11613, 211, 234, 244, 254, 30, 33, 35, VCA36, 37, 40, 43, 454, 48, 50, 505, 51, 52, 53, 54, 55, 56, 57, 58, VCA60, 605, 615, 67, 68, 1031, VCB320, VCBS97, VCD805, VCD806, 810, 815, VCH80, 81, 85, 865, 910, VC51000, VCT212, 310, 410, 610, VCT1314, VCTS312, 313, VC790ET	80p
VCC10	70p
SONY	
SLC6, SLJ10, SLT6ME	140p
SLC5, SLC7, SLJ7, SLJ9, SLT7ME	140p
SLC9, SL8000, SL8080, SLT50	165p
SL8000E, SL8080E, SL8200, SL8600	175p
SLV255, 125, 213, 225, 262, SLVX1, 20, 3	95p
TOSHIBA	
V55, V57	85p
V33, V31, V32, V51, V52, V53, V9600, V9680	85p
V61, V63, V65, V66, V67	150p
DV80B, DV80D, V71, 73, 74, 75, 77, 81, 83, 85, 86	80p
V108, 105, 110, 120, 130, 140, 199, 209, 210, 211, 220, 221, 411,V421, 609, 610, 611, 659, 660, 711, 880	115p
V91 G, V95G	
V212, 213, 22-2, 312, 322, 403, 412, 413, 610, 763, 813	50p
VCP91E	110p

REPLACEMENT IDLERS & PULLEYS

Make	Models	Description
Hitachi	VT11, 14, 17, 19, 33, 34, 35, 38, 39, 52, 57, 61, 62, 63, 64, 65, 85, 86, 330, 350, 640, 16S, 5030	FF Rew Idler 6886792
Order Code: IDL01		**Price 100p**
Hitachi	VT680, 6500, 6800, 9300, 9500VT9700, 9900	Play Idler 6861482 6881481
Order Code: IDL02		**Price: 180p**
Blaupunkt	RTV301, 306, 307, 309, 311, 312, 315, 316, 317, 319, 320, 404, 414, 424, 434, 444, 478, 707	Idler
Goldstar	GHV1221, 1232, 1240, 1241, 1242, 1243, 1244, 1245, 1246, 1247, GHV1248, 8000, 8200, 8210, 8215, GVHP51, VCP4100, 4130	Idler
Grundig	MVS400, 440, VS400, 410, 440VS450, 460	Idler
National	NV230, 250, 260, 280, 370, 380, NV430, 431, 433, 450, 460, 465, 470, 480, 630, 650, 730, 780, NV810, 830, 850, 870, 890, NVG7, 9, 10, 11, 12, 14, 15, 16, 18, 30, 130, 400, AG1000, AG1050, 1200, 1500, 1810, AG2100, 2200, NVH65, 70	Idler Arm VXP 0521
Philips	VR6460, VR6520, VR6920	Idler Arm 40340162
Order Code: IDL08		**Price 100p**
Amstrad	VCR7000	Idler 150280
Sharp	VC200, 381, 383, 384, 385, 386, VC388, 390, 393, 3300, 8381, 9100, 9300, 9500, 9700	Idler NIDL0005GEZZ
Order Code: IDL10		**Price: 100p**
Philips	VR6540	Idler
Sharp	VC300, 387, 402, 471, 473, 477, VC481, 482, 483, 486, 488, 496, 500, 571, 573, 581, 582, 583, 584, 585, 8481, 5F3, 5W20E	Idler NIDL0006GEZZ
Order Code: IDL11		**Price: 100p**
Akai	VS10	Reel Idler
Ferguson	3V23, 3V29, 3V30, 3V31, 3V323V35, 8923, 8924, 8929, 8930, 8931, 8940, 8941, 8942	Reel Idler PU48967
J.V.C.	HR7200, 7300, 7350, 7600, 7610, 7650, 7655, 7700	Reel Idler PU48967
Order Code: IDL20		**Price: 175p**
Ferguson	3V39, 3V30, 3V31, 3V32, 3V353V36, 3V38, 3V39, 3V49, 8930, 8931, 8933, 8940, 8941, 8942, 8943, 8944	Take Up Idler PU 51402
J.V.C.	HR7200, 7600, 7650, 7655, 7300, 7350, 7610, HRD110, 111, 120, 121, 225	Take Up Idler PU 51402A
Order Code: IDL22		**Price 100p**

Make	Models	Description
Ferguson	3V39, 3V30, 3V31, 3V32, 3V353V36, 3V38, 3V39, 3V49, 8930, 8931, 8933, 8940, 8941, 8942, 8943, 8944	Take Up Clutch PU 51380
J.V.C.	HR7200, 7600, 7650, 7655, 7300, 7350, 7610	Take Up Clutch PU 53462A PU 51380
Order Code: IDL23		**Price: 200p**
Philips	DB532, VR6520, 6843, 644	Reel Idler
Sharp	VC600, 651, 681, 682, 684, 685, 693, 699, 700, 783, 6FR, 6V3, 6F3	Idler Assembly NPLYV0107GEZZ
Order Code: IDL88		**Price: 615p**
Philips	VR6843, 6943, 44SB9, VR44SB920, 44SB922, 6943	Reel Drive Unit
Sharp	VC772, 780, 781, 782, 785, 786, VC787, 800, 793, 799, 7810, 7822, VCA100, 102, 104, VCA131, 140, 170, 202, 203, 234, 501, VCA602, 5011, VCD801, 802, VCH851, 852, VCH882, VCM73, VCT72, VC782MK11	Idler NPLTV0111GEZZ
Order Code: IDL90		**Price: 700p**
N.E.C.	N911, 915, 916, 917, 9012, 9013N9014, 9016, 9033, 9034, 9053, N9054, 9055, 9056, 9066, 9096, N9110, 9120, 9510, 9520, 9530, N9610, DX1000, 1600, 2000, DX3000, PX1200	Idler Arm Assembly
Order Code: IDL245		**Price: 270p**
Philips	DV186, 190, VR211, 2115, 212, 213, 223, 286, 291, 292, 311, 312, 313, 3210, 3219, 322, 3229, 323, 535BO, VR486, 471, 562, 582, 571, 761, 201, 202, VR203, 302, 303, 305, 6180, 6182, 6185, 6285, 6290, 6291, 6293, VR6362, 6367, 6390, 6391, 6393, 6467, 6468, 6470, 6561, 6570, 6581VR6670, 6676, 6710, 6760, 6761, 6762, 6870, 6970, 6975, 86B1, 63SB7, 68SB4, 71SB4, 71SB5. 72SB8, 72SB8, 92SB31, 20DV1, 20DV2, 20RW7, 21DV1, 21DV2. 2SB01, 2SB02, 2SB11, 2SB12, 30DV2. 31DV1, 31DV2, 31DV, 33SB02, 3SB03. 3SB05, 3SB11, 3SB12, 3SB13	Pressure Roller Assembly PS403-40205
Toshiba	V91, V95	Pressure Roller Assembly PS403-40205
Order Code: PR232		**Price: 300p**

REPLACEMENT IDLER TYRES

Akai	M32773	IT01	Ferguson	PU51380	IT07		VXP0433	IT15	
	MZ366960J2	IT02		PU51402A	IT08		VXP0463	IT16	**Price:**
Goldstar	VXP0521	IT17		PU55373	IT09		VXP0521	IT17	**20p each**
Hitachi	6861471	IT03		PU55374	IT10		VXP0581	IT18	**16p each pack of 5**
	6861482	IT04	National	VXP0329	IT11	Sanyo	1430662T15620	IT19	**13p each pack of 10**
	6886971	IT05	Panasonic	VXP0343	IT12	Sharp	NIDL0005GEZZ	IT20	
JVC	PU48697B	IT06		VXP0344	IT13		NIDL0006GEZZ	IT21	*Packs are for each model*
				VXP0401	IT14		NPLY0107GEZZ	IT22	

TELEVISION

TV/VCR SPARES GUIDE 1998

The following list gives spares department addresses and telephone numbers or, where these are the same, service department or head office addresses and telephone numbers. Also included are details of various spares distributors.

Aiwa UK Ltd., P.O. Box 443, West Drayton, Middx UB7 0NZ.
0181 899 5520
Fax 0181 899 0055/0181 564 9067
See also CPC and Willow Vale.

Akai UK Ltd., Haslemere Heathrow Estate,12 Silver Jubilee Way, Parkway, Hounslow, Middx TW4 6NQ.
0181 897 6388
Fax 0181 759 6118 (Service)
See also CPC, Wizard and Chas Hyde.

Akura Spares available from Akura Components Ltd., 44 Deerdykes View, Westfield, Cumbernauld, Glasgow G68 9HW. Also spares for Luks, Minoka and Royal Lux products.
01236 457 022
Fax 01236 457 053.

0141 332 2324 FAX

Alba Radio Ltd., 12 Thames Road, Barking, Essex IG11 0HZ. Spares for Alba, Bush, Roadstar. Some Goodmans and Hinari models and some Brother microwave and Dirt Devil.
0181 787 3000
Fax 0181 787 3110
See also Willow Vale, CPC, Wizard.

Ambassador Brand name used by Sentra Electronics.

Amstrad Spares handled by CPC Ltd. See also Chas Hyde & Son Ltd., Willow Vale and Wizard.

Autovox See Comet Group plc.

Beko (UK) Ltd., 40 Caxton Way, Watford Business Park, Watford, Herts WD1 8QZ.
01923 818 121
Fax 01923 819 652/3.

Beovision/Beocord Bang and Olufsen UK Ltd., Unit 630, Wharfdale Road, Winnersh, Wokingham, Berks RG41 5TP.
0118 969 2288
Fax 0118 969 3388
See also CPC.

Binatone Electronics plc., Unit 1, Ponders End Industrial Estate, East Duck, Lees Lane, Enfield EN3 7SP
0181 344 8888
Fax 0181 344 8877.
Trade only.

Blair's Electrical Services, 13 Belgrave Road, Dresden, Stoke-on-Trent ST3 4PR.
Spares for Saba, Thomson, Telefunken and Nord Mende.
01782 599 377
Fax 01782 599 378.

Blaupunkt Merrivale Television Services, 1 Lockside, Tatbank Road, Oldbury, Warley, W. Midlands B69 4NS.
0121 544 6250
Fax 0121 552 1503.

BPL Spares for these TV sets available from Falmouth Hi Fi, 14 Market Strand, Falmouth, Cornwall TR11 3DE.
Spares also available for Crown, Dansai, Datsurai, Kuro and Zenor
01326 313 412
Fax 01326 211 210.

Bush See Alba Radio Ltd. Also CPC, HRS and Willow Vale.

Cambridge Spares available from SEME.

Canon UK Ltd., Photo Division, Brent Trading Centre, North Circular Road, Neasdon, London NW10 0JF.
0181 459 1266
Fax 0181 459 4202.
See also CPC.

Cathay Spares available from Diamond Television.

Commodore Spares available from CPC.

Comet Group plc., After Sales H.Q., Unit 5, City Park Ind. Estate, Gelderd Road, Leeds LS12 6DR.
01132 310 523
Fax 01132 311 463.

Contec CTVs sold by Dixons. Spares available from Partmaster.

CPC Ltd., Component House, Faraday Drive, Fulwood, Preston, Lancs PR2 4PP.
01772 654 455
Fax 01772 654 466.
Authorised spares distributor for Aiwa, Alba, Amstrad, Bush, Citizen, Commodore, Ferguson, Fidelity, Finlux, GEC, GoldStar, Goodmans, Hinari, Ingersoll, ITT, Logic, Luxor, Matsui, Nokia, Orion, Osume, Pace, Philips, Pye, Saisho, Salora, Samsung, Sinclair, Skantic, Sony, Toshiba and Triumph.
Compatible spares available (video certain models only) for Akai, Bang and Olufsen, Canon, Crown, Daewoo, Decca, Dual, Funai, Grundig, Hantarex, Hitachi, JVC, Kenwood, Marantz, Mitsubishi, NEC, Nikkai, Panasonic, Pioneer, Questar, Sansui, Schneider, Sentra, Sharp, Solavox, Tashiko, Tatung and Telefunken.

Crown Corporation Spares available from Key Electronics. See also CPC, HRS. Made in India models see BPL.

Daewoo Electronic Sales UK Ltd., Daewoo Building, 640 Wharfedale Road, Winnersh Triangle, Wokingham, Berks RG41 5TP.
0118 927 2272
Fax 01189 699 0007
Note: Daewoo brand products only, not OEM products. For the latter, refer to the original distributor.
See also CPC and Willow Vale.

Dansai TV and Video spares available from NEI Made in India models see BPL.

Decca See Tatung (UK) Ltd., CPC and Wizard Distributors. Spares for chassis up to and including the 110/115 series available from D&S Electronic Services, Building 15, Unit 4, Stanmore Industrial Estate, Bridgnorth, Salop WV15 5HR.
01746 766 641
Fax 01746 766 641.

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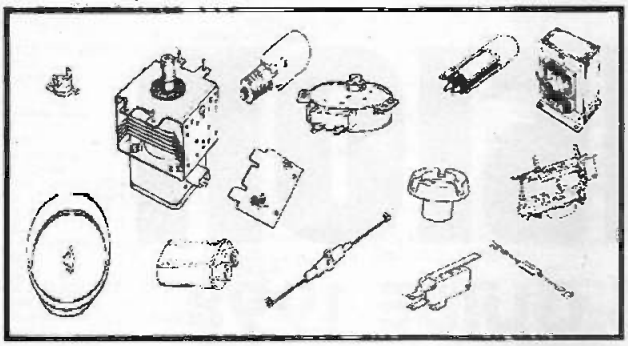

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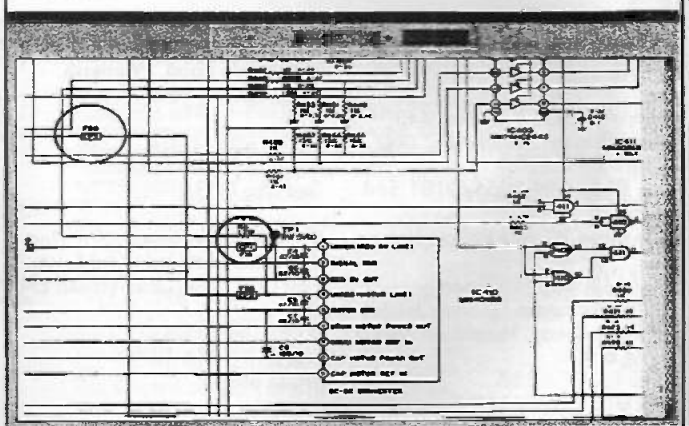

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01753 888 447
Fax 01753 880 109.

Diamond Television
15/15a Rodbourne Road, Rodbourne, Swindon, SN2 2AG. Spares for Cathay and Venturer products. Murphy TVs with model numbers starting CTV, the Murphy VCR7101, Sansui SV77 VCR and Osaki VCR31/2/3 plus mechanical parts for the VCR35, also spares for the Venturer audio full range.
01793 497 591
Fax 01793 431 687.

Dynatron. Pre 1981 sets see Philips Service, post 1981 sets spares from SEME.

Elftone Electronics Ltd., 4 Beresford Avenue, Wembley, Middx HA0 1YZ
0181 902 6222
Fax 0181 903 5011.

Etron Brand name used by Nikkai Imports Ltd.

Expert. Sets use Tatung, GEC, or Luxor chassis.

Ferguson Spares available from Thomson Multimedia Sales UK Ltd., Sales Dept, Crown Rd, Enfield, Middx EN1 1DZ.
0181 344 4411/2
Fax 0181 344 4452.
See also CPC, HRS, Chas Hyde, SEME, Willow Vale and Wizard.

Fidelity Spares available from SEME, HRS, CPC, Wizard and Willow Vale. See also Ross Consumer Products.

Finlux Spares available from Genserve Ltd. and CPC.

Finlandia Spares available from Granada Rental Services.

Fisher Spares available from Sanyo UK Sales Ltd., Sanyo House, Otterspool Way, Watford, Herts.
01923 222 244
Fax 01923 818 251.
See also Chas Hyde.

Fujitsu General 154 Great North Road, Birchwood Industrial Estate, Hatfield, Herts AL9 5JN.
0181 421 7000
Fax 0181 421 7029

GEC Spares available from CPC, HRS, SEME and Willow Vale.

General See Fujitsu General

Genserve (GTS) Ltd., Bridgemead Close, Westmead Industrial Estate, Westmead, Swindon, Wilts SN5 7TS.
01793 556 002
Fax 01793 556 015.

GoldStar See LG Electronics UK Ltd.

Goodmans. See Alba Radio Ltd or Comet Group plc. depending on model. Also CPC.

Granada Rental Services
Unit 37, Roman Way Ind. Estate, Longridge Road, Ribbleton, Preston, Lancs PR2 5BD.
01772 654 551
Fax 0177 265 4551
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Granada Spares available from Granada Rental Services.

Grundig Spares available from GCAS, Unit 35, Woodside Park, Wood Street, Rugby CV21 2NP.
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Fax 01788 577 227
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See also CPC and Willow Vale.
Spares for VCR4000 and SVR4004 ranges available only from Willow Vale.

Harwood Spares available from Key Electronics.

Hinari Spares available from CPC, Chas Hyde and SEME.

Hira The Hira Co., Ltd., Hira House, 1 Elizabeth Street, Manchester M8 8JJ.
01618 347 432
Fax 01618 324 566.

Hitachi Sales (UK) Ltd., Hitachi House, Station Road, Hayes, Middx UB3 4DR.
0181 569 2570
Fax 0181 569 1441.

HMV Sets use Ferguson or Fidelity chassis.

HRS Electronics Ltd., Electron House, 100 Great Barr Street, Birmingham, B9 4BB.
0121 766 6668
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Kenwood Electronics UK Ltd., Kenwood House, Dwight Road, Watford, Herts WD1 8EB.
01923 816 444
Fax 01923 819 131
See also CPC.

Key Electronics Unit 5, Brow Mills Industrial Estate, Brighouse Road, Hipperholme, Halifax HX3 8EF.
01422 203 676
Fax 01422 203 674.
Spares for Crown Carporation Harwood, Kyosho and Ssangyong products.

Konica Plane Tree Crescent, Feltham, Middx TW13 7HD.
0181 751 6121
Fax 0181 755 0681.

Korting Some spares available from Telefaults, St Michael's Road, Pitts Hill, Turnstall, Stoke-on-Trent ST6 6LG. Spares for other brands alsa available.
01782 813 757
Fax 01782 835 762.

Kuro Made in India models see BPL.

Kyoshu Spares available from Key Electronics.

LG Electronics UK Ltd., LG House, 264 Bath Road, Slough, Berks SL1 4DT
01753 500 400
Fax 01753 517 445.
See also CPC and Willow Vale.

Lloytron Electronics Ltd., Service Dept., Laltex House, Matthews Street, Ardwick, Manchester M12 5DT.
0161 272 8833
Fax 0161 272 8844.

Logik Brand name used by Dixons. Spares available from Mastercare, CPC, HRS.

Loewe-Opta Spares available from Wizard.

Longreach Marketing Ltd., Riverside Business Park, Lower Bristol Road, Bath, Avon BA2 3DW.
01225 444 894
Fax 01225 448 676.
Distributors of satellite, aerial and CCTV equipment.

Luks Industrial Company UK Ltd., 1/3 Mollins Court, Westfield, Cumbernauld, Glasgow G68 9HP.
01236-457 989 Ext.18.
Fax 01236-457 919.
See also Akura.

Luxor Spares available from Genserve Ltd., CPC and Willow Vale.

Manhattan Eurasat Distribution Ltd., Oxgate Lane, London NW2 7JA.
0181 452 6699
Fax 0181 452 6777.

Marantz Hi Fi UK Ltd., Kingsbridge House, Padbury Oaks, 575/583 Bath Road, Longford, Middx UB7 0EH.
01753 680 868
Fax 01753 680 428
See also SEME and CPC.

Mastercare PO Box 60, Hemel Hempstead, Herts HP2 7TZ.
01442 888 444
Fax 01442 888 145.
Spares for Dixons/Currys ranges – Matsui, Link, Logik, Prinz, Saisho, Sanyo.

Matsui Brand name used by Currys and Dixons. Spares available from Mastercare. Also CPC, Chas Hyde, SEME and Wizard.

Metz No UK source of spares. Manufacturers address: Metz Werke Gmbh 2 Co., D8510, Furth, Germany.

Minoka Spares available from Luks Industrial Co. UK Ltd. and Akura Components Ltd.

Mitsubishi Electric Europe B.V. Travellers Lane, Hatfield, Herts AL10 8XB.
01707 276 100
Fax 01707 278 859.
See also CPC, Willow Vale and Wizard.

Morphy Richards Spares available from R and M Technical Services.

Murphy Spares available from Diamond Television for TV sets beginning with CTV and VCR 7101. Some sets fitted with Fidelity chassis. Older sets fitted with Rediffusion chassis. Earlier sets fitted with Rank chassis.

National, National Panasonic See Panasonic.

NCS See Genserve (GTS) Ltd.

NEC Spares available from SEME and CPC.

NEI, Network Spares Division, Unit 6, Southfork Industrial Park, Dartmouth Way, Leeds LS11 5JL.
0113 277 4310
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Nikkai See NEI, CPC, HRS, SEME, Willow Vale and Wizard.

Nokia Spares available from Genserve Ltd. and Willow Vale.

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Orion See CPC.

Osaki Brand name used by Rumbelows. Spares for models VCR31/32/33, also mechanical parts for VCR35 available from Diamond Television.

Osume See CPC.

Pace Micro Technology plc, Victoria Road, Saltaire, Shipley, West Yorkshire, BD18 3LF.
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Spares available from HRS, CPC and Willow Vale.

Panasonic (UK) Ltd., Panasonic House, Willoughby Road, Bracknell, Berks RG12 8FP.
01344 860 133
Fax 01344 861 598.
Account holders only.
Non-dealer orders handled by SEME Ltd., School Lane, Buckingham, Bucks. MK18 1HD.
01280 823 523
Fax 01280 814 916
See also Willow Vale and CPC.

Philips Service, PO Box 97, City House, 420/430 London Road, Croydon CR9 4QX.
0181 686 5414
Fax 0181 681 0796.
Account holders only supplied.
See also CPC, HRS, Chas Hyde, Willow Vale and Wizard.

Pioneer High Fidelity (GB) Ltd., Pioneer House, Hollybush Hill, Stoke Poges, Slough SL2 4QP.
01753 789 876
Fax 01753 789 534.
Account Holders only.
See also SEME and CPC.

Prinz Brand name used by Dixons. See Mastercare.

Proline Brand name used by Comet Group plc.

Pye See Philips Service.

Quart see Denon, Hayden Lab.

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0181 560 6644
Fax 0181 560 5853
Helpline 0181 758 0338.
Spares for Morphy and Roberts Radio models.

Roadstar See Alba.

Roberts Radio Spares available from R and M Technical Services.

Ross Consumer Products, Emlyn Street, Farnworth, Bolton BL4 7EB
01204 862 026
Fax 01204 862 033.
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Saba Spares available from Blair's Electrical Services.

Saisho Brand name used by Dixons. See Mastercare, CPC, HRS, Chas Hyde, SEME, Willow Vale and Wizard.

Salora Spares available from Genserve Ltd. and CPC.

Samsung Euro Service Centre, Unit C, Stafford Park 12, Telford Shropshire.TF3 3BJ.
01952 207 171
Fax 01952 293 459.(spares only).
Also CPC, Chas Hyde, Willow Vale and Wizard.
Agents in N. Ireland M.Black, 33 Somerton Industrial Park, Dargan Crescent, Duncrue Industrial Estate, Belfast BT3 9JP.
01232 370 587
Fax 01232 370 852.

Sansui Spares available from Willow Vale and CPC, or Diamond Television for VCR Model SV77.

Sanyo UK Sales Ltd., Sanyo House, Otterspool Way,Watford, Herts WD2 8JF.
01923 222 244
Fax 01923 818 251.
See also Chas Hyde.

Schneider. Spares available from Wizard and CPC.

Seleco See SEME.

SEME Ltd., Unit 2, Saxby Road Industrial Estate, Melton Mowbray, Leics LE13 1BS.
01664 481 818
Fax 01664 563 976.
Spares Available for Alba, Crown, Daewoo, Ferguson LG/Goldstar, Marantz, Matsui, Mitsubishi, Nikkai, Panasonic, Philips, Pioneer, Pye, Saisho, Sharp, Thomson, Thorn, Toshiba.
For Panasonic & Pioneer Spares telephone **01280 823 523**
Fax 01280-814 916.

Sentra Post-1991 spares available from Alba.
See also SEME, CPC and Wizard.

Sharp Spares available from Willow Vale, CPC, HRS and Wizard.

Siemens Spares available from Appliance Care Limited, Unit 4, Ballymount Drive, Ballymount Road Industrial Estate, Dublin 12.
00 353 145 02655
Fax 0145 02520.

Sinclair Spares available from CPC.

Skantic Spares available from Genserve Ltd. and CPC.

Solavox Brand name used by Comet Group plc. See also CPC.

Sonatel Brand name used by Morphy Richards Consumer Electronics Ltd.

Sony UK Ltd., Spares Division, PO Box 58, Newbury, Berks RG13 9LQ.
01635 861 133
Fax 01635 874 099
Account holders only. Non-account holders can obtain spares from:
SES, The Sony Service Centre, Unit 1, The Causeway Estate, Lovett Road, Staines, Middx TW18 3AN.
01784 466 111
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See also CPC, Chas Hyde, Willow Vale and Wizard.

Steepletone Products Ltd., Park End Works, Croughton, Nr Brackley, Northants NN13 5RD.
01869 810 081
Fax 01869 810 784.

Ssangyong Spares available from Key Electronics.

Sunkyong Spares available from S K Global Europe Ltd., Cedar House, Vine Lane, Hillingdon, Middx UB10 0BX.
01895 207 100

Fax 01895 207161.
Trade only.

Tandberg R.D.E. Tandberg, Holly Tree House, The Green, Full Sutton, York YO4 1HW.
01759 372 795.

Tashiko Brand name used by Granada. Spares available from Granada Rental Services. See also CPC.

Tatung (UK) Ltd., Service Division, Stafford Park 10, Telford, Shropshire TF3 3AB.
01952 290 111
Fax 01952 292 096.
Trade only.
Spares also available from CPC, HRS, Wizard and Willow Vale.

Technics See Panasonic (UK) Ltd.

Telefunken Spares available from Ferguson, Blair's Electrical Services and CPC.

Teleton See Fujitsu General.
Texet Spares available from The Hira Co., Ltd.

Thomson TV and VCR spares available from Willow Vale and Blair's Electrical Services.

Thorn brand equipment. Spares available from Thorn UK Ltd., Glaisdale Drive, Bilborough, Nottingham NG8 4LA.
0115 929 3618
Fax 0115 929 2911.

Toshiba European Service Centre, Units 6/7 Admiralty Way, Southern Trading Centre, Camberley, Surrey GU15 3DT.
01276-694 000
Fax 01276-600 521.
Trade only. See also CPC, HRS, Chas Hyde, Willow Vale and Wizard.

Trical Brand name used by Hinari Consumer Products Ltd.

Trio See Kenwood Electronics

Triumph Brand name used by Currys. See Mastercare, CPC.

Uniden Eurosat Distribution Ltd., 1 Oxygate Centre, Oxgate Lane, London NW2 7JA.
0181 452 6699
Fax 0181 452 6777.

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Willow Vale Electronics Ltd., 11 Arkwright Road, Reading Berks RG2 0LU.
01189-876 444
Fax 01189-867 188
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Zenor Made in India models see BPL.

General/miscellaneous parts suppliers

Autogard (UK) Ltd,
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Fax 01902 429 052.

East London Components,
63 Plashet Grove, East Ham, London E6 1AD.
0181 472 4871
Fax 0181 503 5926.

Electromail, PO Box 33, Corby, Northants NN17 9EL.
01536 04 555
Fax 01536 405 555

Electrovalue Ltd,
Unit 5, Beta Way, Thorpe Ind. Park, Egham, Surrey TW20 8RE
01784 433 604
Fax 01784 433 605
Northern branch 680 Burnage Lane, Manchester M19 1NA.
0161 432 4945
Fax 0161 432 4127.

Express Tubes,
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01889 577 600
Fax 01889 575 600.

Farnell Electronic Components, Canal Road, Leeds LS12 2TU.
01132 636 311
Fax 01132 633 411.

Grandata Ltd,
KP House, Unit 15, Pop In Commercial Centre, Southway, Wembley, Middx HA9 0HB.
0181 900 2329
Fax 0181 903 6126.

J.W. Hardy,
231 Station Road, Stechford, Birmingham B33 8BB.
0121 784 8478
Fax 0121 789 7931.

Harrison Electronics,
Century Way, March, Cambs PE15 8QW.
01354 651 289
Fax 01354 651 289

Irwin Electronics,
Unit 200, JC Albyn Complex, Burton Road, Sheffield S3 8BX.
0114 273 9622
Fax 0114 275 9909.

JJ Components,
Rear Of 243/247 Edgeware Road, The Hyde, Collindale NW9 6LU
0181 205 9055
Fax 0181 205 2053.

KSA Wholesale Components, 582 Green Lane, Small Heath, Birmingham B9 5QG.
0121 772 2834
Fax 0121 772 7487.

LRC (Spares),
3-5 Whitfield Street, London W1P 5RA.
0171 323 2107
Fax 0171 323 2191.

Manor Supplies,
172 West End Lane, London NW6 1SD.
0171 794 8751/7346
Fax 0171 431 5778.

Marapet Electronic Components,
1 Hornbeam Mews, Gloucester GL2 0UE.
01452 532 253
Fax 01452 549 514

MCES, 15 Lostock Road, Davyhulme, Manchester M41 0SU.
0161 746 8037
Fax 0161 746 8136
Tuner, modulator, upper drum and LNB repairs.

MPS Electronics, PO Box 777, Rayleigh, Essex SS6 8LU.
01702 554 171
Fax 01702 554 001

Nikko Electronics, Dalbani House, 257 Burlington Road, New Malden, Surrey KT3 4NE.
0181 336 0566
Fax 0181-336 0579.

Philex PLC, 110-124 The Broadway, West Hendon, London NW9 7PP.
0181 202 1919
Fax 0181 202 0015.

PV Tubes, 104 Abbey Street, Accrington, Lancs BB5 1EE.
01254 236 521/390 936
Fax 01254 395 361.

RS Components, PO Box 99, Corby, Northants NN17 9RS.
01536 201 201
Fax 01536 201 501.

TW Electronics (Newbury) Ltd, Beacon House, Harts Lane, Burghclere, Newbury, Berks RG20 9JZ.
01635 278 678
Fax 01635 278 266.

Vista Electronics,
Unit 1B, Wingate Grange Industrial Estate, Wingate, Co. Durham TS28 5AH.
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The disk on the cover of the March magazine contains two programs: the first is a demonstration version of PicoScope for Windows (see screen shots below) and the second an on-line catalogue and order form that allows you to buy any Pico product at a 15% discount. Alternatively you can order either the ADC200 or osziFOX oscilloscopes using the order form below. Please note that this offer is valid until 15 April 1998.

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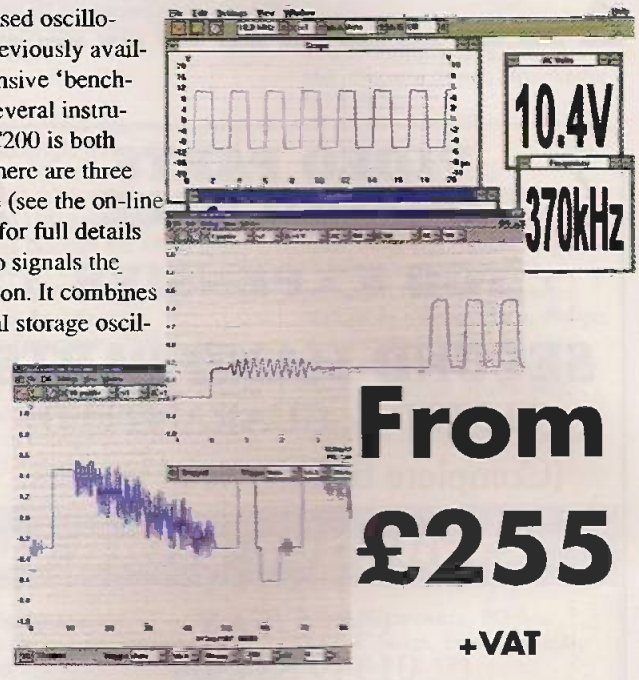
The ADC200 range of PC-based oscilloscopes offers performance previously available only with the most expensive 'benchtop' scopes. By integrating several instruments into one unit, the ADC200 is both flexible and cost effective. There are three models in the ADC200 range (see the on-line catalogue on the floppy disk for full details and specifications). For video signals the ADC200/50 is an ideal solution. It combines a dual-channel 50MS/s digital storage oscilloscope with a 25MHz spectrum analyser. The screen shots of PAL video signals shown opposite were captured using an ADC200/50.



Connection to a PC gives the ADC200 the edge over traditional scopes: the ability to print and save waveforms is just one example. Advanced trigger modes, such as save to disk on trigger, make tracking down those elusive intermittent faults much easier. The ADC200 is supplied with Pico Scope for Windows (see disk for demo version) which is powerful, yet simple to use, especially with its comprehensive on-line help.

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VSF330, 4, 500, 550, VSP88, VSR100, VSX400, 450, 470 **140p**
VSF260, 261, 262, 265, 270, 274, 275, 280, 290, 340, 350, 410, 420, 43C **140p**
VSF441, 440, 450, 455, 480, 490, 497, 510, 560, 580, 590, 599, 600, VSG20, 21, 23, 24, 25, 30, 33, 34, 35, 51, 54, 55, 60, 64, 65, 70, 73, 74, 75, VSP110, VSX560, VSX580 **140p**
VS17, 20, 22, 23, 24, 25, 26, 27, 35, 37, 38, 53, 55, VSA77 **775p**
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VS422, 425, 426, 427, 462, 465, 467, 485, 498, 765, 766, 767, 768, 865, 867, 965, 967, VSA650, VSF10, 11, 12, 14, 15, 180, 190, 200, 210, 220, 221, 222, 230, 240, 30, 300, 301, 310, 320, 33, 330, 4, 500, 510, 600, VSR110, VSX100, 400, 450, 470 **800p**
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AMSTRAD
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VCR7000 **140p**
DD8900, DD8904, VCR6000, 6100, 6200, 8600, 8602, 8603, 8604, VCR8700, 8800, 900>9, 9140, 9244, 9340 **700p**
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VS1004 VS1104 **140p**

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3V29, 3V30, 3V31, 3V32, 3V52, 8930, 8931, 8933, 8940, 8941, 8942 **140p**
3V35, 3V36, 3V38, 3V39, 3V42, 3V43, 3V44, 3V45, 3V48, 3V49, 3V53, 3V54, 3V55, 3V56, 3V57, 3V58, 3V59, 3V65, FV10, FVII, FV12, FV14, 8943, 8944, 8945, 8947, 8948 **140p**
3V52 **140p**
8950, 8951, FV108, 11R, 13H, 14T, 20B, 21R, 22L, 26D, 31R, 32L,FV33H, 39S, 41R, 42L, 50B, 51R, 52L, VC141L **140p**
FV37H, FV44L, FV46T, FV43H, FV57H **140p**
3V35, 3V36, 3V38, 3V39, 3V49, 8943, 8944 **1100p**
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3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V56, 3V57, 8945, 8947, 8948 **1350p**
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FV37, FV57, FV58 **350p**
PINCH ROLLER ASSEMBLY
FV31R **140p**
FV41L, FV42L **925p**
PINCH ROLLER ASSEMBLY
3V58, 3V59, 3V64, 3V65, FV10, 11, 12, 13, 14, 20, 21, 22, 26, 30, 32, 33 FV39, VC141L **875p**
PINCH ROLLER ASSEMBLY
FV43H, FV44L, FV45X, FV46T **700p**
PINCH ROLLER ASSEMBLY
FV61, FV62, FV67, FV68, FV70, FV71, FV72, FV74, FV77 **775p**
PINCH ROLLER ASSEMBLY

FISHER
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FVHP615, 618, 620, 622, 710, 711, 715, 716, 720, 721, 722, 725, 730, FVHP810, 830, 840 **140p**
FVHP905, 906, 907, 908, 910, 911, 915, 916, 918, 970, 975, 980, 990, FVHP 5000, 5005, 5050, 5075, 5100 **140p**
VBR330, VBS3500, 7000, 7100, 7500, 7600, 9000, 9900 **140p**
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FVHD140, 40, 55, FVHP1, 10, 25, 30, 40, 4000, FVHS10, 30 **1350p**
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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 **140p**
GHVP1240, 1241, 1247, 1248, 1290, 1291, GHVP1295, 1296, VCP4000, 4100, 4130, 4200, 4300, 4301, 4305, VCP4306, 4310, 4311, 4315, 4316, 4320, 4321, 4325, 4326, 4350, GSE1290, 1291, 1295, 1296, 1297, 1891, 1910, 20005, 2000 **140p**

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VT7, 11, 14, 16, 17, 18, 19, 33, 34, 35, 350, 38, 39, 88, 330, 680, 4200, VT5000, 5030, 5500, 6500, 6800, 7000, 8000, 8300, 8500, 8700, 930, VT9500, 9700, 9900, VM600 **140p**
VT8, 52, 57, 61, 62, 63, 64, 65, 85, 86, 88, 100, 110, 111, 113, 115, 118, VT120, 122, 125, 128, 130, 135, 138, 145, 150, 168, 170, 175, 220, 225, VT250, 255, 258, 260, 400, 405, 410, 413, 414, 415, 416, 418, 420, 425 **140p**
VT426, 428, 430, 431, 435, 438, 450, 498, 510, 515, 517, 518, 520, 525, VT526, 530, 535, 536, 540, 545, 546, 548, 570, 575, 576, 580, 585, 588 **140p**
VT640, 830, VTF660, 665, 70, 770, 774, 775, 780, 785, 860, 861, 865, VTL30, 1000, 2000, VTLC50, VTM598, 620, 622, 625, 626, 630, 635 **140p**
VTM636, 640, 645, 646, 720, 722, 725, 726, 727, 728, 730, 731, 735, VTM736, 740, 745, 746, 748, 753, 754, 820, 821, 822, 825, 830, 831, VTM835, 838, 840, 841, 845, 920, 921, 922, 925, 930, 931, 935, VTS80, 85, 890, 895VM200, 2300, 2380, 3200, 3280, 500, VMS7200 **140p**
VT3000 **140p**
VT410, 420, 428, 430, 450, 498, 518, 520, 522, 530, VTF770, 780, VTM598, 622, 722, 740, 748, 753 **650p**
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V20H, VXL5, VXL6, VXL7, 8, 9, 10, 11, 19, 90, H13V, VTV100, 200 **140p**
VXL2, VXL3 **140p**
VXL4, VXL20, VXL35 **140p**
VTV100, VXL10, VXL11, VLX9, VXL90 **700p**
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V20H, VXL5, VXL6 MOD KIT **275p**

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HR2200, 3300, 3330, 3360, 3660, 4100, 7700 **140p**
HR2650, 7200, 7300, 7350, 7600, 7610, 7650, 7655 **140p**
HRD110, 111, 120, 121, 140, 141, 142, 143, 150, 152, 156, 157, 158, HRD160, 220, 225, 250, 257, 445, 455, 565, 566, 725, 755, HRP50, BP5000, BR7000, BRS611, 811 **140p**
HRD520, 540, 550, 560, 580, 600, 610, 620, 637, 640, 641, 650, 660, HRD670, 720, 730, 740, 770, 820, 830, 840, 860, 870, 880, 910, 960, HRD980, HRDX20, 22, 25, HRJ200, 205, 210, 215, 300, 315, 316, 318 HRJ400, 405, 407, 410, 411, 415, 416, 507, 600, 605, 610, 615, 715, 815 **140p**
HRJ97, HRS4700, 5800, 5900, 6800, 6900, SR3200, 330, 368 **140p**
HRD170, 171, 180, 210, 211, 217, 230, 300, 320, 321, 330, 337, 350, HRD370, 400, 430, 440, 441, 470, 500, 530, 700, 750, 950, HRS5000, 5500, 8000, 9000, BR7030, 7040, 9060, BRS600, 605, 747, 777, 920, 925 **140p**
HRS10 **140p**
BP5000, HRD110, 111, 120, 220, 225, 455 **1100p**
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HRD140, 141, 142, 143, 150, 152, 157, 158, 160, 565, 566, 725, 755, HRP50 **1350p**
PINCH ROLLER ASSEMBLY
HRD1520, 510, 520, 521, 522, 525, 527, 560, 600, 610, 620, 637, 641, HRD650, 720, 830, 840, 910, HRJ205, HRS5800 **350p**
PINCH ROLLER ASSEMBLY
BR7030, BRS600, HRD160, 170, 171, 180, 190, 210, 211, 217, 227, HRD230, 271, 300, 310, 320, 321, 330, 337, 350, 400, 430, 440, 441, HRD470, 500, 530, 700, 750, 950, HRS5000, 5500, 9000 **875p**
PINCH ROLLER ASSEMBLY
HRD540, HRD550, HRD580, HRD660, HRD860, HRD960 **700p**
PINCH ROLLER ASSEMBLY
HRJ600, HRJ605, HRJ815, HRS9200 **875p**

MATSUI
VX6000, 730, 735, 750, 755, 765, 800, 850, VS888 **140p**
VX1000, VX2000, VX2500, VX3000, VX6000A **140p**

MITSUBISHI
HS12, 5300, 5424, 5600, HSB11, 12, 16, 21, 27, 31, 32, 41, 51, 52, 82, HSE12, 16, 17, 21, 22, 27, 31, 32, 41, 51, 52, 82, HSM1000, 110, 120, 15 0, 16, 170, 190, 210, 23, 25, 250, 27, 33, 34, 35, 36, 37, 370, 380, 45, 450, 5 4, 55, 555, 57, 58, 59, 68, HSMS2, 9, HSS11, 14, 15, 17, 19, 25, 5600, HV F125, 150, 303, 85, SV8900, 8930 **750p**
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HS200, HS300, HS301, HS302, HS303, HS304, HS310, HS320, HS330, HS360, HS700 **140p**
HS306, HS307, HS318, HS319, HS337, HS338, HS347, HS349, HS400, HS410, HS411, HS412, HS421, HS480, HS710, HSB 10, HSB20, 30, HSE 10, 20, 30, 70 **140p**

NATIONAL PANASONIC
NV100, 180, 300, 330PX, 332, 333, 340, 366, 600, 688, 777, 788, 3321, AG6010, 6015, 6100, 6200, 6400, 6800, 7450 **140p**
NV230, 250, 260, 280, 370, 380, 430, 431, 433, 450, 460, 465, 470, 480 **140p**
NV630, 650, 730, 770, 780, 810, 830, 850, 870, 890, 2000, 2010, 3000, NV7000, 7200, 7800, 8050, 8150, 8170, 8200, 8300, 8400, 8500, 8600 **140p**
NV8610, 8620, NVG11, 14, 16, NVG7, 10, 12, 15, 18, 30, 130, 400, AG 1000, 1050, 1200, 1500, 2100, 2200, 6500, 6810, 7500, 7510, NVH70 **140p**
NVG9, NVG120 **140p**
AG6840, 6720, 7150, 7330, 7350, 7355, 7650, NVH65, 75, NVJ30, NVL20, 23, 25, 28, NVG300, NVF65, NVF70, NVFS1 NVFS 100, NVG 19, 20, 25, 33, 40, 50, NVV8000 **140p**
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PVC2300, 2400, 740, 744, 746, 760, 764, 766 **140p**
DX1000, 1600, 1900, 2000, 3000, N9012, 9013, 9014, 9016, 9033 N9034, 9053, 9054, 9055, 9056, 9066, 9095, 9110, 9120, 9510, 9520, N9536, 9610, PX 1200 **140p**
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VHF2A, VP2948 **140p**
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VR6460 VR6920 **140p**
VR2020, VR2021, VR2022, VR2023, VR2024 **140p**
VR6711 **140p**
VR6540 **140p**
DV856, 586, VR702, 703, 6485, 6585, 6589, 6785, 6880, 6948 **140p**
VR445, VR6442, VR6542, VR6643, VR6843, VR6943, 44SB9 **140p**
DV464, 662, VR2220, 2300, 2324, 2330, 2334, 2340, 2350, 2414, VR2480, 2485, 2486, 2489, 2490, 2498, 2840, 6462, 6463, 6464, 6560, VR6660, 6860, 6861, 6862, 5863 **140p**
N-1700, VR2870 **140p**
VR2025, VR6580, VR6581 **140p**
49SB6, VR3260, 6349, 6448, 6449, 6548, 6648 **140p**
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DV186, 190, VR211, 2115, 212, 213, 223, 286, 291, 292, 311, 312, 313, VR3210, 3219, 322, 3229, 323, 535BO, 486, 471, 562, 582, 571, 761, VR201, 202, VR203, 302, 303, 305, 6180, 6182, 6185, 6285, 6290, VR6291, 6293, 6362, 6367, 6390, 6391, 6393, 6467, 6468, 6470, 6561 VR6570, 6581VR6670, 6676, 6710, 6760, 6761, 6762, 6870, 6970, VR6975, 868I, 63SB7, 68SB4, 71SB4, 71SB5, 72SB8, 72SB8, 92SB31, 20DV1, 20DV2, 20RW7, 21DVI, 21DV2, 2SB01, 2SB02, 2SB11, 2SB12, 30DV2, 31DVI, 31DV2, 31DV33SB02, 3SB03, 3SB05 3SB11 3SB12 3SB13 **280p**
VR231, 232, 332, 422, 4229, 512, 5229, 722, 7229, 723 **140p**
VR501 **PR38 140p**

SANYO
VHR1100, 1110, 1150, 1200, 1300, 1500, 2100, 2300, 2370, 2500, VHR2700, 3330, MVR220 **140p**
VTC5000, 5150, 5300, 5350, 5400, 5500, 6000, 6010, 6500, 9100, VTC9300, VTCM10, 20, 11, 21, 30, 31, 40, 50, VPR5800 **140p**
VHR3100,3300, 3310, 3400, 3500, 3700, 3800, VHRD500, 700 **140p**
VTC3000 **140p**
VHR120, 130, 14, 141, 143, 14, 150, 151, 153, 154, 15, 16, 171, 194, 22 **140p**
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VCR100 **140p**
VHR120, 135, 150, 190, 4150, 4160, 4350, 5200, 5240, 5350, 7200, 7250, 7260, 7700, VHRD4410, 4610, 4710, 4890, 5450, VHRS700 **975p**
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VHR3100, 3200, 3300, 3310, 3400, 3700, 3800, VHRD500, 7000 **1350p**
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SHARP
VC200, 381, 383, 384, 385, 386, 388, 390, 393, 800, 2300, 3300, 6000, VC6200, 6300, 7300, 7700, 7750, 7800, 8300, 838, 9100, 9300, 9400, VC9500, 9600, 9700, 9800 **140p**
VC300, 387, 402, 471, 473, 477, 481, 482, 483, 486, 488, 496, 500, 571, 573, 581, 582, 583, 584, 585, 8481, VC5F3, VC5W20E, VCA1031 **140p**
VC108, 208, 405, 408, 550, 600, 651, 671, 674, 681, 682, 684, 685, 693, VC699, 700, 772, 750, 779, 780, 781, 7810, 782, 782MK2, 7822, 783, VC785, 786, 787, 793, 800, 7810, 7822, VCT72, VC6F3, VC6V3, VCA 100, 102, 104, 131, 140, 170, 202, 203, 211, 234, 303, 501, 502, VCA602, 5011, VCD801, 802, 851, 852, 881, 882, VCM73, VCT73, VCT72, VCB361 **140p**
VC220 **140p**
VCA10, 30G, 60, 103, 105, 106, 111, 113, 131, 211, 244, 254, 33, 35, 36, VCA37, 39, 40, 42, 454, 46, 47, 48, 50, 505, 51, 52, 53, 54, 55, 57, 58, 505, VCA60, 605, 615, 62, 63, 67, 68, 1031, 11613, VCB311, 320, VCBS97, VCD805, 806, 810, 815, VCH80, 81, 865, 910, VCS 1000, VCT310, VCT410, 610, VCT 1314, 5313, VC790 **140p**
VC780, 790, VCA10, 103, 1031, 105, 106, 211, 244, 254, 255, 30, 35, VCA340, 43, 47, 50, 60, 605, 615, VCD806, 815, VCH80, 81, 83, 85, VCH865, 87, 910, VCS 1000, VCT212, 310, 410, 510, 610, VCT1314, VCTS313 **525p**
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VHL3, VR1000, 2000, 2500, 3200, 3300, 3500, 3600, 3650, 3800, VRS4400, VRS5000 **140p**
VR3400 **140p**

SAMSUNG
SV716, 717, VB510, 520, 610, 616, 617, 619, 620, 625, 627, 629, 900, V910, V1510, 520, 611, 616, 621, 626, 900, 910, VX510, 520, 616, VX617, 619, 626, 627, 629 **140p**
SVX301, 303, 305, 307, 319, 322, VB710, 713, 750, 770, 971, 8220, VB8225, VT710, 730, 750, 770, 790, 8220, 8225, 970, VX710, 712, VX720, 730, 750, 770, 790, 825, 8225, 970, 971, 972, 8220, PX980, 981, 982, SE9000, 9001, SX7120, 7121, 7220, 7221, 7230, SX7301, VK8220, VPX31 **140p**
VX9880 **140p**
PX31R, 32R, PXR30, SV80, SX3230, 3231, 3260, 3261, VS390, VX30, 31, 32, 3560, 3561, 370, 375, 380, VXK300, 301, 306, 307, 320, VXK321, 326, 330, 331, 336, 337, 350, 351, 356 **140p**
PX990, 991, 992, S11230, 1240, SVX4000, 503, 504, 600, SX1230, SX1231, 1260, 1251, 1566, V11560, VPK43, VX1230, 1260, 1261, VX1560, 1561, 1850 **140p**

SONY
SLC5, 6, 7, SL3000, 8000, 8080, 8200, SLJ 10, SLT6ME, SLT7ME **140p**
SLC9, 20, 24, 30, 33, 44, SLHF100, SLF1, 11, 20, 25, 30, 35, 60, 100, SLF200, SLF60PS, SLF90E, SLFH150, 850, SLK88, 95, SLT20ME, SLT30ME, SLT50ME **140p**
BMC 100, BMC200, BMC500 **140p**
SLV201, 202, 301, 302, 401, 402, 801, 802 **140p**
SLV210, 270, 273, 275, 300, 353, 373, 410, 415, 474, 656, 715 **300p**
SLV757, 777 **140p**
SLV255 **140p**
SLV275, 282, 315, 325, 353, 363, 373, 410, 415, 416, 474, 625, 656, SLV715, 725, 727, 757, 777, 815, 825, SLVX30, 50, 55 **140p**
SLV125, 213, 225, 252, 255, 262, SLVXI, 20, 3 **140p**
SLV215, 216EE, 275, 282, 315, 325, 353, 363EE, 373, 393, 410, 415, SLV416EE, 474, 494EE, 555UC, 559, 575UC, 579, 585HF, 595HF, SLV60W, 615, 625, 656, 676UC, 686HF, 696HF, 715, 725, 727, 757, SLV767B, 777, 815, 825, SLVE7, 8, 9SLVX30AS, SLVX35AF, SLVX50AS, SLVX55DH, SLVX658R, SVO140, 160 **1250p**
PINCH ROLLER ASSEMBLY PART NO: X37277701 SLV210, 212, 270, 273, 275, 285, 300, 310, 335, 425, 427 **350p**
PINCH ROLLER ASSEMBLY
SV6700,8750, 9700, VHR3100, 3200, 3300, 3310, 3400, 3700, 3800, VHRD500, 700 **1350p**
PINCH ROLLER ASSEMBLY
SL100, 200, SLC20, 30, 33, 34, 40, 44, 80, 88, 9, SLF1, 20, 25, 30, 35, 45, SLF60, 65, 73, 90, SLHF100, 150, 950, SLK85, 95, SLO1700, SLS550, SLT0, 30, 50 **300p**
PINCH ROLLER ASSEMBLY

VIDEO LAMPS

Models & Description	Order Code	Price
UNIVERSAL VIDEO LAMP 9V 80mV (310mm WIRES)	VL01	25p
PANASONIC VIDEO LAMPS	VL02	30p
SHARP VIDEO LAMPS	VL02	30p
HITACHI 5381682 (VT63, VT64) VIDEO LAMPS	VL04	135p
AKAI (VS10),GRANADA (VHSXJ3), TT (VR3993,3994), JVC (HR2650, 7600, 7610, 7650, 7655), TELEFUNKEN (VR530, 535, 539, 550, 630, 650), THOMSON (V309, 316, 357, VK309, 411,TX8000), FERGUSON (3V31, 8941, 8942)	VL06	40p
AIWA, AKAI, ALBA, AMSTRAD, BLAUPUNKT, FERGUSON, FIDELITY, FISHER, FUJITSU, FUNAI, G.E.C., GOLDSTAR, GRANADA, GRUNDIG, HINARI, HITACHI, ITT, JVC (HRD SERIES), MATSUI, MITSUBISHI, NEC, ORION, NATIONAL, PHILIPS, SAISHO, SALORA, SAMSUNG, SANYO, SHARP, SIEMEN, SONY, TELEFUNKEN, THOMSON,TOSHIBA	VL05	100p
GRANADA (VHSAY3),SHARP (VC200, 381, 384, 385, 386, 388, 390, 393, 9300, 9500, 9700)	VL08	45p
AKAI, GRANADA (VHSTJ2), HITACHI (VT3000), ITT (VR3912, VRP3833), JVC (HR2200, 3300, 3330, 3660), MITSUBISHI (HS200), TELEFUNKEN (VR510, 519, 610), THOMSON (VK300, 305, 306, 3301), FERGUSON (3V00, 16, 22, 24, 3292, 8900, 8901, 8902, 8903, 8909, 5912, 8922, 8925)	VL01	25p
BLAUPUNKT, ORION (VH1, 2A), NATIONAL (NV200,2010, 3000, 7000, 8150, 8200, 8400, 8600, 8610, 8620), SHARP (VC2300, 6000, 6200, 6300, 7300, 7700, 8300)	VL02	30p
AUTHENTIC (N850), DECCA (VR8300), GRANADA (VHSTJ3, WJ1, WJ3), ITT (VR3913, 3914, 3963) JVC (HT7200, 7300, 7350, 7700) TELEFUNKEN (VR450, 520, 529, 540, 549, 620, 640, 920, 1920), THOMSON (V4100, VK308, 309, 312, 410), FERGUSON (3V23, 29, 30, 8923, 8924, 8929, 8930, 8931, 8940)	VL07	40p

VIDEO SERVICE KITS

AMSTRAD
VCR700
Contents
BELT SET, PINCH ROLLER, REEL IDLER, VIDEO LAMP
Order Code: SK41 £5.50

FERGUSON & JVC
3V42/43
HRD455/HRD725

Contents	*Economy Kit Contents*
BELT SET, PINCH ROLLER, CLUTCH MECHANISM, TENSION BAND	BELT SET, PINCH ROLLER SUPPLY CLUTCH, TAKE UP CLUTCH
Order Code: SK37 £16.00	**Order Code: SK38** £9.00

3V58/59/64/65
HRD170/180/210/230/300/320/370/400/430/530/700/750
HRS5000
Contents
BELT SET, PINCH ROLLER, IDLER ARM, TENSION BAND
Order Code: SK44 £7.00

3V29/3V30
HR7200/7300/7350
Contents
BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES
Order Code: SK05 £5.00

3V35/36, 38/39/49
HRD110/111/120/225
Contents
BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES
Order Code: SK04 £5.00

3V31/3V42
HR7600/7610/7650/7655

Contents	*Economy Kit Contents*
BELT SET, T/U REEL TABLE TYRE, PINCH ROLLER, REEL IDLER, T/U CLUTCH, T/U IDLER TENSION BAND, VIDEO LAMP	BELT SET, T/U REEL TABLE TYRE, PINCH ROLLER, REEL IDLER TYRE, T/U IDLER TYRE, T/U CLUTCH
Order Code: SK33 £11.00	**Order Code: SK34** £5.00

3V35/36/38/39/49
HRD110/111/120/121/225

Contents	*Economy Kit Contents*
BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, T/U CLUTCH, T/U IDLER, REEL IDLER TENSION BAND	BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, T/U CLUTCH, T/U IDLER TYRE, REEL IDLER TYRE
Order Code: SK35 £10.00	**Order Code: SK36** £5.50

3V29/3V30
HRD7200/7300/7350

Contents	*Economy Kit Contents*
BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, REEL IDLER, T/U CLUTCH, T/U IDLER, TENSION BAND, VIDEO LAMP	BELT SET, T/U REEL IDLER TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, REEL IDLE TYRE, T/U IDLER TYRE, T/U CLUTCH
Order Code: SK31 £10.00	**Order Code: SK32** £5.00

3V44/45/48/53/54/55/57
HRP50/HRD140/150/158/160
HRD250/257/565/566/755

Contents	*Economy Kit Contents*
BELT SET, PINCH ROLLER, CLUTCH MECHANISM, TENSION BAND	BELT SET, PINCH ROLLER
Order Code: SK39 £15.00	**Order Code: SK40** £9.50

FISHER
FVHP905/906/907/908/910/911/916/918

Contents	*Economy Kit Contents*
BELT SET, PINCH ROLLER, IDLER, GEAR IDLER UNIT, TENSION BAND	BELT SET, PINCH ROLLER, IDLER TYRE
Order Code: SK57 £13.00	**Order Code: SK58** £5.00

FVHP615/618/620/622/710/711/715/716/720/721/722/725/730/830/840

Contents	*Economy Kit Contents*
BELT SET, PINCH ROLLER, IDLER, GEAR IDLER UNIT, TENSION BAND	BELT SET, PINCH ROLLER, IDLER TYRE
Order Code: SK68 £11.00	**Order Code: SK69** £300

HITACHI
VT11/VT33
Contents
BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES
Order Code: SK08 £5.00

VT11/VT33

Contents	*Economy Kit Contents*
BELT SET, T/UP REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, FF/REW IDLER, CLUTCH PLATE, TENSION BAND	BELT SET, PINCH ROLLER, FF/REW IDLER TYRE, T/UP REEL TABLE TYRE, SUPPLY REEL TABLE TYRE
Order Code: SK45 £13.00	**Order Code: SK46** £3.75

VT52/61/62/63/64/65/85/86/640

Contents	*Economy Kit Contents*
BELT SET, PINCH ROLLER, FF/REW ARM, CLUTCH PLATE, TENSION BAND	BELT SET, PINCH ROLLER FF/REW IDLER
Order Code: SK49 £14.00	**Order Code: SK50** £3.00

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
Contents
TIMING BELT, PINCH ROLLER, FF/REW ARM, CLUTCH BASE, TENSION BAND
Order Code: SK52 £9.75

VT100/110/111/113/115/118/120/125/128/130/135/138/145/150/175/220/225/250/255/258/260/VT130
Contents
BELT SET, PINCH ROLLER, FF/REW ARM, CLUTCH PLATE, TENSION BAND
Order Code: SK51 £14.00

PANASONIC
NV2000/NV2010/NV7000/NV7200/NV7800

Contents	*Economy Kit Contents*
BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES	BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES
Order Code: SK03 £5.00	**Order Code: SK02** £5.00

NV300/NV330/NV333/NV340/NV366
Contents
BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRE
Order Code: SK01 £5.00

NV2000/NV2010

Contents	*Economy Kit Contents*
BELT SET, PINCH ROLLER, FF IDLER, PLAY IDLER, TENSION BAND, VIDEO LAMP	BELT SET, PINCH ROLLER, IDLER TYRE, PULLEY TYRE
Order Code: SK13 £6.00	**Order Code: SK14** £3.50

NV7000/NV7200/NV7800

Contents	*Economy Kit Contents*
BELT SET, PINCH ROLLER, IDLER UNIT, PLAY IDLER, TENSION BAND	BELT SET, PINCH ROLLER IDLER TYRE, CLUTCH TYRE
Order Code: SK11 £8.50	**Order Code: SK12** £3.25

NV300/NV330/NV333/NV340/NV366

Contents	*Economy Kit Contents*
BELT SET, PINCH ROLLER, IDLER UNIT, PLAY IDLER, TENSION BAND	BELT SET, PINCH ROLLER IDLER TYRE, PLAY IDLER
Order Code: SK15 £7.00	**Order Code: SK16** £3.25

NVG7/NVG9/NVG10/NVG11/NVG12/NVG14/NVG15/NVG16/NVG18/NVG30/NVG120/NVG130/NVG400/NVH65 (PX/AC)/AG1810 (P/K)

Contents	*Economy Kit Contents*
LOADING BELT, CAPSTAN BELT, PINCH ROLLER, IDLER TENSION BAND	LOADING BELT, CAPSTAN BELT, PINCH ROLLER, IDLER TYRE
Order Code: SK27 £6.00	**Order Code: SK28** £3.00

NV332

Contents	*Economy Kit Contents*
BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND, FF/REW TYRE	BELT SET, PINCH ROLLER PLAY IDLER TYRE, FF/REW IDLER TYRE
Order Code: SK29 £12.00	**Order Code: SK30** £5.10

NV230/250/260/280/430/450/460/470/650/810/890/AG1200PK/AG1500PK

Contents	*Economy Kit Contents*
BELT SET, PINCH ROLLER, IDLER, TENSION BAND	BELT SET, PINCH ROLLER IDLER TYRE
Order Code: SK23 £6.00	**Order Code: SK24** £3.25

NV600/NV588

Contents	*Economy Kit Contents*
BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND	BELT SET, PINCH ROLLER PLAY IDLER TYRE, FF/REW IDLER TYRE
Order Code: SK25 £12.00	**Order Code: SK26** £6.00

NV730/NV770

Contents	*Economy Kit Contents*
SLOT IN BELT, LOADING BELT PINCH ROLLER, IDLER UNIT, TENSION BAND	SLOT IN BELT, LOADING BELT, PINCH ROLLER, IDLER TYRE
Order Code: SK19 £5.50	**Order Code: SK20** £3.00

NV370/NV380/480/630/780/830/850/AG2100PK/AG2200PK

Contents	*Economy Kit Contents*
BELT SET, PINCH ROLLER, IDLER, TENSION BAND	BELT SET, PINCH ROLLER IDLER TYRE
Order Code: SK21 £5.00	**Order Code: SK22** £2.75

NV777/NV788

Contents	*Economy Kit Contents*
BELT SET, PINCH ROLLER, IDLER UNIT, TENSION BAND	BELT SET, PINCH ROLLER IDLER TYRE
Order Code: SK17 £6.00	**Order Code: SK18** £4.00

SHARP
VC381

Contents	*Economy Kit Contents*
BELT SET, PINCH ROLLER, REEL IDLER, TENSION BAND, VIDEO LAMP	BELT SET, PINCH ROLLER REEL IDLER TYRE
Order Code: SK47 £8.00	**Order Code: SK48** £3.25

VC500/VC571/VC581/VC582/VC583/VC584/VC5F3

Contents	*Economy Kit Contents*
BELT SET, PINCH ROLLER, REEL IDLER, TENSION BAND	BELT SET, PINCH ROLLER REEL IDLER
Order Code: SK60 £9.50	**Order Code: SK61** £5.00

VC781/VC7810/VC7822/VC785/VC786/VC793/VC800/VCA100/VCA102/VCA104/VCA202

Contents	*Economy Kit Contents*
BELT SET, PINCH ROLLER, REEL DRIVE UNIT, TENSION BAND	BELT SET, PINCH ROLLER REEL DRIVE UNIT TYRE
Order Code: SK64 £13.50	**Order Code: SK65** £3.75

VC681/VC682/VC684/VC685/VC693/VC695/VC6F3/VC700

Contents	*Economy Kit Contents*
BELT SET, PINCH ROLLER, REEL DRIVE UNIT, TENSION BAND	BELT SET, PINCH ROLLER REEL DRIVE UNIT TYRE
Order Code: SK62 £13.50	**Order Code: SK63** £5.00

FOR MORE DETAILS OF OVER 500 TYPES OF SERVICE KITS . . .
PLEASE RING US!

NEW UNIVERSAL REMOTES

See Page 426

JUST ARRIVED!!!!

REPLACEMENT VIDEO CASSETTE HOUSINGS

Name	Models	Code	Price
AKAI	VS35, VS53, VS55, VS56, VS75	CH18	3200p
GRANADA	VHSDP1	CH05	1100p
	VHSYJ2	CH01	2800p
GOLDSTAR	GHV1290P, 1291P, 1295P, 9400, 7340I, GSE1295P, GSE1891P, 20001Q, 20051Q, VCP4200, 4300, 4301, 4305, VCP4306, 4311, 4315, 4316, 4320, 4321, 4325	CH25	2000p
	GHV51, 1221, 1232, 1240, 1241, 1242, 1244, 1246, 1248, GHV8000, 8200	CH26	2900p
FERGUSON & J.V.C.	3V39, 3V39, 8943, 8944, 8951, 3V35, 3V36, 3V49, HRD 110, 11T, 120, 121, 225	CH01	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
	8948, 8950, FV10B, 12L, 13H, 14T, 20B, 21R, 22L, 26, 395, HRDZ30, 430, 530	CH03	2800p
	3V58, 3V59, 3V64, 3V65, FV11R, 8950, 8951, HRD170, HRD180, HRD370	CH04	2800p
	FV31R	CH19	4300p
	HRD515, 520, 527, 540, 550, 580, 600, 610, 620, 660, 670, HRD830, 840, 850, 860, 4050, 6600, FV37H	CH20	2200p
	HRD540, 580, 830, 860, 910, 960, HRD970, HRDX20,		
FERGUSON	FV57H	CH27	2400p
I.T.T.	VR3605, VR3905	CH01	2800p
	VR3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948	CH02	2800p
	VR3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948	CH02	2800p
NATIONAL PANASONIC	NV730	CH06	4300p
N.E.C.	N830EG, N831EG, N831EG, N832, N833EG	CH01	2800p
	N895	CH02	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, 6750, 6761, 6870, 6970	CH05	1100p
	VR6443	CH22	2900p
	VR6448	CH23	2500p
	49SB6	CH24	2500p
SHARP	VCA100, VCH851, VCH852	CH22	2900p
	VCA103, 103GV, 106, 106GVM, 254GVM	CH23	2500p
	VCS211, 244, 5055, 6055, VCB230, VCD806G, 810G, VCT212, 310, 410G, 610	CH24	2500p
TELEFUNKEN	VR2970	CH02	2800p
THOMSON	V320, 321, 323, 326, 4200, 4300	CH01	2800p
	V342, 343, 352, 353, 360, 364, 368, 4210, 4230, 4260, 4400, V5500, 6000, 8540	CH02	2800p
TOSHIBA	V55, V57	CH01	2800p
	V65, V66	CH02	2800p

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	£3.50
(VSS0110)	£2.25
NV830 (VSS0091)	£2.10
NV300, 333, 340, 366, 688, 777, 778	
(VSS0060	£3.75
NVG21, 25, NVH65, NVD80 (VSS0175A)	£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, GOLDHAND, GRANADA, HINARI, MARQUANT, OMEGE, 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	NVG7 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

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

3 REVERSIBLE SCREWDRIVERS CIRCLIP PLIERS
SPRING HOOK 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 Price: 75p
Part Nos: 138 - 10229, 2.4v 100mAH
Order Code: BB02 Price: 135p

FERGUSON
Part No: 00E6 - 067 - 001 1.2V 100mAH
Order Code: BB03 Price: 90p
Part Nos: 00E6 - 606 - 8001 2.4V 100mAH
Order Code: BB04 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 impedence: 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
10A	FUSE48	825p

NB. All fuses are made in the UK and fully meet BS4265 & BS1362 safety standards and should not be compared with cheap imported types

** ALL THE ABOVE PRICES ARE FOR PACKS OF 10 FUSES **

VOLTAGE TESTER

A terminal screwdriver incorporating continuity & voltage with Euroslot

ORDER CODE: TOOL11 **PRICE: 220p**

SPRING HOOK

Spring Hook, to unlock springs in audio tape recorders & VCRs

ORDER CODE: TOOL20 **PRICE: 265p**

FAULT FINDING / COMPARISON BOOKS

Satellite Fault Finding Guide Issue 1. Listing about 1,000 faults for over a range of 24 different brands. Order Code: BOOK05. **Price £8.50 – No VAT.**

TELEVISION Edition 6

Lists more than 8,450 faults with 460 pages covering 58 different brands

Price: 1600p only – no VAT. Order Code: BOOK02

SEMICONDUCTOR COMPARISONS 1997/8

Listing more than 31,600 Semiconductors with suitable alternative complete with descriptions and base information.

Price: £15.50 – No VAT. Order Code: BOOK04

Video Recorders Edition 5 1997

Over 300 pages packed with more than 5500 faults for different brands

Price £15.00 – No VAT. Order Code: BOOK01

Satellite Repair Manual Edition 4

A comprehensive guide to receiver reviewing, featuring stock faults and installation tips.

Price £15.00 Only No VAT Postage 100p Order Code: BOOK03

SEMICONDUCTOR COMPARISONS 1997

The new 1997 Jaeger Semiconductor with 952 pages packed with information on over 80,000 semiconductors in much greater detail plus marketing data on SMD devices and a separate generic table of all type designations.

Price: £40.00 only – No VAT (+ £5 Postage). Order Code: BOOK06

SERVICE AIDS

DESCRIPTION	VOLUME	CODE	PRICE
VIDEO HEAD CLEANER	75ML	SP01	125p
SWITCH CLEANER	176ML	SP02	140p
SILICONE GREASE	200ML	SP03	170p
FREEZE IT	170ML	SP04	280p
FREEZE IT	400ML	SP16	570p
FOAM CLEANER	400ML	SP05	155p
ANTI-STATIC	150ML	SP06	155p
AEROKLEANE	135ML	SP07	185p
AERO DUSTER	150ML	SP08	290p
AERO DUSTER	400ML	SP17	550p
PLASTIC SEAL	200ML	SP09	230p
GLASS CLEANER	250ML	SP10	155p
COLDKLENE	250ML	SP13	225p
EXCEL POLISH 80	250ML	SP18	145p
ADHESIVE 120	400ML	SP19	190p
LABEL REMOVER 130	200ML	SP20	240p
REFURB 140	400ML	SP21	240p
TUBE SILICON GREASE	50 GRAMMES	SP11	200p
TUBE SILICON SEALANT WHITE	75ML	SP22	250p
TUBE SILICON SEALANT CLEAR	75ML	SP23	250p
TUBE HEAT SINK COMPOUND	25 GRAMMES	SP12	140p
DRIVE CLEANER	200ML	SP24	130p
SCREEN CLEANER	200ML	SP25	145p
COMPUTER CARE KIT	–	SP26	2100p

All the above items are manufactured by Servisol

If you purchase more than one Servisol Product, postage & package will be charged as follows:

300p for 2- 5 cans **500p** for more than 5 cans

SOLDERING ACCESSORIES

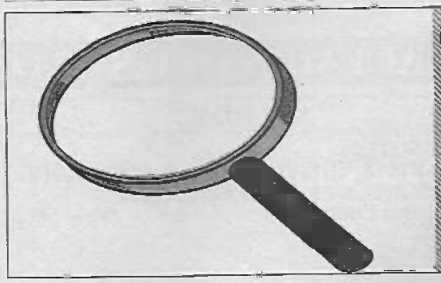
DESCRIPTION	CODE	PRICE
ANTEX SOLDERING IRONS		
25 WATT 240 VAC (XS25W 240V)	S101	900p
15 WATT 240 VAC (XS15W 240V)	S102	900p
25 WATT SPARE ELEMENT	S103	450p
15 WATT SPARE ELEMENT	S104	450p
SOLDERING STAND & SPONGES		
SOLDERING STAND (MADE BY ANTEX)	S108	350p
SPARE SPONGE	S109	55p
SOLDER		
18 SWG 500 GRAMMES	S110	500p
20 SWG 500 GRAMMES	S111	650p
22 SWG 500 GRAMMES	S112	700p
DESOLDERING AIDS		
SOLDER MOP STANDARD GAUGE 1.2MM X 1.5M	S107	80p
SOLDER MOP 1.2MM X 10M	S113	400p
DESOLDERING PUMP	S105	320p
SPARE NOZZLE	S106	60p

I.C. PROTECTORS

ICPF10, ICPF15, ICPF20, ICPF25, ICPF38, ICPF50, ICPF75

ICPN5, ICPN10, ICPN15, ICPN20, ICPN25, ICPN 38, ICPN50, ICPN75

PRICE: 30p EACH ONLY



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GRANDATA LTD

Tel: 0181 900 2329

CASSETTE DC MOTORS

6V MOTOR	170p
9V MOTOR	170p
12V CW MOTOR	170p
12V CCW MOTOR	170p
13.2V MOTOR	290p

CASSETTE TAPE HEADS

MONO HEAD	90p
STEREO HEAD	110p
MINI HEAD	150p
AUTO REVERSE HEAD	200p

CD PICK UPS

Models & Description	Order Code	Price
AIWA		
XC007	KSS151A	1900p
DX-990A, DX-D1A	KSS152A	1600p
CXL60, CXL66G, CXL80, CXN3100, CXN320, CXN3300, CXN360, CXN400, CXN430, CXN540, CXN550G, CXN990, CXN999, CXNV20, CXSL70, DXZ9100M, FDN636, FDN6636, FDN939, LCX60, LCX66G, LCX70M, LCX80, M7460, M75, NSX320, NSX360, NSX400, NSX430, NSX990, NSX992, NSX999, NSXD636, NSXD939, NSXV20, SXFN550,SXFN520, XC300, XC550, XC750, XC900, XC950, XCN992, XG320, XG380, XG400, XG990, ZD3000M, ZD3100M	KSS152A	1600p
CXAP1, CXL7, CXL8G, CXLC50P, CXZ58, DXM740, DXM75, DXM76, DXM77, LCX50, LCX7, LCX8G, LCXAP1, XC002, XC004, XC005, XC777	KSS210B	2000p
XP31, XP33, XP55, XP60G	KSS220A	2500p
XP6,XP7	KSS331A	3400p
AKAI		
CD73, DC93	KSS151A	1900p
CD25, CD26, CD27, CD32, CD36, CD37, CD52, CD55, CD57, CD650, CD670, CD69, CD750, CD79, CDM480, CDM600, CDM670, CDEM770, CDM999, MX550, MX570, MX650, MX670, MX750, MX950	KSS210A	1800p
DENON		
DCD1500, DCD1520, DCDE3520	KSS151A	1900p
DCD1400, DCD600, DCD800	KS152A	1600p
DCD1420, DCD520, DCD610, DCD620, DCD660, DCD810, DCD820, DCD860, DCD910, DCD920	KSS210A	1800p
DCD1015, DCD1290, DCD2060, DCD2060G, DCD315, DCD480, DCD580, DCD615, DCD715, DCD825, DCD890, DCD895, DN2000F	KSS240A	3000p
GOLDSTAR		
CD952A, CD952AJ, CD952LJ, CD952SJ, FFH101KL, FFH101WL, FFH222A/L, FFH272L, FFH333L, FFH373K, FJ606, FR606L	KSS210A	1800p
CD320A/L, CD630S/L, FFH212A/L,FFH212E	KSS210B	2000p
GRUNDIG		
CD360, CD435	HOPM3	2150p
CCD300, CD101NCD904, MC10, NEW ORLEANS CD	KSS210A	1800p
KRCD100, RR1900CD, RR3100CD, RR4000CD, RR610CD, RR700CD	KSS210B	2000p
CDP80, CDP90	KSS220A	2500p
CDP65	KSS331A	3400p
CD905	OPTIMA5	3000p
HITACHI		
DAW560	HOPM3	2150p
FX-10	KSS210A	1800p
AXC10	KSS210B	2000p
J.V.C.		
1990-1992, LATE 1987-1988 - XLE300BK, XLE318K, XLE518K, XLE900BK, XLME918K, XLV101BK, XLV211BK, XLV222BK, XLV311BK, XLV333BK, XZ1010TN, XLZ411BK, XLZ444BK, XLZ555BK, XLZ611BK	OPTIMA3	4000p
CDRADIO CASSETTE, MINI SYSTEMS - MODELS 1990-1992	OPTIMA4S	5000p
CA-C33, CA-MX30BK, CA-MX33BK, UX-A5, UX-A6, XL M309, XL M403BK, XL M408, XL-M409, XL M504BK, XL-M505TN, XL-M506, XL-M509, XL M705TN, XL V131BK, XL-V151TN, XL-V221BK, XL-V241TN, XL-242BK, XL V251TN, XL V252BK, XL Z1050TN, XL Z551TN, XL-Z552BK	OPTIMA5	3000p
1994 ONWARDS - CAE48BK, CAMCG7, CAMXG9, CAS20BK, CAS33BK, VAS50, CAS60RBK, MXS20, MXS30, MXS50, PCX105, PCX130, PCX95, RCX230, RCX320, RCX520, RCX620, RCX720, UXA4, UXA5, UXA55, UXC7, UXT1, UXT3, XLF115, XLF116, XLF215, XLF216, XLMC100/M, XLMXG7, XLMXG9, XLV163TN, XLV164BK, XLV174, XLV263TN, XLV264BK, XLV274BK, XLZ463TN, XLZ464BK, XLZ574, XLZ674, XTMXG7, XTMXG9, XTS60	OPTIMA6S	3300p
KENWOOD		
DP47, DP660SG, DP8020, DP87, L10000	KSS152A	1600p
DP1030, DP1510, DP2010, DP2030, DP3010, DP3030, DP3050, DP4030, DP491, DP5010, DP5030, DP5040, DP520, DP7030, DP7040, DP7050, DP730, DP920, DP930, DP950, DPM650,DPM6630, DPM7730, DPM850, DPM991, DX6620, M225, M25, M450, M650, PD3030, PDM991, RDX25, RXDC3, RXDC3L, UD202, UD302	KSS210A	1800p
DPC42, DPC72, DPC77, DPC80, DPC92	KSS220A	2500p
DP1050, DP2050, DP3060, DP501, DP5080, DP722, DP76, DP85, DP89, M77A, PD3060, UD502, UD70, UD701, UD90, XE5	KSS240A	3000p
DPC321, DPC521, DPC531, DPC631K, DPC721, DPC731	KSS331A	3400p
DP1060, DP2060. PART No: RCTRH8136AFZZ	RH8136A	4500p
PANASONIC		
SLP177A, SLP202A, SLP212A, SLP222A, SLP277A, SLP377A, SLP477AK, SLP477A, SLPG100A, SLPG200A, SLPG400A, SLPG500AK, SLPG500AS, SLPJ24A, SLPJ26A, SLPJ27A, SLPJ28A, SLPJ325A, SLPJ325A, SLPJ37A, SLPJ38A, SLPJ46A	691-30209	5500p
SAD30, SLCH9, SLP150, SLP170, SLP200, SLP202, SLP222, SLP230, SLP250, SLP333, SLP370G, SLP400C, SLP555, SLP777, SLP999, SLPA10, SLPC20, SLPC25, SLPJ25, SLPJ26, SLPJ27, SLPJ37, SLPJ45, SLPK25, SLPK26, SLPS50, SLPS70, SLPS700, SLPS840, SLPS900	SDAAD70A	2350p
PHILIPS		
AZ8304, CD070, CD080, 890, 910, 920. PART NO. 4822-691-20768	4822-691	3100p
CD100, CD130, CD1380, CD1432, CD200, CD204, CD210, CD300, CD303, CD304, CD380, CD480, CD482, CD500, CD502, CD582, CD583, CD584, CD610, CD620, CD630, CD780, CD781, CD782, CD840, CD883, CD960, CDF104, CDM419, FCD185	691 30209	5500p
AS440, AS445, AS540, AS640, AZ8048, AZ8640, CD070, CD080, CD091, CD163, CD165, CD690, CD710, CD720, CD732, CD740, CD750, CD910, CD920, CD935, FW17, FW21, FW26, FW330, FW36, FW360, FW380, FW40, FW41, FW46, FW56, FW66, FW68	CDM12.1	1800p
CD1210/40	CDM12.4	2200p
AZ8006	KSS210B	2000p
FW11	OPTIMA6S	3300p
PIONEER		
PDM400, PDM410, PDM500, PDM510, PDM600, PDM610, PDM700, PDM710, PDM730, PDT303. PDT403, PDT503, PDX940M, PDX950M. PDZ560T, PDZ72T, PDZ73T, PDZ81M, PDZ82M, PDZ83M, PDZ960M, XDZ53T, XDZ54T	KSS151A	1900p
N32, N90M, PD101, PD201, PD32, PD41, PD4500, PD4700, PD52PD5700, PD65,PD6500, PD6700, PD7700, PD8700, PD970, PDCP420, PDCP520M, PDCP520T, PDJ400T, PDJ500T, PDJ800M, PDJ900M, PDM430, PDM450, PDM550, PDM630, PDM650, PDM750, PDM901, PDP710T, PDP720T, PDP910M, PDP920M, PDS501, PDS601, PDS701, PDS701G, PDS901, PDT310, PDT510, PDZ, PDZ570T, PDZ74T, PDZ84M, PDZ970M, PXA1349, S125CDT, S135CDT, S303CDM, S303CDT, S505DM, S505DT, S707DM, S707DTM, S909DM, S990DT, XCP410M, XCP410T, XDZ54T, XDZ55T, XDZ64M, XDZ84T, XRP310, XRP320	PEA1030	4400p
PDM400, PDM410, PDM500, PDM510, PDM600, PDM610, PDM700, PDM710, PDM730, PDT303, PDT403, PDT503, PDX940M, PDX950M, PDZ560T, PDZ72T, PDZ73T, PDZ81M, PDZ82M, PDZ83M, PDZ960M, XDZ53T, XDZ54T, XDZ55T, XDZ62, XDZ62M, XDZ630, XRZ82	PWY1009	4800p
SAMSUNG		
CD20	HOPM3	2150p
CD1200, CD1310, SCM-6000, SCM6900	KSS210A	1800p
RCD1200, RCD1300, RCD1350, RCD1600, RCD2600, RCD990, RCD995, SCM6900	SDH90T4N	3600p
SANYO		
DCFS3, DCT55, DCX502, DCX701, DCX702, DCX802, DCX891, DCX891N, MCDZ10. PART No. 6142186855	614218	2300p
DCFS5, MCD450K, 660K, MCDZ30L, 60F. PART No. 6142205006	614220	5600p
DCX1000MD, DCX1003, DCX900MD, DCX903, DCX915	KSS210A	1800p
DC010, DCD11U, DCD20, DCD30, DCD30AT, DCD6, DCD8U, DCMS1, DCX110, DCX120, DCX210, DCX220, DCX993, DCX994, MCDMS40L, MCDMS50L, MCDMS660L, MCDZ1L, MCDZ2L, MCDZ3L. PART No. 6142391303	614239	3300p
DCD12. PART No. 6450055966	645005	3700p
MCDZ31L, MCDZ41L, MCDZ51L, MCDZ71L	KSS210B	2000p
SHARP		
CD 111, CD 301, CD-302, CD-304, CD-310, CD-C3, CD-L700, CD L800, CD-U1, CD-U10, CD-X10, CD-X12, CD-X15, CD-X16, CD-X17, CD X20, CD-X9, CDL850, CMS95CD, DX-150, DX-160, DX 450, DX-450, DX-461, DX 650, DX 660, DX-969, DX-A3, DX-N45, DX-R552, DX-R7, DX-R75, DX R750, DX-R77, DX-R770, DX-R820, DX-R840, DX-Z700, DX-Z1000, DX-Z1500, GFCD55, QT-30CD, QT-33CD, QT-350CD, QT 37CD, QT-38CD, QT-CD20, QT-CD33, RS95, SC-77CD, SC 99CD, SC-RS95, SG-A1, SG-W1CD, SG-W2CD, SYS302, ZCD7CD. PART No. RCTRH8122AFZZ	RH8122A	5750p
QT-50CD, QT-60CD, QT80CD. PART No. RCTRH8124AFZZ	RH8124AF	2900p
DXR-8408. PART No. RCTTRH8130AFZZ	RH8130AF	2900p
CDS360E, 360H, 370, 450H/E. CMS150CDH, CMSR400CDH, CP150, CPR400, CPS360, 370. PART No. RCTRH8136AFZZ	RH8136AF	4500p
SONY		
KSS240A	KSS240A	3000p
KSS121A	KSS121A	3500p
KSS151A	KSS151A	1900p
KSS210A	KSS210A	1800p
KSS210B	KSS210B	2000p
KSS220A	KSS220A	2500p
KSS331A	KSS331A	3400p
KSS360A	KSS360A	2600p
TECHNICS		
SLP200, SLP230, SLP250, SLP333, SLP555, SLP777, SLP999,SLPA10, SLPC20, SLPJ25, SLPJ45, SLPS700, SLPS900	SDAD70A	2350p

REMOTE CONTROLS

Description	Code	Price
AKAI		
RC-V10A	RC876	650p
RCV 37 B	RC891	650p
V25A	RC896	650p
DECCA		
RC70	RC894	650p
FISHER		
RC905B	RC879	650p
GRANADA		
UNIVERSAL TEXT	RC309	650p
MK4 TEXT, 70115G, 70115G, 70133G	RC880	650p
95288E	RC882	650p
94490D	RC884	650p
GRUNDIG		
TP160E	RC107	650p
TP200, TP300	RC380	650p
TP400	RC401	600p
TP590-600	RC600	650p
TP390, TP610	RC610	650p
TP621	RC612	650p
TP630, TP650	RC650	650p
TP666	RC660	650p
TP661	RC661	650p
HITACHI		
CLE800-CLE830	RC140	650p
A617402/655602	RC1920	650p
A512120/230	RC900	650p
A514790	RC901	650p
A5088470	RC902	650p
A518612	RC903	650p
SCL002	RC904	650p
C2096	RC905	650p
A511940	RC906	650p
655602H	RC1920	650p
ITT		
IFB13, 14, 15	RC143	650p
FS4	RC148	650p
RG305	RC305	650p
RG306	RC306	650p
FSS/1-10/1	RC307	650p
VS5 RUK	RC308	650p
VS4-1	RC308	650p
MULTICONTROL (17C20)	RC311	650p
LOEWE		
DC11	RC146	650p
MATSUI		
010270601	RC889	650p
VX770	RC892	650p
NOKIA		
SATELLITE	RC550	650p
ORION		
RC53	RC892	650p
PANASONIC		
EUR51200	RC200	650p
TC2200	RC204	650p
VSQ0357/NV730	RC202	650p
TNQ1621	RC203	650p
PHILIPS		
RC5002,5154	RC134	650p
KT3 NON TEXT	RC135	650p
69117032	RC178	650p
69117194	RC180	650p
RC5991-UNIV	RC300	550p
RC38	RC301	650p
KT3 TEXT	RC5301	650p
RC5352	RC5352	650p
RC5375	RC5375	650p
RC5 STANDARD	RC300	550p
RC5903	RC5903	650p
SALORA		
SERIES L	RC190	650p
86173	RC882	650p
SANYO		
RC218, RC222, RC228, RC238	RC140	650p
JXGE	RC878	650p
JXDE	RC884	650p
VHR2300	RC890	650p
RC628	RC865	650p
SHARP		
G0121CESA, 123CESA, 204, 251	RC140	650p
SONY		
RM604, RM605, RM606	RC140	650p
32 CHANNEL	RC140	650p
RM613	RC141	650p
RM632, RM636	RC160	600p
TATUNG		
FXA	RC877	650p
RC70	RC883	650p
FX70 FASTTEXT	RC894	650p
TELEFUNKEN		
FB632	RC632ST	650p
FB639	RC639	650p
THORN/FERGUSON		
3V35-42	RC342	600p
3V31-32	RC344	650p
3V57-58	RC628	650p
TX10 TEXT	RC732	575p
TX10 STEREO TEXT	RC738	575p
TC9-90-100	RC740	600p
3V55, FV11	RC783	650p
TX100 FASTTEXT	RC789	650p
TX100 ST, FASTTEXT	RC789	650p
PROFESSIONAL	RC790	650p
TOSHIBA		
CT937	RC950	650p
CT9117	RC951	650p

WE STOCK REMOTE CONTROLS FOR OVER 5,000 DIFFERENT MODELS
RING FOR MODELS NOT LISTED ABOVE ON 0181 900 2329

8 way Preprogrammed Universal Remote Control

A single remote control to operate Televisions, Videos and Satellite Receivers. Plus Auxiliary Options!

- Replaces up to 8 remotes with one • Simple 4 digit setup routine
- Controls 1000s of models • Teletext functions with Fastext
- Clear (large key) layout • Code Search Facility
- Stylish and easy to operate • Replace broken or lost remotes
- Original remote not required

Order Code: 8 WAY **PRICE: 1450p + VAT**

2 way Preprogrammed Universal Remote

- Replaces up to 2 remotes (TV/Satellite)
- Simple key arrangement
- Set-up by library review

Order Code: 2 WAY **PRICE: 925p**

REPLACEMENT LINE OUTPUT TRANSFORMERS

Part No.	Code	Price
AKAI		
45150344	LOT56	1650p
101-214017-03	LOT278	1300p
101-220005-03A	LOT72	1600p
D 050/37	LOT27	1450p
D 053/37	LOT207	1550p
D 056/37	LOT56	1650p
D 059/37	LOT200	1400p
D 069/37	LOT56	1650p
FCM 2015 AL	LOT78	1500p
FERGUSON		
00 D-3-508-001	LOT38	1250p
00 D-3-508-002	LOT38	1250p
00 D-3-508-003	LOT276	1400p
00 D-3-515-001 PL1	LOT276	1400p
00 D-4-208-001	LOT79	1600p
00 D-4-208-002	LOT79	1600p
00 D-4-235-002	LOT240	1250p
00 D-4-235-002 HTI	LOT81	1350p
00 D-4-235-00201G	LOT81	1350p
00 D-4-260-004 HTI	LOT38	1250p
00 H-0-701-2400	LOT182	1450p
06 D-3-083-001	LOT82	1250p
06 D-3-083-002	LOT82	1250p
06 D-3-084-001	LOT23	1400p
06 D-3-087-001	LOT23	1400p
06 D-3-088-001	LOT84	1450p
06 D-3-093-001	LOT204	1600p
06 D-3-095-001	LOT87	1000p
06 D-3-095-002	LOT87	1000p
06 D-333-512-001	LOT204	1600p
FETX 100 90 DEG	LOT04	1500p
FETX 90 WHITE	LOT06	1650p
FETX 100 100 DEG	LOT34	1600p
GRUNDIG		
29201.008.01	LOT153	1750p
29201.014.01	LOT140	1500p
29201.015.01	LOT149	1400p
29201.017.01	LOT60	1250p
29201.018.01	LOT163	1300p
29201.018.02	LOT61	1700p
29201.019.01	LOT62	1250p
29201.019.02	LOT62	1250p
29201.022.01	LOT63	1700p
29201.022.02	LOT166	1600p
29201.022.03	LOT165	1350p
29201.022.04	LOT165	1350p
29201.022.04A	LOT165	1350p
29201.024.01	LOT65	1500p
29201.024.04	LOT164	1400p
HINARI		
154 138 K	LOT24	1500p
51 13914 1	LOT24	1500p
51 14184 1	LOT24	1500p
CF 44 A	LOT24	1500p
HM51-1411834-1	LOT24	1600p
HITACHI		
2424593	LOT44	1050p
2432101	LOT79	1600p
2432461	LOT169	1500p
2432611	LOT80	1800p
2432651	LOT80	1800p
2432761	LOT169	1500p
2432981	LOT37	1200p
2432981	LOT37	1200p
2432982	LOT37	1200p
2433011	LOT171	1650p
2433012	LOT171	1650p
2433014	LOT171	1650p
2433212	LOT168	1500p
2433291	LOT172	1350p
2433301	LOT246	1600p
2433441	LOT188	1900p
2433442	LOT191	1600p
2433451	LOT81	1350p
2433452	LOT82	1250p
2433453	LOT82	1250p
2433455	LOT234	1600p
2433521	LOT85	1600p
2433581	LOT22	1250p
2433721	LOT83	1400p
2433751	LOT01	1300p
2433752	LOT01	1300p
2433752	LOT250	1350p
2433891	LOT23	1400p
2433892	LOT84	1450p
2433893	LOT23	1400p
2433952	LOT33	1000p
2434002	LOT200	1400p
2434141	LOT33	1000p
2434141	LOT33	1000p
2434274	LOT44	1050p
2434274	LOT44	1050p
2434453	LOT86	1600p
2434455	LOT234	1600p
2434593	LOT44	1050p
2435062	LOT296	1400p
2435121	LOT87	1000p
2435131	LOT251	1450p
2435141	LOT282	1300p
2435301	LOT88	1450p
2435671	LOT89	1600p
2436201	LOT109	1200p
2436202	LOT109	1200p
2432101-2	LOT79	1600p
2433451H	LOT81	1350p
2433453H	LOT82	1250p
2433891H	LOT23	1400p
2433892G	LOT84	1450p
I.T.T.		
4515 01 08	LOT113	1400p
4515 01 15	LOT136	1600p
4515 01 16	LOT139	1675p
4515 01 17	LOT139	1675p
4515 01 19	LOT169	1500p
4515 01 24	LOT137	1600p
4515 01 46	LOT136	1600p
4515 03 01	LOT169	1500p
4515 03 02	LOT180	1550p
4515 03 04	LOT169	1500p
4515 03 05	LOT180	1550p
4515 03 06	LOT168	1550p
4515 03 08	LOT22	1250p
4515 03 09	LOT178	1500p
4515 03 10	LOT168	1550p
4515 03 13	LOT30	1250p
4515 03 14	LOT174	1400p
4515 03 15	LOT22	1250p
4515 03 18	LOT192	1550p
4515 03 19	LOT30	1250p
4515 03 20	LOT190	1650p
4515 03 22	LOT196	1550p
4515 03 24	LOT194	1550p
4515 03 25	LOT22	1250p
4515 03 26	LOT198	1650p
4515 03 28	LOT27	1450p
4515 03 29	LOT193	1550p
4515 03 30	LOT179	1550p
4515 03 31	LOT207	1650p
4515 03 34	LOT56	1650p
4515 03 35	LOT193	1550p
4515 03 38	LOT27	1450p
4515 03 40	LOT200	1400p
4515 03 41	LOT56	1650p
4515 03 43	LOT156	1550p
4515 03 44	LOT56	1650p
4515 03 46	LOT201	1550p
4515 03 50	LOT27	1450p
4515 03 51	LOT27	1450p
4515 03 75	LOT56	1650p
4516 16 01	LOT22	1250p
MITSUBISHI		
731003	LOT51	1550p
276-16399	LOT49	1500p
334 B 07803	LOT50	1450p
334 B 078030	LOT50	1450p
334 B 08104	LOT74	1600p
334 B 08108	LOT295	1600p
334 P 18506	LOT51	1550p
334 P 18507	LOT75	1500p
5908-05008A-AA	LOT70	1500p
O 108/37	LOT49	1500p
DCF1577	LOT273	1700p
DCF2077A	LOT272	1300p
KFS 60226B	LOT279	1550p
MSH-1FBW08	LOT78	1500p
NIKKAI		
BABY10	LOT67	1450p
ORION		
3714002	LOT02	1500p
PANASONIC		
TLF 14512 F	LOT39	1850p
TLF 14520 F	LOT40	1500p
TLF 14521 F	LOT39	1850p
TLF 14567 F	LOT39	1850p
TLF 14568 F	LOT40	1500p
TLF 14584 F	LOT41	2000p
TLF 14586 F	LOT42	1800p
TLF 15606 F	LOT256	2000p
TLF 70012	LOT78	1500p
TLF 70012 F	LOT78	1500p
TLF 70012A	LOT78	1500p
TLF 70018	LOT274	1550p
TLF 70018 F	LOT274	1550p
TLF 70161	LOT278	1300p
TLF 70162	LOT72	1600p
TLF 70162A	LOT72	1600p
TLF 70162B	LOT72	1600p
TLF 70162G	LOT72	1600p
TLF 77001 B	LOT274	1550p
PHILIPS		
4822 140 10142	LOT142	1800p
4822 140 10145	LOT134	1450p
4822 140 10146	LOT112	1700p
4822 140 10151	LOT102	1700p
4822 140 10161	LOT103	1250p
4822 140 10171	LOT104	1500p
4822 140 10176	LOT114	1150p
4822 140 10194	LOT105	1500p
4822 140 10198	LOT116	1600p
4822 140 10201	LOT104	1500p
4822 140 10236	LOT118	1550p
4822 140 10246	LOT111	1500p
4822 140 10247	LOT105	1500p
4822 140 10254	LOT107	1450p
4822 140 10263	LOT117	1650p
4822 140 10269	LOT210	1350p
4822 140 10271	LOT208	1650p
4822 140 10274	LOT123	1450p
4822 140 10282	LOT122	1300p
4822 140 10283	LOT104	1500p
4822 140 10294	LOT125	2150p
4822 140 10306	LOT110	1200p
4822 140 10325	LOT132	1500p
4822 140 10326	LOT122	1300p
4822 140 10328	LOT124	1450p
4822 140 10349	LOT106	1250p
4822 140 10353	LOT284	1450p
4822 140 10356	LOT284	1400p
4822 140 10367	LOT286	1400p
4822 140 10369	LOT109	1200p
4822 140 10381	LOT128	1300p
4822 140 10384	LOT127	1550p
4822 140 10395	LOT116	1600p
4822 140 10406	LOT73	1150p
4822 140 10421	LOT109	1200p
4822 140 17078	LOT103	1250p
SANYO		
094-00020/0.9	LOT113	1400p
094-00035/0.2	LOT162	1350p
094-01020/0.7	LOT59	1400p
094-01021/0.6	LOT59	1400p
094-01027/0.0	LOT186	1825p
094-01038/0.7	LOT245	1900p
094-01052/0.8	LOT186	1825p
094-01057/1.1	LOT285	1450p
610.018.6620	LOT189	1650p
610.018.6637	LOT215	1800p
SHARP		
RTRNF 1220 CEZZ	LOT39	1850p
RTRNF 1783 BMZZ	LOT202	1800p
RTRNF 1783 CEZZ	LOT202	1800p
RTRNF 1786 BMZZ	LOT211	1850p
RTRNF 1786 CEZZ	LOT211	1850p
RTRNF 2000 BMZZ	LOT214	1600p
RTRNF 2002 BMZZ	LOT307	1450p
RTRNF 2002 CEZZ	LOT307	1450p
RTRNF 2003 BMZZ	LOT308	1350p
RTRNF 2004 BMZZ	LOT307	1450p
RTRNF 2005 BMZZ	LOT308	1350p
RTRNF 2006 BMZZ	LOT308	1350p
RTRNF 2007 BMZZ	LOT307	1450p
RTRNF 2023 BMZZ	LOT310	1500p
SONY		
3753100	LOT275	1500p
1-439-243-00	LOT91	1600p
1-439-243-11	LOT91	1600p
1-439-243-12	LOT91	1600p
1-439-243-31	LOT229	1700p
1-439-243-32	LOT229	1700p
1-439-243-41	LOT229	1700p
1-439-244-00	LOT48	1600p
1-439-244-11	LOT48	1600p
1-439-244-21	LOT48	1600p
1-439-244-31	LOT48	1600p
1-439-256-00	LOT45	1650p
1-439-256-11	LOT45	1650p
1-439-256-21	LOT45	1650p
1-439-256-22	LOT45	1650p
1-439-276-21	LOT230	1700p
1-439-280-00	LOT92	1600p
1-439-280-13	LOT92	1600p
1-439-286-00	LOT46	1300p
1-439-286-11	LOT46	1300p
1-439-286-12	LOT46	1300p
1-439-286-13	LOT46	1300p
1-439-286-21	LOT46	1300p
1-439-288-00	LOT228	1750p
1-439-288-12	LOT228	1750p
1-439-289-00	LOT47	1400p
1-439-289-21	LOT47	1400p
1-439-289-22	LOT47	1400p
1-439-289-31	LOT47	1400p
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1-439-294-11	LOT93	1450p
1-439-294-21	LOT269	1550p
1-439-303-00	LOT94	1300p
1-439-303-11	LOT94	1300p
1-439-303-31	LOT94	1300p
1-439-303-32	LOT94	1300p
1-439-311-00	LOT95	1550p
1-439-311-11	LOT95	1550p
1-439-311-13	LOT95	1550p
1-439-311-31	LOT95	1550p
1-439-311-32	LOT95	1550p
1-439-331-22	LOT96	1550p
1-439-331-41	LOT98	1550p
1-439-332-00	LOT99	1600p
1-439-332-11	LOT9	1600p
1-439-332-21	LOT99	1600p
1-439-332-41	LOT100	1600p
1-439-332-42	LOT101	1450p
1-439-332-52	LOT100	1500p
1-439-333-00	LOT270	1550p
1-439-333-11	LOT270	1550p
1-439-333-12	LOT270	1550p
1-439-363-11	LOT268	1400p
1-439-363-21	LOT268	1400p
1-439-387-11	LOT311	1450p
1-439-387-21	LOT311	1450p
1-439-416-11	LOT255	1600p
1-439-416-12	LOT255	1600p
1-439-416-21	LOT255	1600p
1-439-416-23	LOT255	1600p
1-439-416-41	LOT255	1600p
1-439-416-51	LOT255	1600p
1-439-430-21	LOT271	1650p
154125A	LOT275	1500p
TOSHIBA		
37010	LOT131	1450p
37011	LOT131	1450p
37012	LOT131	1450p
37013	LOT131	1450p
37014	LOT131	1450p
37015	LOT131	1450p
37016	LOT131	1450p
37017	LOT131	1450p
37018	LOT131	1450p
37019	LOT131	1450p
1810951	LOT55	1400p
2433751	LOT01	1300p
2433752	LOT250	1350p
23236023	LOT281	1300p
23236052	LOT131	1450p
23236098	LOT288	1400p
23236198	LOT288	1400p
23236255	LOT289	1500p
23236424	LOT129	1400p
23236425	LOT288	1400p
23236428	LOT289	1500p
3122113837011	LOT131	1450p
150F6D	LOT131	1450p
TFB 4039 AD	LOT293	1550p
TFB 4048 AD	LOT281	1300p
TFB 4048 BD	LOT281	130 0p

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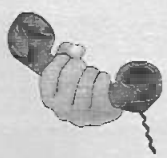

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From the above it will be clear that beam current limiting has little effect on doming. There is enough energy in the beams to cause doming when the CRT is operating within normal limits. If the beam current is excessive, the symptoms will be worse: double the beam current and you double the power dissipation and hence the heat in the shadowmask.

I feel that the symptoms Jim saw are the result of shadowmask detachment. If you study the construction of a mask and frame you will see that there are spot welds at various places. These are subjected to continual stresses as the shadowmask expands and contracts. As a result, a less than perfect weld can fail. When this happens, mask movement as it heats up ceases to be unidirectional – because the mask is at this point free to move in a direction not intended. A very noticeable purity error will be apparent when there is high brightness in the vicinity of the detached area.

In such a case the best course is to replace the tube or, failing that, keep the brightness and contrast down, as suggested by the other engineer.

Geoff R. Darby,
Proprietor Monitech,
Earls Barton, Northampton.

Monitor Servicing

Since starting to repair monitors I've found a new type of clientele. On the whole they are far more appreciative of my skills, especially the PC shops and the self-employed computer engineers who pass their customers' monitor problems over to me. I too respect them for their knowledge.

It makes a refreshing change to work for these people. I do get tired of members of the general public, who always seem to want something for nothing and are so quick with condemnation when things don't go their way. I've lost count of the times I have had to listen to people moaning about a TV engineer they once went to but have stopped, normally for some trivial reason. I generally end up feeling sorry for the engineer.

John Edwards,
Welling, Kent.

Mel's Mod

Recent Alba/Bush sets and their derivatives (Onwa chassis) generate their running 12V supply from a winding on the line output transformer via a simple resistor/zener diode regulator – see Fig. 1(a). The most common fault with these sets is failure of the zener diode, which goes short-circuit. The feed resistor then goes open-circuit, with loss of the 12V supply. We've tried fitting replacements, but they don't last very long.

The solution we now adopt is to forget the resistor/zener diode network and install a three-pin 7812 voltage regulator – see Fig. 1(b).

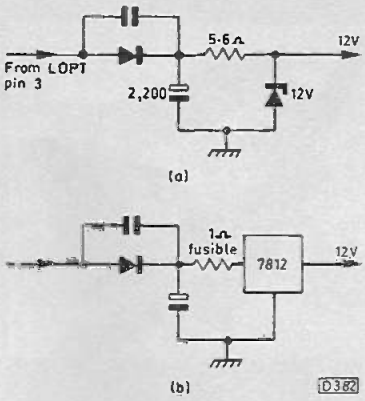


Fig. 1: Top (a) the zener diode 12V regulator circuit that's used in many Alba/Bush and other sets (Onwa chassis). Bottom (b) Mel's mod, using a 7812 regulator instead. It would be preferable to add 0·1µF decoupling capacitors at the regulator's input and output.

We've never had any comebacks after doing this. The modification is known locally as "Mel's Mod".

Depending on the exact chassis type, implementation of this modification is either easy or moderately easy.

Note that the HT voltage should always be checked. It can rise because of failure of electrolytics in the primary side of the power supply.

Mel Davies, Holland Electronics, Skelmersdale, Lancs.

Obituary

Masaru Ibuka

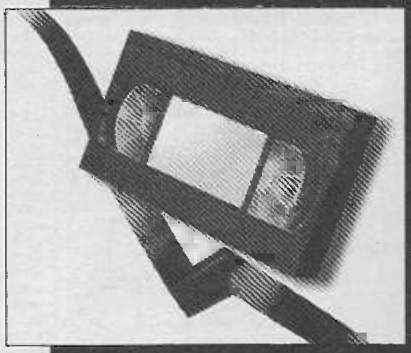
Masaru Ibuka, co-founder of the Tokyo Telecommunications Engineering Corporation, which was later to become the Sony Corporation, died of heart failure on December 19th, 1997, aged 89. He was born in Nikko City, north of Tokyo, in 1908, and attended Waseda University where he carried out research in the photochemical laboratory. During this period he developed a neon light modulation system, which won him a prize at the 1933 Paris Exhibition, and acquired a knowledge of the properties of tape.

He founded the Tokyo Telecommunications Engineering Corporation with Akio Morita in 1946. It was a small company whose aim was to look for opportunities for new products using new technology. One of his first bright ideas was an electrically-heated carpet, which sold very well. But it had no thermostat and no heat-insulating material, and was thus potentially dangerous when laid out on the traditional Japanese floor with its tatami covering. When the main hall of Horyuji Temple, Nara was burnt down because of a similar product made by another company, Ibuka decided to stop production.

His research into tape material brought the first major breakthrough, with the development of magnetic recording tape in 1949 followed by the first Japanese tape recorder a year later. In 1955 Masaru Ibuka led the development of the first Japanese transistor radio, which was another success. The company's name was changed to the Sony Corporation in 1958 – a snazzy name was required for its products – and soon became internationally known. A transistor television receiver followed in 1960.

There were other innovations during this period, but perhaps the biggest project that Masaru Ibuka led was the development of the Trinitron TV system which went into production in 1967. Other innovations followed, including the Walkman and the development, with Philips, of the compact disc.

Masaru Ibuka was president of the company from 1950-71, chairman from 1971-76, honary chairman from 1976-94 and chief adviser from 1994-1997. His final title at Sony was as Supreme Founder and Consultant. But Masaru Ibuka had collapsed with arrhythmia, a heart condition, in 1992, after which he was confined to a wheelchair. He was married twice, and is survived by a son and two daughters.



VCR Clinic

Reports from
Michael Dranfield
Brian Storm
Chris Watton
John Trimmer
Gerald Smith
Roy Gaddas
Terry Lamoon
Adrian Spriddell
Ronnie Boag and
Michael Maurice

Samsung SI1240/1260

To disable the auto-tracking when carrying out deck adjustments, solder together pins 4 and 6 of IC202. This is not mentioned in the service manual. **M.Dr.**

Sharp VC9300

These well-built VCRs from the Eighties video boom seem to go on and on, with very few problems apart from failure of the reel idler and cassette lamp. Something that's becoming more common however is failure of the tape to be wound back fully into the cassette. The cause is a weak reel motor. It's a great pity that this is no longer available from Sharp. You can increase the reel motor's unloading torque by adding a 12Ω, 0·5W resistor across the emitter and collector of transistor Q7754. **M.Dr.**

Ferguson 3V36/JVC HRD225

If the cassette housing refuses to accept a tape and the reel motor is turning, you will find that a circuit protector on the bottom PCB, at the back next to the word 'Elna', is open-circuit. In every machine I've come across where this N15 protector has failed the cause has been a shorted loading motor.

If you're stuck, a motor from an old cassette housing can be fitted – by swapping the pulley over. **M.Dr.**

Amstrad DD8900

If you have tuning problems with one of these double-decker machines, i.e. some stations can't be stored, try replacing C7, C9 and C15 in the IF block first. They are all 1µF, 50V: the 105°C type should be used. **M.Dr.**

Panasonic NVHD100

Slow rewind with four-hour tapes was the complaint with this machine. On test, rewind was indeed very poor with the sample four-hour tape provided. After extensive checking and testing I replaced the end sensor diodes Q1501 and Q1502, more in hope than anything else. But this cured the fault! The part number for both of them is PN205L. **B.S.**

Panasonic NVJ45

The E-E picture had jagged verticals and the playback picture was non-existent. For video problems with these machines IC302, which is expensive, is the first suspect. Fortunately on this occasion the cause of the trouble was C1127 (330µF, 10V), which smooths the unregulated 6V feed to the series regulator in the power supply. **B.S.**

Saisho VR3000X

There was no sound recording. Playback sound was OK with pre-recorded tapes, and the E-E sound was also OK. A healthy sinewave erase bias, about 60V p-p, was present and bulk erase worked. There was a good audio signal at pin 19 of the audio processor chip IC5001 on the audio/IF module, but no audio signal at pin 2 of the BA7755 audio record/play switching chip on the same board. It had an internal short. **C.W.**

Matsui VX755/Saisho VR3600

The UHF output was intermittent because of loss of the supply to the modulator. A check at pin 5 of CN501 in the power supply showed that there were no problems up to this point. The voltage here is applied to the 2SC2274 ripple filter transistor Q507, which was going open-circuit. We didn't have one in stock, but a BC639 proved to be a suitable replacement. **C.W.**

Panasonic K Mechanism

If you have a VCR that shows F03 or F04 in the front display, remove the loading motor and examine the white plastic coupling fitted to it. The coupling sometimes splits. You can either replace the whole motor assembly or, alternatively, the coupling is available separately from Panasonic as part number VDP1434 – a jig, part number VFK1322, is required to fit it on the motor shaft correctly. **J.T.**

Hitachi VTM502EUK

This machine had no display. A voltage check at pin 80 of the deck controller IC7400, which is also the display driver, showed that the 3V supply was missing. It's labelled HEST. When I traced back to the source I came to a faulty BC848B surface-mounted transistor, 7409, on the main PCB. Replacing this item restored the display. **J.T.**

Panasonic NVG50PX

This VCR's power supply didn't start up. Once I'd replaced C3 on the power board everything seemed to be fine initially. Then I noticed that the real-time counter didn't move and that playback was marred by tracking bars. The machine was OK in the rewind and fast-forward modes and also, strangely enough, in reverse search.

I first thought that there must be an alignment error, but close examination showed that the tape remained in the same position in all

modes. As this is a foreign model we didn't have a circuit diagram. After a lot of heating and freezing I discovered that C29 on board ref. 6500 series was low in value. The correct value is 10µF. 16V. I fitted a high-temperature type. **J.T.**

Panasonic NVSD30 (K Mechanism)

The customer complained of tracking bars and slurred speech. The machine also damaged my test tape. Tests showed that there was excessive back tension, but no amount of adjustment would correct it. Then I noticed that the reel brake didn't release. Part of the brake release mechanism was broken. The part number is VX20313. **J.T.**

Daewoo V200

There was intermittent loss of the playback picture – just snow. Checks showed that in the fault condition the PB5V supply to the head amplifiers was missing. It comes from Q304, which was dry-jointed. **G.S.**

Nokia 3716

The fluorescent display had failed. Checks showed that there was no –25V supply at either the display or the driver chip. Further checks showed that R927 (10Ω, 0·25W) was open-circuit. A replacement restored the display. **G.S.**

Daewoo V435

This machine would accept a tape, but there was no play/record/FF or rewind. The drum motor wasn't turning properly. Once this had been replaced all functions were back to normal. **G.S.**

Akai VSG245

This machine could be tuned in but wouldn't memorise Ch. 4. When the EPROM presettings were checked they were found to be wrong and couldn't be adjusted. When a new EPROM (IC404) had been fitted and set up and the switching points had been adjusted the machine would memorise Ch. 4. **G.S.**

Sharp VCM20

This machine's owner complained that the LP symbol on the front display was always alight. A new microcontroller chip restored correct operation. **G.S.**

Daewoo V21

This VCR wouldn't tune. A check on the tuning voltage showed that it didn't change. The PMW signal at the timer chip varied, and on further investigation I found that there was a small crack in the print at the back of the PCB. Hard-wiring here restored the tuning. **G.S.**

Nokia VR3615/Daewoo V200

If stop was pressed during play the tape would wrap around the guides. It would then get chewed when the customer tried to eject the cassette. The cause of the trouble was traced to the idler assembly FM mechanism. The moulding can become distorted: as a result, the assembly fails to kick the take-up motor into reverse.

The solution is to fit the upgraded assembly that's available from SEME under order code VDC7456. In fact it's best to replace this assembly as a matter of course whenever one of these machines comes into the workshop.

Another problem is that the pin tends to snap off the metal lever below the idler assembly. So the lever should be replaced as well. **R.G.**

Matsui VP9501OP

If the complaint with one of these machines is slowish, noisy rewind, do check the reel spools. They are clutches and have a tendency to fall apart when you remove the retaining clip. A new one will cure the fault. It's probably safest to replace both spools while you are carrying out the repair. It is also advisable at least to clean the mode switch: better to replace it, as the switch oxidises quite badly, giving rise to all sorts of strange symptoms. **T.L.**

Hitachi VT860

Poor and/or noisy loading and occasionally jamming were the complaints with one of these machines. Close inspection revealed that the capstan motor was struggling. So a replacement was fitted, along with the clutch base assembly, belt and pinch roller, which was very shiny. These items got the machine to work perfectly, but the repair proved to be a bit expensive. **T.L.**

Hitachi VT150

The E-E picture was subject to pulling and overloading. Playback of prerecorded tapes was OK, also operation with a video feed via the scart socket. The cause of the trouble was C07 (1µF) in the IF unit. **A.S.**

Matsui VX3000

The problem we had with one of these machines was tuning drift. Replacing Q6006 (BC182L) and R6045 (33kΩ) cured the fault. **A.S.**

Sharp VCA111HM etc

If the drum speed is excessive, the amplitude of the FG pulses could be low. Check the printed FG coil on the motor PCB. You should get an almost short-circuit reading: if the reading is several ohms, the motor PCB will have to be replaced – it's available separately.

This fault can occur with any machine that uses the M series chassis. **A.S.**

Akura VX150

There was no E-E or playback video. Scope checks showed that the video waveform at pin 28 of IC201 was missing. It reappeared when pin 14 of ICC01 (type LC7475) was desoldered. A new LC7475 chip cured the fault. **R.B.**

Toshiba V711

This VCR was dead with no outputs from the STK5383 chip IC802 in the power supply. A new STK5383 chip restored normal operation. **R.B.**

Sharp VCM721

There was no tape take-up with one of these machines. The cause was dry-joints at plug AC on the capstan motor. **R.B.**

Daewoo V435

The symptoms with this machine were intermittent failure to come out of standby and no functions when a tape was inserted. The cause was C822 (330µF, 10V). This capacitor should be upgraded to 1,000µF, 10V. **R.B.**

Granada VHSHP7/Philips VR6185

When review was selected this machine would start to search then switch off. All other functions worked faultlessly. The cause of the fault was the mode switch – a replacement restored correct operation.

These models are fitted with the Panasonic G deck. **M.M.**

Akai VSS99

This S-VHS machine turned out to be a Mitsubishi clone. The symptoms were intermittent or no off-air signals. The tuner/IF pack is the same as that in the Mitsubishi CT2564STX range of TV models which can exhibit the same faults. Resoldering the dry-joints in the IF can restored normal operation. **M.M.**

Servicing

Panasonic Models NVJ30/J35/F65/F70

These oldish models can still provide excellent results. Fortunately the faults are reasonably predictable. Brian Storm on what to check when a faulty machine comes in

Although these VCRs are now well into middle age they are still capable of providing superb picture quality and performance. The NVJ30 and NVJ35 are improved versions of the NVL20 and NVL25. The NVF65 and NVF70 are hi-fi stereo versions with Nicam reception and editing facilities such as jog and shuttle.

These VCRs were all supplied with a bar-code scanning, multi-function remote control unit. A jog and shuttle remote control unit, Model VWRM65E, was available as an optional extra.

The Power Supply

Fig. 1 shows the power supply circuit. As with all older AV equipment, this is the place to look for the causes of obvious and not so obvious faults. It has become almost second nature with me to measure the 45V output from the power supply module in any Panasonic VCR, as this tells you so much about the machine's operation.

If the 45V supply is high, check C1114 on the primary side of the chopper circuit. If the voltage is low, check the reservoir capacitor C1118. A clue that the 45V supply was high is failure of the 20V zener diode D1113. It goes short-circuit when the 14V supply rises above 20V, killing the power supply completely.

Whatever the fault, it's always worth scoping the power supply outputs for hash noise. Replace any capacitors that are suspect. It's also wise to renew the soldering around the power components. It can become dry after passing high currents for eight or so years.

The most common power supply faults are as follows:

Dead power supply: Check C1109 (1µF, 400V), D1110 (10ELS2) which could be leaky, and whether D1113 (MA2200 20V zener diode) is short-circuit. In the latter event, check whether C1114 (47µF, 16V) is open-circuit. Check the crowbar circuit which was added in Model NVF65 (see below).

Capstan servo problems: Check C1122 (330µF, 10V).

Mechanism

Panasonic mechanisms became very much more reliable as the G deck evolved – there were four versions in all. With the addition of a review motor in Models NVF65/F70, placed cunningly above the deck mode switch, the machines became suitable for serious domestic editing, with seamless control of pause, cue and review. This was not previously possible with the G deck.

Here are the common mechanism faults:

Intermittent squeaking: Replace the capstan brake, part no. VXL1873/VXL2088.

Noisy rewind or fast forward: Replace the tension roller, part no. VXA3516.

Cassette housing keeps going out of line with the mechanism: Replace the side plate, part no. VXA4076.

Intermittent deck solenoid operation, Models NVJ30/35: Check whether plug P1504 is loose.

After the addition of the DC-controlled review motor, which first appeared in Model NVF70, Model NVF65 was provided with a crowbar transistor (Q6021) plus control circuitry (Q6020 and IC6004) as a precaution against incorrect operation and possible tape damage. Should the supply rails deviate far from their correct voltages the crowbar circuit will cut in, killing the power supply. Check this additional circuit, in the systems control area, if the power supply in Model NVF65 doesn't work when it's connected to the main PCB.

System Control

The syscon circuitry in all these models is generally reliable, though the MN15522VMS sub-systems microcontroller chip IC6801 in Model NVJ35 can be responsible for a number of different symptoms when it fails, ranging from 'write' shown in the timer display and refusal to power up to no E-E video and no systems operation.

Intermittent or permanent failure of the MN188166VHI chip IC6001 can occur with Model NVF70. The result is no operation, with a pause or play symbol in the fluorescent display or the tracking LED pulsing.

The NVF65/F70 and their bigger brother the NVFS100 can produce misleading symptoms when the 0·9Ω resistor R6035 in the feed to the review motor goes open-circuit. If a tape is inserted it may be played, but any attempt to rewind or operate in the fast-forward mode will result in power-down.

Servo Circuitry

The servo circuitry is also reliable. With Models NJV30/J35 the most common problem is C1122 (330µF, 10V) in the power supply going open-circuit. This can produce several symptoms, ranging from wow on sound to an unstable capstan then drum motor drive problems.

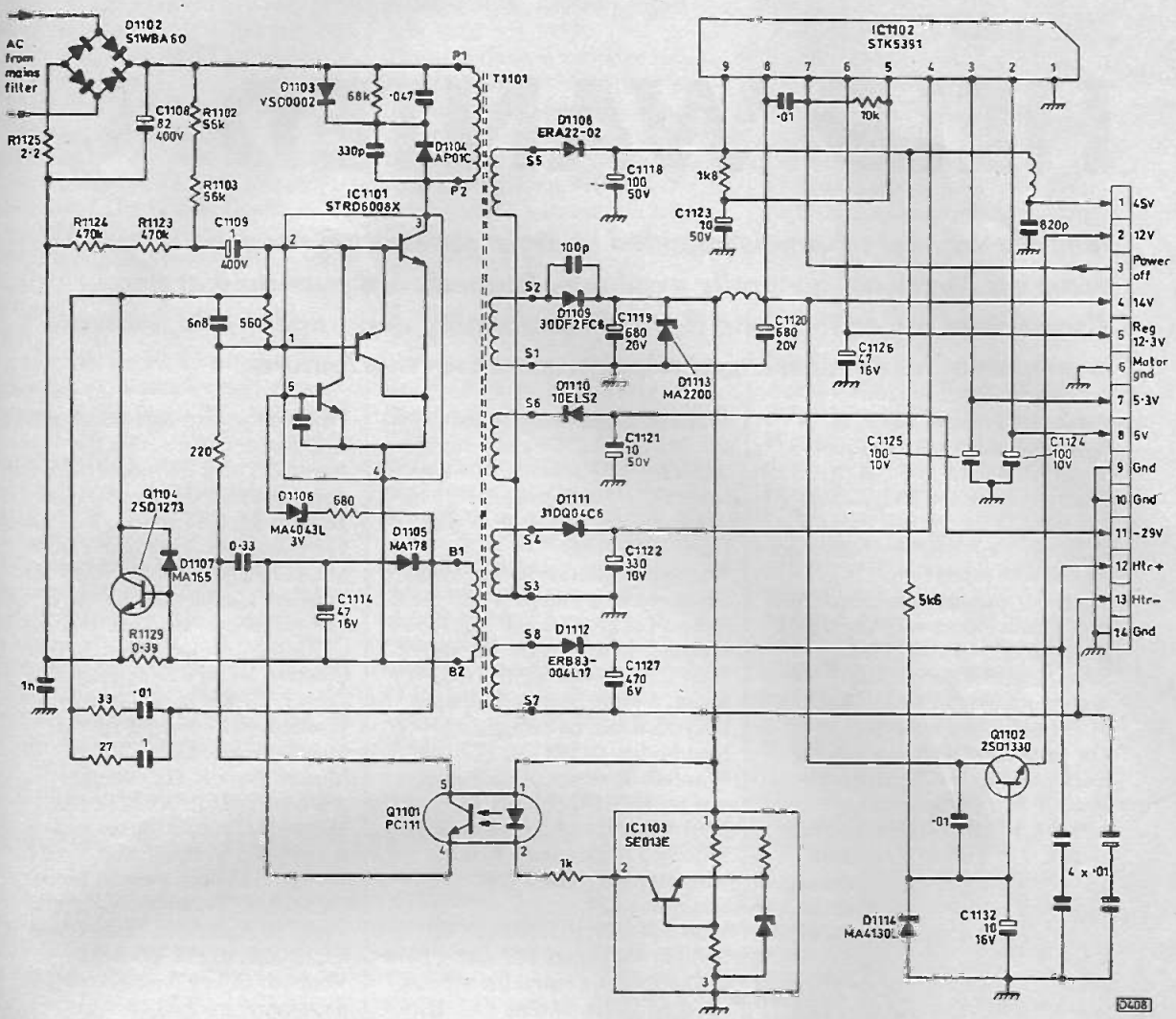


Fig. 1: Power supply circuit used in the Panasonic Models NVJ30/J35/F65/F70.

Another cause of capstan speed instability is the gap between the capstan stator FG head and the rotor. If this gap is too wide, the FG amplifiers will start to amplify noise. The result is intermittent playback speed faults.

A less common problem occurs when the capstan motor plug has been inserted in connector P2001 incorrectly. The result can be intermittent capstan cogging or capstan motor cut-out. It's a good idea to check this whenever a machine comes in, also to remake the solder connections to P2001 as dry-joints are another possible cause of intermittent stopping.

A particularly nasty fault with the NVJ35 occurs when the 1·5kΩ resistor R2302 in the FG circuit cracks. This can result in SP recordings being played back as if they are LP recordings, with no colour in the trick modes and wide noise bars in cue and review.

Miscellaneous Faults

The video circuitry, demodulator pack and timer board give very few problems. Don't be fooled by no E-E video with the NVF65: this machine has an audio only facility in the LP mode, with the video muted.

There will be no tuning when the tuner is stuck in the VHF mode because the memory chip IC7502 is faulty. This chip can also be responsible for problems with the AFC defeat switching, which should be high or low and not somewhere in between – the symptom is failure to lock to stations when search tuning.

Finally, a general common faults summary:

No or distorted video, Models NVJ30/J35: The LA7150 chip IC3901 has probably failed.

No E-E picture (NVF65): Machine is in the LP mode.

No scart socket output, Model NVF70: R4908 and R4910 missing.

E-E picture patterning in the top corner: Replace C7678 (10µF, 16V).

Smeary E-E picture: Check C730 and C731 (10µF, 16V).

Low E-E or feedthrough gain: Replace the tuner unit, type ENV87837H3Y.

No tuning, stuck in the VHF mode: Replace the MN12C261 chip IC7502.

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: Source of supply of Betamax video tapes, preferably new. F.C. Bailey, 53 Peile Drive, Taunton, Somerset TA2 7SZ. 01823 253 905.

Wanted: VHF/UHF TV converters for use with piped signals, any make any quantity considered. Also £1 TV coin meters with keys. G.H. Jones, Einion Electrics, Bridge Street, Llanfair Caereinion, Welshpool. Powys SY21 0RZ. 01938 810 539 phone/fax.

For disposal: Old Luxor satellite receiver, slightly dilapidated, for spares/repair £8. Spectroline PC110A UV EPROM/wafer erasing system with built-in timer, £80. Two unused Verran AC Datalink Units with all leads and manuals, for transmitting serial or parallel via a mains ring at 39.200 baud maximum, £30. *Getting the Best from your Graphics Computer* by Lisa Walker and Steve Blount, 160 pages, £3. Julian Bohan 01522 871 926, mobile 0958 771 319.

For disposal: Two thousand or so radio and TV receiver circuit diagrams dating from 1937-83 – some later. Any offers? L. Burge, 40 Arch Road, Wyken, Coventry CV2 5AB. 01203 613 783.

Wanted: Tuner/modulator board TUV CPCB (BK2001F01002A) for the Amstrad DD8900 – or complete unit for break-up. J. Thomas, 21 Firs Close, Folkstone, Kent CT19 4HZ. 01303 277 864.

Wanted: Dynamic transistor checker Model TT144, new or used, or any other model with the same function. D. Bland, 311 Oxford Road, Reading, Berks RG30 1AV. 01189 504 212.

For disposal: Workshop mains isolation transformer, 1kVA metal cased for floor or wall mounting. Would exchange for reasonably sized IDE hard drive. Brian Hesling, 39 Oak Road, Glinton, Peterborough PE6 7LD. 01733 253 446 (evenings).

Wanted: IF panel and sound IF for the Philips G2.2 TV and a capstan motor for the Panasonic 6010 time-lapse VCR. Jim Littler. 363 Atherton Road, Hindley, Wigan, Lancs WN2 3XD.

Wanted: Replacement video drum or whole working Philips N1701 VCR. Robert Langton 01304 852 415.

Wanted: LOPT for the Dansai 10in. CTV Model 1051 (T). J. Stuart, 2 Little Bell Hall Cottages, Drayton Road, Belbroughton. Nr. Stourbridge. 01562 730 197.

Wanted: Two sets of scan coils, part no. DSE1422BL, for the Matsui Models 1420/1440A. John Wilson, 373 Dewsbury Road. Wakefield, W. Yorks WF2 9DT. 01924 381 824.

Wanted: TDA1037D audio IC (used in old Sanyo, ITT and Grundig sets). Central Electronics, 6 Queen Street. Stirling FK8 1HN. 01786 451 230.

Wanted: Capstan motor for the Hitachi VTF70E (it's marked Sankyo B2QKB on underside and has five electrolytics glued to the PCB). Ex-equipment ideal. Also Psions, dead or alive. Mark Stevenson 01507 478 570, mkstevo@nildram.co.uk

Wanted: Circuit diagram for the Telequipment S51B scope (the DS1 circuit is unsuitable). I need to know the values of R22, L3 and RV6. Also require front frame and graticule. P. Guarini, 31 Alderson Avenue, Rawmarsh. Rotherham, S. Yorks S62 7DE. 01709 371 188.

Wanted: Chopper transformer for the Zanussi Model 22ZT505 or complete power supply PCB. G.R. Goldsmith, 2 Stanley Close, Verwood, Dorset BH31 6EX. 01202 824 398.

Wanted: Signal-strength meter with Band II (FM) coverage. Working or non-working considered. J.M. Ainscoe, 49 Lon Ceredigion, Pwllheli, N. Wales LL53 5PP. 01758 613 790.

Wanted/for disposal: Require CRT base board with leads for the Amstrad TVR2 televideo. Have for disposal Video Circuits 31A and Telepart 3A CRT testers. V. Smith, 175 Lyon Park Avenue, Wembley, Middx HA0 4HD. 0181 902 5447.

Wanted: Circuit diagram for OTEC M14A monitor, s/n. G/H 01102410. C. Rigley, 1 Route D'Anton, Petit Claudos, MIOS 33380, France. Fax/tel. 33 556 266291.

Wanted: R/C handsets for the Mitsubishi HSM55 VCR and Mimtec Premier 2LD satellite receiver. Ted, 0151 632 0614.

Wanted: Circuit diagram and any information to repair a BIT Phax switch (fax/phone switch) Model PXS-C3. D. Benyon, Marshland View, St. Annes Hill, Bude, Cornwall EX23 0LT. 01288 353 373.

Wanted: Circuit diagram (or good photocopy) for the Canon E60 camera. Loan would help if necessary. Tyler TV, 26 Littlecote Estate, Petworth. W. Sussex GU28 0EF. 01798 342 210.

Wanted: CZ1 thermistor (grey dog-bone type as used in valve heater chains) for completion of a radio restoration. Trevor Wiltshire. Tora Technology, Pelican Road, Pamber Heath, Tadley, Hants RG26 3EL. 01189 701 163.

Wanted: 20MHz 5mV/div single- or dual-beam scope. Have for sale home-made crystal set, approx. 60 years old, in good condition. M. Payne, 23 Flagg Court. South Shields, Tyne and Wear NE33 2LS. 0191 427 6654.

Wanted: Working power supply panel for the Amstrad SRD510 satellite receiver. E.E. Woodcock, Que-Sera, 162 Maindenway Road, Paignton, S. Devon TQ3 2PT.

Wanted: Circuit diagram and parts list for a Vanilla VAN-C1402-39 monitor, sold by Tempo. G. Uddin, 52 Berkshire Road, Trowbridge Estate, Hackney, London E9 5LU.

Wanted: Remote control unit for a

Sony LDP3300 LaserDisc player (professional model) – or a way of operating it remotely with a replacement unit. Pone David Kimera on 0181 346 8809.
Wanted: Circuit diagram and any fault diagnosis information for the Commodore 1084SD2 colour monitor. R. Musson, 32 Ailsa House, Fairhaven-Green, Idle, Bradford, W. Yorks BD10 9ND. 01274 622 684.
Wanted: Sony remote commanders RMT223 and RMT230; a working Philips CTX-E chassis (Model 20CT2636/05T); a working110° scan panel for the Rediffusion Mk 4 chassis; a Granada 8 rotary tuning panel 55-332 P5 (ITT); an operating manual for the Philips VCR Model VR2021/05. R. Bruce, 11 New Zealand Way, Rainham, Essex RM13 8JP.
Wanted: Circuit details for the Avo Universal LCR Bridge and Universal Test Bridge. D. Jannece, 54 Wyatts Green Lane, Brentwood, Essex CM15 0PX. 01277 822 380.
Wanted: Circuit diagrams to enable a Telequipment DM63 and a Gould OS245A scope to be be repaired. Loan or copy if necessary. S. Parkins, 70 Charlton Avenue, Newton, Hyde, Cheshire SK14 4ES. 0161 351 1892.
Wanted: 64 mon cartridge (assembler/disassembler) or similar, with instructions, for the Commodore 64 computer. Any hardware, software, books, mags etc. for this computer. Also looking for a VIC1541 disc drive + lead + instructions. John Mangan, 14 Chancery Lane, Huddersfield, W. Yorks HD1 2DT. 01484 435 014.
Wanted: Service manual or circuit diagram for the AOC monitor Model CM335. Photocopy or loan OK. A. Horsfield, 37 Hereward Way, Deeping St. James, Peterborough PE6 8QA. 01778 346 287.
Wanted: Two STK8250 Mk 2 chips or an equivalent. David Rolfe, 11a Aldwick Road, Bognor Regis, W. Sussex PO21 2LN. 01243 862 242.
Wanted: Service manual/circuit diagram for the Pioneer RT71 open-reel tape deck. Photocopy OK. Alternatively a layout showing and identifying the presets. E.T. Plumb, 44 Railway Road, Downham Market, Norfolk PE38 9EB. 01366 384 099.
Wanted: Touch-tuner control unit for the Rediffusion Mk 3 chassis. A. Tomkinson, 10 Lodge Court, Station Grove, Wembley, Middx HA0 4AP. 0181 903 5574.
Wanted: JVC HRD120MS VCR with working timer. Within travelling distance of Bournemouth. Also information on a supplier of JVC parts. Frank Cosgrove, 59 Fenton Road, Bournemouth, Dorset BH6 5BS. 01202 432 973.
Wanted: Tuner and tube for a Pye Red Box or Philips equivalent. Complete TV set would be even better. Brian Barron, 55 Henderson Avenue, Cavehill Road, Belfast BT15 5FN. 01232 715 826.
Wanted: VHF to UHF converter, or circuit diagram + information. I have an old display unit with VHF output and wish to display the information on a TV set. T. Collins, 215 Arlott Crescent, Oldbrook, Milton Keynes MK6 2QT.
Wanted: Back issues of *Television* 1991-1994 in exchange for a Loewe Profit T28 chassis complete and/or tuner type U1100. P. Hill, 3 Mayfair Avenue, Halifax HX4 9JH. 01422 370 338 (evenings).

New CD Format

Sony and Philips have developed a new CD format, Super Audio CD (SADC), as the next-generation music CD. It uses direct stream digital (DSD) technology and a 1-bit representation of the audio waveform with 2·8224MHz sampling. SACD is compatible with existing CD players and discs.

An SADC disc has a dual-layer configuration, with CD information on top and DSD data beneath: a super bit mapping direct system downconverts the DSD sound. The system can offer two-channel or up to six-channel sound. An optional multimedia system enables the discs to provide text, graphics and video. The discs are protected by a digital watermarking system which can also include anti-copy data.

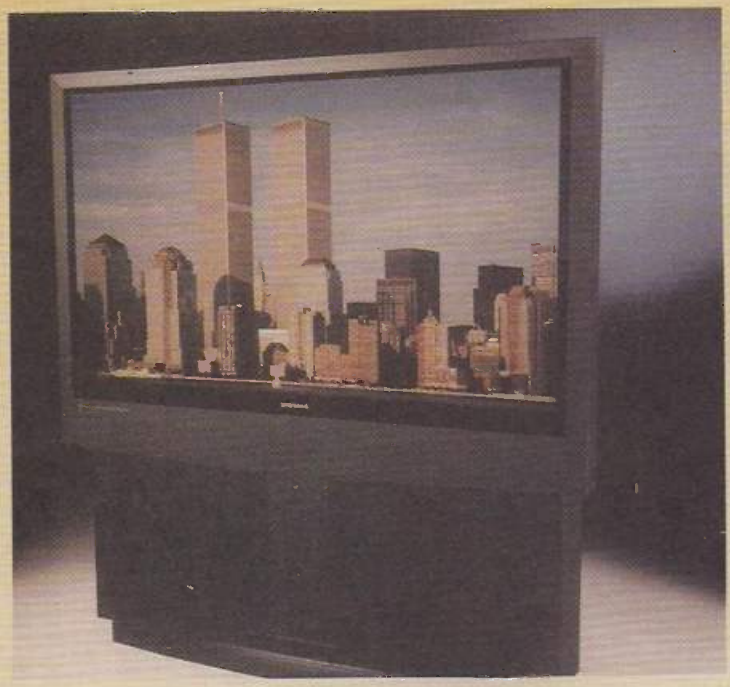
Sony and Philips have begun licensing SACD. The companies say that the first SACD players and discs will be launched in Japan early next year.

Keighley Instruments Ltd. has published its 1998 full line catalogue and reference guide. The 700-page catalogue covers a wide range of test and measurement equipment, data acquisition hardware and software products. For a copy contact the company at The Minster, 58 Portman Road, Reading, Berks RG30 1EA – phone 0118 957 5666, fax 0118 959 6469.

Video News

JVC has launched its first digital still camera, Model GCS1, and the GR-DVL9000 digital camcorder. Features of the GCS1 include an easily adjustable f1·6 lens, a 4MB internal flash memory, 10x optical zoom and a 1·8in. LCD screen. In the economy mode the memory can store up to 100 images. IR data transfer provides wireless data transfer to a digital printer or PC. A numnber of software packages are provided for PC connection. Suggested retail price is £399. The GR-DVL9000 is an ultra-compact camcorder with 4in. LCD monitor. Its progressive-scan CCD, progressive colour filter and high-band processor provide a resolution of 500 x 560 lines. The impressive specification includes PCM digital stereo sound and digital effects. Outputs include a JLIP terminal for direct serial port connection and an IEEE 1394 based terminal for direct digital-to-digital connection to other equipment with DV input terminals.

Pioneer is to launch two DVD players in the UK. Model DV505 at about £500 is a CD/DVD player; Model DVL909 at about £900 is a combi CD/LD/Video CD/DVD player. Hitachi is to start supplying mass-production DVD-RAM drives. They will use rewritable cartridges with a capacity of 4·6Gbytes.



The Winter Consumer Electronics Show at Las Vegas is a major event for the introduction of new products and systems. George Cole reports on this year's show, where the emphasis was on digital TV, DVD and multimedia devices

CES '98 Las Vegas

The Winter Consumer Electronics Show was held at Las Vegas in early January. This year's show took place during a time of major changes in the consumer electronics field: digital TV in particular was very much to the fore.

Digital TV

With the new services due to start towards the end of the year, digital TV was being busily pushed by broadcasters, manufacturers and programme makers. The road to digital TV in the USA has been a long one: many formats, including the European DVB system, were considered before agreement on a standard was reached. The Advanced Television Systems Committee (ATSC), whose members include chip manufacturers, broadcasters and electronics companies, finally agreed on a standard in December 1996. In April 1997 the Federal Communications Commission (FCC) accepted it and allocated digital channels to the broadcasters.

The ATSC standard encompasses many things that digital technology has made possible. It includes provision for standard- or high-definition reception; video frame rates of 30 or 60 per second, with 24/30 frames per second for film material; 4:3 or 16:9 aspect ratios; and interlaced or progressive scanning. Broadcasters and developers can use any or all of these features, secure in the knowledge that viewers with a digital TV set will be able to receive whatever's transmitted.

Whereas in Europe the prime purpose of digital TV is to offer a multitude of channels, in the USA the emphasis is on the provision of high-definition pictures. This makes sense: US viewers already have scores of channels available via terrestrial, cable and satellite services – DirecTV, a digital satellite TV service that was launched in June 1994, offers 175 channels. Another reason for the priority given to HDTV is the mediocre picture quality provided by the current NTSC system.

The ATSC Standard

So what is the ATSC standard? It's a sort of umbrella digital TV system. The channel bandwidth is 6MHz and the data transmission rate 19·3Mbits/sec. Audio is Dolby Digital, which offers two-channel stereo or 5·1 multichannel sound. Broadcasters can choose the type and number of signals they transmit, provided the basic specifications are observed.

The HDTV specification provides a display resolution of 1,920 x 1,080 lines interlaced or 1,280 x 720 lines with progressive scanning. Transmission is within a single channel at one million pixels per 1/60th sec. A product or system that conforms with the HDTV standard must be also be able to produce a 16:9 aspect ratio picture at the minimum-resolution level, with Dolby Digital audio.

The standard-definition mode provides a resolution of 704 x 480 lines with progressive scanning or 640 x 480 lines interlaced. In the 480P mode half a million pixels are transmitted per 1/60th sec: in the 480I mode the transmission rate is a quarter of a million pixels per 1/60th sec. A product or system that conforms to the standard-definition specification is defined as having lower resolution than HDTV while providing acceptable audio: the aspect ratio is undefined. Broadcasters can transmit up to four SDTV programmes simultaneously, or offer a mixture of SDTV programmes and interactive services such as data, internet and pay-per-view channels.

The FCC has laid down strict guidelines for the transition from analogue to digital broadcasting. The plan is to switch off the analogue transmissions in the year 2006, which could cause some dissension – there are around 250 million TV sets in the 98 million US households. For this reason some believe that the switch-off date will be deferred. The FCC has laid down that Network broadcasters, such as ABC and CBS, covering the top ten regions must simulcast at least half their analogue programming in DTV form from May 1999.

The top ten areas of greatest population density include cities such as New York, Washington and Los Angeles, accounting for about thirty per cent of US viewers. By November 1999 DTV broadcasting must be extended to the next twenty largest regions, including cities such as Miami and Seattle. The remaining commercial stations must begin DTV transmissions by May 2002, with non-commercial (i.e. public service) broadcasters going digital the year after. In 2004 all stations must transmit at least

Our heading photo, top of page, shows the Samsung SVP555JHD HDTV receiver.

three-quarters of their analogue programmes in DTV form, and by 2005 all programmes must be available in digital form.

The brodcasters and the consumer electronics companies are enthusiastic about DTV. Some broadcasters have already announced their plans for a start to digital transmissions in November. A major marketing operation is being undertaken to inform the public about DTV. As part of this operation the ATSC and the Consumer Electronic Manufacturers Association (CEMA) have agreed on a logo that will be used to identify digital receivers.

Some companies, including Hitachi, Mitsubishi, Sharp and Panasonic, have launched 'digital-ready' TV receivers – analogue sets designed for use with a digital set-top decoder. These sets have component video input sockets and the claim is that they will provide better picture quality. The first decoders are expected to be launched this summer.

The Hardware

Many companies showed digital receivers at CES '98. There were sets on display at the Hitachi, JVC, Panasonic, Philips, Sony, Sharp, Samsung and Thomson stands. US viewers like big sets, and many of the digital receivers were large-screen projection models. I have to confess that I was surprised by the picture quality produced by many of the HDTV projection sets, having expected to find the displays poorer than with direct CRT viewing. All the HDTV pictures were clear and sharp.

Samsung's first HDTV receiver, Model SVP555JHD, is a 55in. projection set with a built-in Dolby Digital decoder and an internal 45W sound system for the centre, left and right channels. There are output terminals for the Surround and sub-woofer channels. Hitachi's 61in. "ultra HDTV receiver" has a built-in digital satellite decoder. Mitsubishi announced several digital TV sets for launch next winter, including a 73in. HDTV projection receiver. Sharp's display included various prototype digital TV receivers, both projection and direct-viewing models, and set-top boxes.

Philips announced a 64in. HDTV rear-projection model that's to be launched this autumn. The Philips Semiconductors TriMedia Product Group has developed hardware and software that enables manufacturers to develop ATSC receivers and set-top boxes quickly: a network interface module incorporates a Philips VSB chip that provides the channel-decoding operations and special function chips for audio and video source decoding.

Setmakers were being a bit coy about prices, but industry observers expect the first HDTV sets to cost around $8,000-10,000 (£5,000-6,300). CEMA points out that one in four households buys a new set each year – a market of around 25 million sets per year. About 18 million households paid at least $2,000 (£1,300) for their last TV set. With an average set life of eight years, CEMA believes that many of these 18 million will be ready to replace their analogue TV sets with HDTV ones. CEMA adds that in the past the price of new consumer electronics products has dropped by fifty per cent within ten years. That's a sobering thought!

Flat-screen TV

A number of flat-screen TV sets were on show, and it was interesting to note that most companies have adopted gas-plasma technology. Sharp displayed a set with a prototype 42in. plasma-addressed liquid-crystal (PALC) screen however – it looked great.

The Philips Flat TV is a 42-in plasma model that's just 4·5in. deep. Its features include split-screen displays (there are two tuners), digital picture effects and Dolby Pro-Logic sound. Philips forecasts that flat-screen TV receiver production in the USA will reach a million units by the year 2000.

The Panasonic DVD-L10 portable DVD player.

Fujitsu showed its 42in. Plasmavision model. The screen provides a contrast ratio of 400:1 and has a life cycle of 30,000 hours, defined as when the brightness falls to fifty per cent of its initial level. Mitsubishi's 46in. DiamondPanel flat TV claims to have an even better contrast ratio of 500:1. This set will be launched in the USA during the second half of the year. Pioneer also had an impressive 50in. plasma set on display. Not all flat-screen TVs are large however: Hitachi showed a rather nice 25in. model.

DVD

The Digital Versatile Disc (DVD) system, which uses CD-sized discs to carry films and music videos, was launched in the USA in the spring of 1997. Since then over 320,000 players have been sold and over 600 DVD titles are now available. Most of the major Hollywood studios support DVD, the main exceptions being Fox and Paramount. The general feeling within the trade is that DVD sales have been good rather than spectacular. During the show the DVD Working Group 4 (WG4) announced that it had produced a draft specification for a DVD audio standard. It includes 96kHz sampling and 24-bit coding: this compares with 44·1kHz and 16 bits for audio CDs.

You could hardly move for second- and third-generation DVD machines. Sony had on show a five-disc CD/DVD-Video changer, Model DVP-C600. Denon's DVD3000 plays DVDs, Video CDs and audio CDs: it has a built-in Dolby Digital decoder and various video outputs including composite video, S-Video and component video. Denon's DVD5000 is a DVD player that conforms to the THX standard, which is claimed to provide better sound and picture quality than basic DVD players. The Pioneer DVD909 plays DVDs, audio CDs and LaserDiscs.

Panasonic presented five new DVD players including a portable model (see below). They all feature Panasonic's Virtual Surround Sound, which aims to provide surround-sound effects using a single pair of speakers. The new models include the DVD-A105, DVD-A110 and DVD-A310 – the latter includes a built-in Dolby Digital

The Marantz DR700 CD recorder.

decoder. All models have outputs for the Digital Theatre Sound (DTS) 5.1-channel audio system (see the Home Cinema section for more on this).

Samsung's DVD905 at $750 (£490) is a smart-looking player with a steel chassis: outputs include composite video, S-Video and RGB. The Philips Model DVD420 at $650 (£408) has a universal remote control unit and a handy remote control locator: if you can't find the handset you can press a button on the front of the player and the handset will beep. Sharp's DV550U, the company's first DVD player, is designed for use with audio mini systems – it's less than 30cm wide. The JVC XV-D2000BK has a Dolby Digital decoder and six analogue outputs: it also plays audio and Video CDs.

One of the nicest looking DVD players was Panasonic's portable Model DVD-L10. Weighing less than a bag of sugar, it has a 5·8in. colour LCD screen that can display 4:3 or 16:9 pictures. Other features include built-in speakers and an optical digital audio output. Power is provided by nickel metal hydride batteries that provide a continuous playing time of up to two hours. The DVD-L10 is priced at $1,300 (£817).

Samsung also showed a dinky portable DVD player, called the P-Theatre. It weighs 0·9kg and can be used with a portable video headset. Alpine showed an in-car entertainment system that includes a DVD player.

There was disappointing news about DVD's European launch. A "big-bang" launch had been expected this spring, but delays in producing discs in sufficient quantities means that the launch will now be in the autumn at the earliest.

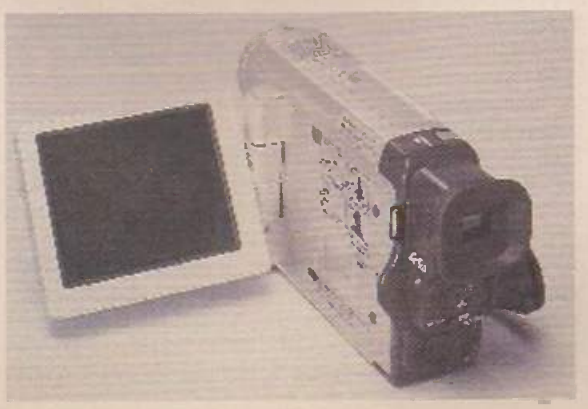
Divx

Digital Video Express, which has developed the DVD variant known as Divx, was present at CES '98. Unfortunately the first Divx hardware and software was hidden away in a back room: only selected dealers and manufacturers got a chance to see it. I was able to attend a special DVD conference that included the chairman of Divx however. To recap, Divx is a play-and-dispose DVD system. The idea is that consumers will buy a Divx title for about $4-5 and play it on a special Divx machine (ordinary DVD players cannot play Divx discs, though Divx ones can read DVD discs). The Divx player is connected to an ordinary domestic TV set and to the telephone socket and has a built-in modem. Divx suggests that the first players will sell for about $100 (£63) more than a conventional DVD player.

When Divx is used as a rental system the disc is designed to play for some 48 hours, after which the disc's content becomes scrambled (powerful encryption keys are used). The player contains a clock which starts to count down when the disc is first played (not when purchased). If the user wants to extend the playing time for a further 48 hours an on-screen menu can be used to order the extra viewing time. A computer calls up the player at night, via the phone line, unscrambles the data and collects billing information. These calls are free to the Divx user. There will also be "gold" Divx discs for outright purchase: these provide unlimited viewing time.

Divx is being tested at two so far unnamed US cities. A national launch is planned for this summer. Companies that support Divx include Paramount, Universal, Buena Vista (Disney) and DreamWorks. There will be 100 or so titles at the launch, with 500 planned for the end of the first year. Companies that plan to sell players include Zenith (machines made by LG Electronics), Thomson, JVC and Panasonic.

The industry is divided over the arrival of Divx. Some Hollywood studios like Warner and some hardware companies such as Philips are resolutely opposed to it, arguing that Divx will create confusion. Others wonder whether Divx could stay in business, especially as forthcoming digital satellite and cable TV services will provide a myriad of near-video-on-demand services.



The Sharp digital camcorder Model VLDP1U, which has a novel touch-screen control system.

VCRs

Although DVD dominated the show there was plenty of evidence that VHS is still very much alive and kicking. Sony demonstrated a remarkable VCR tape library system called SmartFile. A number of companies have developed tape library systems, including Grundig, Hitachi and Sanyo. But most of these involve considerable user effort. SmartFile is different: it uses an ultra-thin memory chip which is housed within a cassette label (you read that right!). It can store up to twelve programme details.

The date, time, channel number and programme length are automatically stored in the chip whenever a video recording is made. The user can add the programme title by using an on-screen menu and the remote control keypad. Top-of-the-range SmartFile VCRs automatically add the programme title however by using data from a system called TV Guide Plus. Developed by Gemstar, this transmits programme information during the field blanking period, like teletext.

SmartFile VCRs have two sensors, one at the front and one inside. When a SmartFile cassette is placed in front of a sensor, its contents appear on the TV screen. With the cassette inside the machine, the VCR can be programmed to find a specific recording. Other features include a blank-time display which shows how much tape is left for recording, and programme lock which prevents erasure of a specific recording.

The first two SmartFile VCRs are Models SLVM10HF, which is to go on sale in the USA in June at around $450 (£282), and SLVM20HF which will cost $500 (£313). Each machine will be supplied with memory chip cassettes. Sony plans to market the labels separately.

Thomson's Models VRK692HS, VR645HF and VR568 include features called Commercial Advance and Movie Advance. The former places electronic markers at the start and end of commercial breaks recorded on a tape so that they can be skipped. Movie Advance looks for the end of promotional material at the beginning of a prerecorded tape, going straight to the start of the film. The VCRs sell in the range $230-330 (£144-207).

Hitachi and JVC demonstrated Data VHS (D-VHS) VCRs that can store up to seven hours of MPEG-2 video on a VHS-sized cassette. JVC has two D-VHS machines. Model HM-DSR11DU comes with a dish and built-in decoder for EchoStar's DISH network. Price is $1,000 (£630). Model HM-DSR11RU comes without a dish and costs £950 (£597).

The Samsung SV4000W is a four-head hi-fi VCR that can play, record and copy in the PAL, NTSC and SECAM modes. Price is around $2,200 (£1,400). Sharp has developed a remote pager system for finding a mislaid VCR remote control handset: press a button on the VCR's fascia and the handset flashes and bleeps.

Satellite TV

US viewers can choose from three major digital satellite systems, DirecTV, Primestar and EchoStar. The largest is DirecTV, which was pushing its system hard at CES '98. It has almost three million subscribers and uses a set-top decoder and 18in. dish to receive up to 175 channels. These range from sport to films and news to home shopping.

The service includes 'season tickets' for specific sports teams and pay-per-view events. Equipment prices start at around $400 (£240), though there are special offers. Companies that market DirecTV equipment include Thomson, Sony, Toshiba, Panasonic and Hitachi.

Home Cinema

Home Cinema, or Home Theater as it's known in the USA (and that's how they spell it), is big business there. Some 1·2 million home theater-in-a-box systems are expected to be sold this year. Philips showed the DVX8000, a multimedia home theater system that incorporates a PC, a DVD player and a Dolby Digital system. The specification includes a DVD-Video/DVD-ROM drive that can also read CD-ROM and audio CD discs, a Dolby Digital and Dolby Pro-logic decoder, a video line doubler and a 233MHz Pentium PC with 32Mbytes of RAM. Not surprisingly, it has many audio and video input and output sockets – it would take too long to list them all here! Price is $5,000 (£3,200).

Dolby says that there are now more than 1·2 million Dolby Digital decoders in use worldwide. The format received a boost when it became part of the statutory PAL area DVD specification (titles must now include either MPEG-2 or Dolby Digital sound – the latter was originally optional). Dolby Digital is the audio standard for NTSC area DVD discs, and over 1,110 LaserDisc titles are encoded with the system. In addition Dolby Digital is the standard audio system for the US digital TV system.

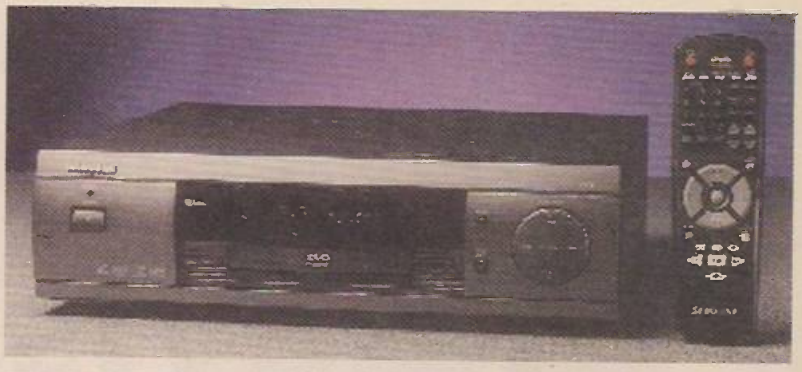
But Dolby has rivals, including Digital Theatre Sound (DTS), a 5.1-channel format that's used in many cinemas around the world. Technics, Panasonic and Yamaha displayed AV amplifiers and DVD players that were DTS compatible. The first DVD titles to be encoded with DTS audio are expected to be launched in the USA this summer.

Multimedia

The computer and consumer electronics worlds are converging. So it was no coincidence that Microsoft was prominent at CES '98. Sony and Philips demonstrated WebTV Plus. The system enables TV viewers to explore the internet: it uses a set-top box which plugs into a TV set and a telephone line. WebTV is now owned by Microsoft, and has some 200,000 subscribers in the USA.

WebTV Plus is an enhanced version with a faster modem (56kb/sec instead of 33·6kb/sec), a 1Gbyte hard drive for storing files and data from the internet (including video clips), and TV crossover links. The latter work when a TV channel produces web pages associated with a programme. By clicking an on-screen icon (the letter I) the viewer can see the programme and web page together on the screen – the TV programme is displayed in a 6 x 5in. window. The Philips WebTV receiver costs $300 (£189). It includes an infra-red receiver called Web Eye: this enables the box to be hidden away. It can also be used with a keyboard and a printer.

Zenith and Mitsubishi also demonstrated internet set-top boxes while Sanyo showed its internet TV. This is a 16:9-format TV set with a built-in web browser, a modem and an 880 x 480 dots per inch display for showing computer graphics. It can be used to send picture e-mails (e-mail messages with pictures) and can be operated by a remote-control handset or a wireless keyboard.



The Samsung DVD905, a second-generation DVD player.

Camcorders

Camcorder penetration in the UK has been stuck at around ten per cent of households for some time now. In the USA the figure is 29 per cent, and it's interesting that the full-size VHS format is still very much in evidence. RCA's CC4371 at $700 (£440) includes a 3in. colour viewfinder and 32x zoom.

The JVC Dualcam Model GR-AXM700 is a combined VHS-C camcorder and digital camera with a flash memory that can store up to 44 images, a 3in. LCD screen for viewing images, and software that enables digital images to be downloaded to a PC. It also has a video input socket (a rare sight with UK camcorders) for putting PC images back into the flash memory. JVC plans to launch its Dualcam in the UK later this year.

Sharp's Slimcam Model VLPD1U is a mini DV model that's less than 3in. wide and weighs less than 1kg. It has a novel touch-screen control system with icons for activating features such as play, record, zoom and focusing. If you want to focus on a particular subject you touch the relevant icon then the image, after which the VLPD1U zooms in. Clever stuff – but the LCD will surely get rather grubby!

Electronic Delivery

I first came across a company called EMC3 (Entertainment Made Convenient) about four years ago. It was developing a digital electronic delivery system to transmit time-compressed data via satellite, cable, broadband telephone or microwave systems. Electronic Video, as it's called, can transmit a full-length film to a suitably-equipped VCR in five minutes. The VCR then plays the film back in real time.

At CES '98 EMC3 announced that it is to start the first Electronic Video service next year, in Canada. It will operate via the Telsat satellite, which is due to be launched this autumn. According to EMC3 it has received letters of intent from seventeen manufacturers that plan to build ELD technology into their products. They include JVC, Samsung and Sony.

Long-distance Television

Terrestrial DX and satellite TV reception. News from abroad and the latest on satellite launches and services. John Breeds' latest satellite book reviewed. Roger Bunney reports

January was an even quieter month for TV-DX reception than December. The weather wasn't so quiet however, with strong gales and rain, though there have fortunately been no reports of damage to DX aerial systems.

Apart from a few unidentified ch. E4 signals, the only DX reception here at Romsey has been from Lopik, Holland. The signal is usually present each morning just above the noise level – it's a weak, fluttery tropospheric signal, which I receive using a two-element wideband Band I aerial at 32 feet above ground level.

Fortunately conditions have been more active for our Australian friends, who have benefited from some solar-related propagation such as transequatorial skip (TE). During the closing weeks of 1997 Wenlock Burton (Victoria) received China ch. C1 (49·75MHz), Malaysia (RTM) ch. E2 (48·25MHz) and Samoa (KVZK) ch. A2 (55·25MHz, system M). The latter signal was seen mid-afternoon, suggesting double-hop Sporadic E propagation: the other two signals were logged after 1900 hours and were therefore more likely to be TE propagation. Robert Copeman (Victoria) has received similar signals, and comments that the current SpE season in Australia is better than in previous years.

There has been some TE reception in the Mediterranean area, in particular 50MHz signals from amateur radio stations in the southern regions of Africa. So we can hope that the millenium will bring plenty of activity as solar cycle 23 develops. A big maximum sunspot count is predicted for March-May 2000, at the peak of the cycle. It may be the last chance for really long-distance F2 terrestrial TV reception: by the time solar cycle 24 peaks, around 2011, terrestrial TV may well be largely digital and long absent from Band I.

Eutelsat II F4 at 7°E and Intelsat 601 at 27·5°W provided, as usual, coverage of the Paris-Dakar race, with live news inserts nightly.

Satellite Reception

The Satellite Festival took place over the weekend of January 16-18th. This year it seemed to be more of an infotainment than in previous years. Apart from line dancing and a fascinating video trip around the Mebo-2 Radio Caroline boat, there were numerous interviews that dealt with satellite topics, the internet and computerised (virtual) studio sets, also an item about digital TV. Hosted as ever by Eric from TESUG, the programme was available Europe-wide via the 12·225GHz horizontal transponder aboard Sirius 2 at 5°E.

Various Arabic downlinks carried the closing ceremonies of Ramadan. The transmission provided by Dubai TV from 13°E was an impressive event, featuring the central sacred area with a backdrop of soaring white minarets against a dark blue and then black sky. While Dubai, ART and MBC carried the event in its entirety, most of the North African countries served by Eutelsat at 16°E (Egypt, Libya, Tunisia and Morocco) transmitted their usual programming.

The VYVX ATLN downlink is usually carried by Intelsat K at 21·5°W. Interesting to find it carried eastbound via PAS-3R (43°W) at 0700 on January 22nd. Some days earlier this carrier transmitted pictures of what I assume was the VYVX back yard. Apart from the two Brightstar analogue leases and often a GMTV early morning feed, Intelsat K has become relatively quiet – perhaps it has all gone digital. One of the Brightstar transponders carried a Reuters feed with the indication "BMAC tests for USA Superbowl".

The weekend of January 24-25th brought lots of winter sports. Intelsat 803 with BT-UKI-156 featured cars racing on ice and snow; Kopernikus DFS-2 at 28·5°E carried two OB feeds with skiing and ice-hockey; there was skiing in the French Alps via Telecom 2C at 3°E and in Austria/Switzerland via Eutelsat II F4 at 7°E, the latter with sound in syncs.

Those with a tracking dish and a clear view to the south west should check PanAm PAS-5, which is now in orbit just above the UK horizon at 58°W. Ku band signals have been seen in the UK from this source – an Italian feed was seen during the Pope's visit to Cuba. This satellite is really intended to provide American coverage, so it represents a real DX challenge in the UK.

Nicholas Earley (Victoria, Australia) tells us that he now has 1·5 and 95cm dishes, the latter driven by a Pace positioner. The 1·5m dish is being converted to 4GHz (C

band) operation. For digital signals he has a Nokia 9500S receiver which performs well and "is easy to use once you get the hang of it". The handbook doesn't tell you how to access the red menus, but overall Nicholas is pleased with the receiver which he considers to be good value. It has an Irdeto CAM/card slot but cards are not available.

Roy Carmen in the Isle of Wight has been trying out a friend's Nokia 9500D box. While it gives great pictures and sound he feels that it's a one-satellite home-entertainment unit which is useless as a DX machine. Strong words! His criticisms are that it has no Ku-band search facility, that once a programme 'bouquet' is stored it prevents splitting out the clear, non-encrypted channels, that the clock relates to the received channel only, that storage is limited to about 330 channels, that satellite searching means keying in 1MHz at a time, and that there's no local UHF TV and no analogue loopthrough.

Julian Redwood in Christchurch has also found that digital DXing is more time-consuming than analogue. But John Locker, who has been receiving digital signals for over a year and has spent many hours with Nokia receivers, has found ways of speeding up the tuning and digital parameter changing.

I am investigating a new MPEG model that's claimed to be user-friendly, running at 2-45Mbits with all FEC rates. Until the second generation of digital receivers arrives I think we are stuck with D boxes that have much-modified software.

Broadcast News

Pirate TV: Older readers may recall TV Nordzee from the REM island. There are media rumours that an offshore TV studio is being established aboard a ship outside territorial waters in the Baltic Sea. "Zoom TV" would produce TV programming for distribution via satellite, thus avoiding national legal requirements. Apparently $3m has been promised by a Monaco-based group. The water-based pirate would not provide any local terrestrial transmissions.

Poland: Nasza Telewizja started to provide a full service in central Poland on January 17th. Test transmissions started on December 31st. In the evening it joins with the TV Odra network in western Poland.

Hungary: TV2 is now on air. It started within 88 days of being awarded the franchise and offers news, sport and family entertainment. It's the first independently owned and operated national network and uses the transmitters vacated by MTV–2 which has now moved to satellite transmission.

Belgium and the Netherlands: The Belgian BRTN-2 programme is now called KETNET/CANVAS – the 16:9 PM5544 pattern has CANVAS at the top and KETNET lower down. The PM5544 pattern used by TV Noord in Holland has TV NOORD at the top and NOZEMA HOOGEZAND K36 lower down – the ch. E36 transmitter runs at 100kW ERP.

Portugal: Hugh Cocks reports that the state broadcaster RTP has been given EEC cash to experiment with 16:9 transmissions. Local broadcasters RTP/SIC/Ch 4 transmit many Brazilian telenovelas (soaps). Programme timings are still irregular. SIC recently transmitted part of a new telenovela before the previous series had finished, and on another occasion broadcast three hours of soap that consisted of parts of a new series intercut with sections of the old one.

Switzerland: The equipment, frequency allocation and assets of Milan-based SEI-TV have been sold to TV Svizzera, the Italian-language channel of Swiss state TV. SEI-TV, which provided a Milan regional news channel, closed down at the end of last year.

Japan: The Ministry of Posts and Telecommunications is pushing satellite digital TV and delaying terrestrial digital TV, which might start up in 2000. The reason for this is cost. Apparently each digital satellite costs some $200m compared with an estimated terrestrial digital start-up cost of $8bn!

Colombia: Two commercial national networks are now in operation, run by RCN and Caracol. The two public services continue. Full 18-hour, seven days a week operation of the new networks starts in July.

Satellite News

After suffering losses of over £13m during the past two years CMT (County Music Television) has ceased distribution in Europe. CMT was sold to CBS last September. It will continue in the Americas and SE Asia.

More on the loss of AsiaSat-3, which was launched at the Baikonur base, Kazakhstan on Christmas Day. For the first six hours the flight went well. Then the two-minute fourth stage burn lasted just one second, putting the satellite into an elliptical orbit between 200km and 36,000km. Cause of the failure was burn out of the Energiya Co. gas generator, the third such failure. AsiaSat may purchase a second-hand in-orbit craft pending the launch of AsiaSat-4 in 1998. Unfortunately most of AsiaSat-3's capacity had been booked.

There are problems with the PAS-6 satellite at 43°W because of

An IRIB-SAHAL Iranian TV feed received via the Eutelsat Hot Bird slot at 13°E.

Sporadic E reception in Sydney, Australia from the Te Aroha ch. 1 (45·25MHz) transmitter in New Zealand. Photo from Todd Emslie, taken off VCR.

reduced output from its solar panels. Sky Latin America had booked all 36 transponders.

SES (Astra) plans to use the Spanish Hispasat craft at 30°W to provide digital TV services to Central America. Hispasat-C is to be launched next year with seventeen transponders to provide digital services across Europe.

Japanese Sky Broadcasting (JSkyB), which was about to start providing DTH services, and PerfecTV, which started DTH broadcasting just over a year ago, are to merge. JSkyB is being incorporated in PerfecTV. More competition came from DirectTV, which started DTH broadcasting on December 1st. It is estimated that one and a half million subscribers per service are required to make a profit. The high cost of setting up services made JSkyB think twice.

In France, a merger between CanalSatellite and Television par Satellite (TPS) is being considered to overcome the problem of high operating costs. AB SAT earlier agreed with CanalSatellite to use a common simulcrypt decoder standard.

INSAT has bought the Arabsat 1C craft which is now at 31·25°E.

Nigeria now has two satellite broadcasters. African Independent Television provides a 24-hour service via Intelsat 601 at 34·5°W. Its studio centre is just outside Lagos. Minaj-TV, based at Obosi in Eastern Nigeria, has leased 9MHz of C band capacity aboard PAS-3R at 43°W to transmit its digital Minaj Broadcast International service across Africa.

Sony Entertainment TV is to start an Indian-language service intended for cable distribution in Europe: it's being supplied from Molinare's Soho, London HQ. Several UK cable groups have apparently booked the service. It's not known yet which satellite will be used. African-Caribbean Satellite Television is to start as a pan-European service via Eutelsat II F3 at 16°E.

The Swedish TV8 business channel is now available as an analogue service via Sirius 2. The UK 24-hour weather channel, also its Dutch and Italian versions, has closed down.

Intelsat has confirmed contracts for the launch of its first four IX series craft. Orbits are to be as follows: 901 at 60°E; 902 at 62°E; 903 at 24·5°W; 904 at 34·5°W.

Book Review

Satellite Know How! is the snazzy title that John Breeds has adopted for the sixth edition of his well-known, authoritative and respected Satellite Television Installation Guide. The book is so well established that it's the study basis for trade assessment by the Confederation of Aerial Industries.

The page size and layout are the same as in previous editions, but this one has been expanded to cover the many changes that have been introduced in satellite TV technology in recent times.

The great advantage of this book is the clear, simple writing, with mathematics avoided, and its large, clear illustrations. Theory is presented in simple language, with appropriate drawings to make everything clear. If I can understand it all, the book has succeeded in its educational aim – it is also great bedtime reading for satellite anoraks!

The basic theory is all there, along with the essential practical information. So we have geostationary orbits explained, then information on the signals, dishes and related hardware, cabling, and wall, roof and garden installations. For serious installation work, elevation/azimuth tables are essential. So here are the angles for Land's End, Lerwick, Lisbon or Losinj (Croatia), should you be called upon to install dishes at these locations! It's not a solely how-to-Astra book: you get information on optimising for Astra, Eutelsat, Intelsat, Orion or PAS reception.

The old material has been expanded as necessary – installing a tracking dish, polarisers, dual-probe LNBs, fixing bolts for wall brackets and actuators and so on. New features include DiSEqC switching, dual/multi LNB single-dish operation, and equipment connection via scart sockets – where and how. There's an extended section on actuator arm alignment – including the H-to-H assembly. Signal distribution is also included. This explains for example vertical/horizontal switching with four-receiver systems.

Digital TV receives a mention but it's too early yet to go into practical details – a lot still has to be finalised. Once the decisions have been made, John will doubtless be using his trusty Amstrad to hammer out more digits in plain English.

I've recommended earlier editions of this work, and I recommend this one (you can claim it as a business expense!). For both the professional and the enthusiast, it's a worthwhile guide and reference work to keep on the bookshelf.

The book now runs to some 130 A4 pages, with soft covers. The basic price is £22, but postage is an expensive extra nowadays – £3 in the UK, £5 to continental Europe and £10 to the rest of the world, via air.

There have been some special offers associated with the new edition, such as satellite software. See the advertisements placed by Swift Television Publications (17 Pittsfield, Cricklade, Wilts SN6 6AN) in recent issues. For further information you can phone 01793 750 620, fax 01793 752 399, send an e-mail to

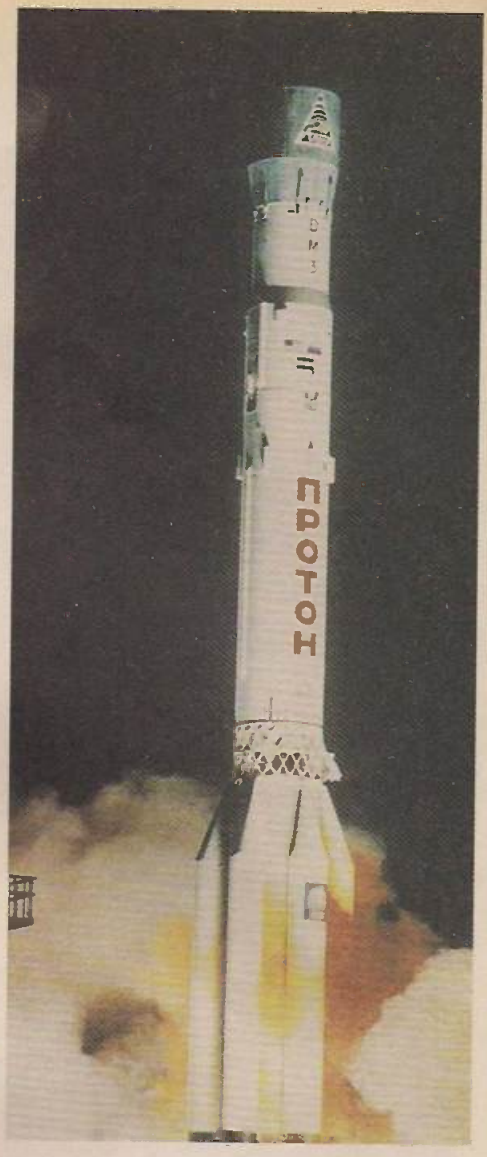
john@swiftpub.u-net.com

or consult the web site

http://www.swiftpub.u-net.com

Astra Update

George Cole describes SES's plans for digital TV from 28·2°E and developments at 19·2°E



A special conference was held by the Société Européenne des Satellites (Astra) during February to explain the company's plans for digital TV and beyond.

Current System

There are at present seven Astra satellites, 1A-1G, co-located at 19·2°E. They can all be received using a fixed dish equipped with a universal LNB. This gives coverage of the analogue low-band frequencies (10·7-11·7GHz) and the digital high-band frequencies (11·7-12·75GHz). Astra 1A-1D have a total of 64 transponders which are used for analogue services: 1E-1G, with 56 transponders, are used for digital services.

Currently 97 analogue TV channels are broadcast via the Astra system, 47 of them aimed at English-speaking viewers. There are many more digital services – 201 TV and 148 radio. The largest digital TV markets in Europe are currently France, Germany and Spain. According to SES, of the 2·07 million digital TV subscribers in Europe at present 1·39 million use Astra for reception.

The number of digital TV subscribers is expected to show considerable growth during the next twelve years: SES predicts that digital will exceed analogue subscribers in 2004. By 2010, SES expects the European satellite TV market to have 52 million subscribers with 44 million of them watching digital services.

Astra at 28·2°E

So extra transponder capacity will be required. Later this year SES will launch two new satellites, Astra 2A and 2B, which will be co-located at 28·2°E. They will provide an additional 56 transponders, many of which have already been booked. BSkyB plans to launch the UK's first digital satellite TV service this June. The start will in practice be low-key, with a major push planned for the busy pre-Christmas period.

Astra 2A was due to be launched late last year, but problems with the Russian Proton launch vehicle have delayed matters and a May launch is now expected. This would be too late for the proposed start of BSkyB's digital services, but as a stop-gap solution SES is to move Astra 1D to 28·2°E, using its transponders for digital TV. This won't affect existing Astra services and consumers will not notice the change. This is possible because there are at present 21 spare transponders at 19·2°E.

Three satellites will be involved in the changes, 1D, 1E and 1G. Astra 1D has 18 transponders: 15 use band D (10·7-10·95GHz), with three spare. Astra 1E has 20 transponders, with three spares and the other 17 using band E (11·7-12·1GHz). Astra 1G has 32 transponders, with 16 operating in band G (12·5-12·75GHz) and 15 spare.

The plan is to move the 15 band D services via Astra 1D to 1E, leaving just four transponders for band E use. 1E will have 19 active transponders plus one spare. Astra's band E transmissions are to be moved to 1G, which will have 14 transponders operating in band E, the original 16 operating in band G and two spares. SES says its customers, the service providers, simply have to reposition their uplink dishes, which takes about five minutes.

It will take around three weeks to move Astra 1D to 28·2°E: it could be done in as little as five days, but this would use up a lot of fuel and increase the risk of satellite collision. By moving 1D slowly, only one and a half month's fuel is used for the round trip. 1D should be in its new position by mid-March, ready to begin test transmissions. BSkyB will use up to 14 transponders aboard 1D.

If Astra 2A's launch is a success, the digital services will be transferred to it from 1D and the latter will return to 19·2°E. Should the 2A launch fail for any reason 1D will remain at 28·2° awaiting the launch of 2B towards the end of the year.

Most of 2A's 28 transponders have been booked, 14 by BSkyB, two each by Flextech and the BBC, one each by Discovery, UKTV and Viacom and a half by Turner Broadcasting, while 2·5 are booked for multiplexes. Deutsche Telekom has booked 16 Astra 2B transponders. Thus 40 of the additional 56 transponders are already assigned.

Developments at 19·2°E

SES will also be introducing changes at 19·2°E. Astra

Top photo. Launch of the Astra 1G satellite from Baikonur, Kazakhstan, via a Russian Proton rocket.

The SES-Astra digital network operations centre at Betzdorf, Luxembourg.

1H is to be placed in orbit here at the end of the year, for use as a back-up and for new two-way services (see below). A more powerful satellite, 1K, has been ordered from Aérospatiale. At the start of its life it will have 52 transponders in operation, reducing to 46 at the end. They are powered by 105W travelling-wave tubes. Astra 1K's expected lifetime is 13 years, though the new xenon-ion propulsion system could extend this for a further three years.

Astra 1K will serve three main purposes. The first is as a replacement for 1B and to provide back-up in bands A, C and D. The second is to extend Astra's coverage into central and eastern Europe as far as Russia. The third is to enhance a system known as the Astra Return Channel System (ARCS).

ARCS

ARCS is to serve businesses – and, eventually, consumers – who wish to send and receive data via satellite transmission. Satellites are good for sending data to large numbers of reception sites, but sending data back is awkward using e-mail, the public switched telephone network or ISDN lines.

ARCS will use Satellite Interactive Terminals (SITs) and dishes to send data to Astra 1H or 1K in the Ka band (29·5-30GHz). The return path data rate will vary with the SIT power and dish size. A SIT type I terminal operating at 0·5W with a 60cm dish will provide a bit rate of 150kbits/sec: the more powerful SIT type III with 2W and a 120cm dish will have a bit rate of 2Mbits/sec, which is fast enough for MPEG-1 video. SIT prices will start from about £630.

The data sent from a SIT will be returned from Astra 1H or 1K to a central hub at SES's Betzdorf, Luxembourg headquarters. From there it will be uplinked to an Astra satellite and retransmitted in Ku band at speeds of up to 38Mbits/sec. SES plans to offer ARCS in 1999, but some countries have regulations that forbid the use of unlicensed transmission systems. SES is holding talks with European officials aimed as establishing a common, open standard for systems like ARCS.

ARCS is a step forward in satellite communications, but the need to use two satellites means that there are limitations with real-time interactive services – there's a gap of around one second as the data hops from one satellite to another. For this reason ARCS will probably not be used for telephony services. But SES is investing in a new generation of satellites that will provide on-board processing, thus eliminating the need to use two satellites.

Answer to Test Case 424

– see page 401 –

While it's true that capstan motors in Hitachi VCRs can give trouble, it is seldom that a motor fault causes a speed up. There was no doubt that the tape was running fast when the fault was present, but this didn't necessarily mean that the capstan was rotating faster than it should do – in fact it was running at the correct speed when the fault was present, as Sage proved with his test.

What he did, while the faulty recording was being played, was to lever the pinch roller away from the capstan shaft a little. With many machines, depending also on the amount of tape on the take-up spool, this will stop the tape motion. But there was sufficient torque to keep the tape moving – at a higher than normal speed of course, and without any servo control. The fact that in this condition the sample tape was being played back at about the correct speed showed very clearly that at the time the recording had been made the pinch roller had not been fully engaged. The tape had been pulled across the deck solely by the take-up spool.

The primary suspect became the mode switch. There was no more trouble once a replacement had been fitted – along with the loading motor that comes with it. When it was dismantled, the old switch was found to have tarnished contacts.

NEXT MONTH IN TELEVISION

Surface-mounted Component Markings

Because of their small size, it's not possible to print the full type numbers on surface-mounted diodes and transistors. So a separate code is used. Many readers have reported difficulty in obtaining details of this code. We have therefore compiled a listing of the code numbers for commonly used devices. This will be provided as a separate, cover-mounted data card with next month's issue.

LG Electronics/GoldStar Fault Guide

Des Bray and Mike Hardy of the LG Electronics Technical Department have compiled for us a list of the more common LG and GoldStar TV/video equipment faults that users of the company's Technical Line ask about.

Digital TV – What Next?

Digital TV could bring about a convergence of the computing, TV and telecommunications worlds to provide us all with new services. Some of these are already available in various regions. J. LeJeune looks at some of the systems and possibilities.

Servicing the Microvitec Series 13 Chassis

The Microvitec Series 13 chassis is used in several VGA/SVGA monitors. Its unusual line output stage can operate at frequencies between 30-50kHz. Russ Phillips looks at the circuitry and provides guidance on fault finding.

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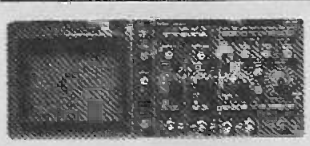

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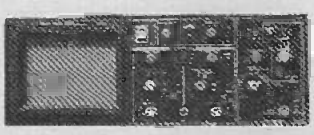

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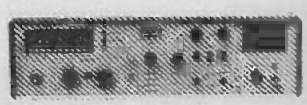

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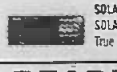

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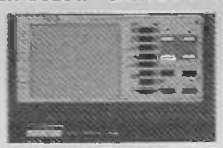

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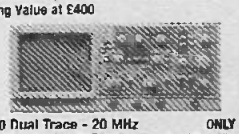

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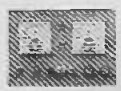

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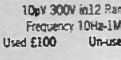

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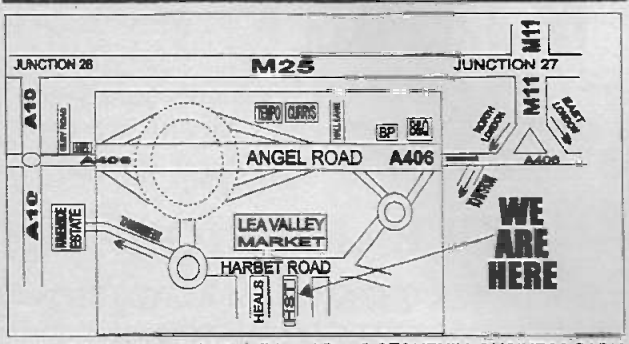

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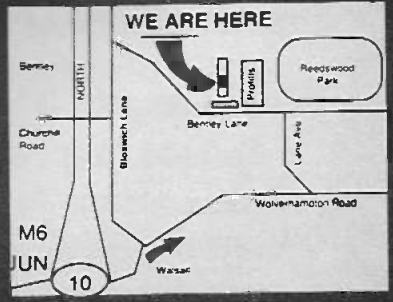

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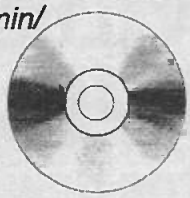

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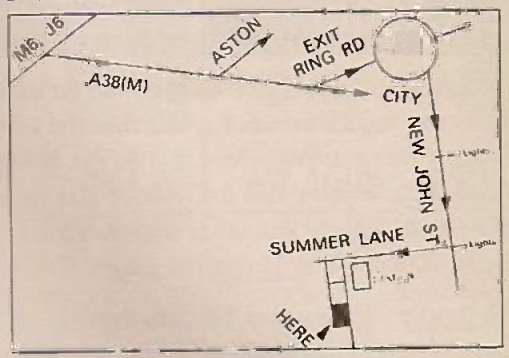

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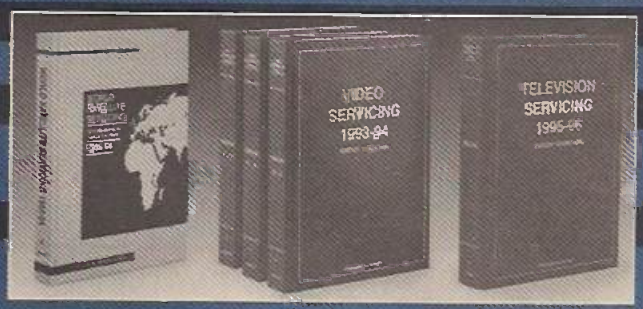

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2SC3973B	£1.00	AN5551	£1.00	BU508D	80p	BY225	15p	CA3123Q	50p	L2898	£4.00
2SC4513	£5.00	AN5831	£2.00	BU508DF	£1.00	BY229	6p	CD5555BE	20p	LA7830	£1.00
2SC4589		BC550C	20p	BU705	£1.00	BY255	5p	CLE87A	£5.00	LA7831	£1.00
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2SC7350	15p	BDV65B	50p	BU806A	£1.00	BY299-800	30p	HA1140	£1.00	M708 LBI	£1.50
2SD200	£1.00	BF869S	20p	BU807	50p	BY371-800	15p	HA1185	£1.00	M37201ECSP	£1.00
2SD401	40p	BF870	20p	BU808DFI	£1.00	BYV19-30	£5p	HA1196	50p	M58655P	£1.00
2SD716	£1.00	BPW41	15p	BU824	50p	BYV28-200	15p	HA11485ANT	£1.50	MN650	£1.00
2SD787	30p	BU105/01	80p	BU826	£1.00	BYV95B	10p	HA11804NT	£1.50	S13522V	£1.00
2SD789	30p	BU108	£1.00	BUK444/800	£2.00	BYV95C	12p	HA513385P1	£2.00	SAA1061	£3.00
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2SD880	30p	BU180A	65p	BUT11	50p	BYW29/50	15p	HCF4520BE	50p	SAA5231	
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2SD1398	£1.00	BU206	£1.00	BUT18AF	£1.00	BYW562A		HEF4028BP	15p	SAA5241A/P	£4.00
2SD1415	£1.00	BU207	£1.00	BUT71/800	15p	100V	8p	HEF4029BP	20p	SAA5243A/P	£4.00
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