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TELEVISION

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

January issue on sale December 16th.

Next issue, dated February, on sale January 20th.

Pay TV and the Licence

Now that we have all these digital channels on subscription, the need for the TV licence fee has once again come into question. It does, on the surface, seem to be a bit of an anomaly. The licence dates back to the time when the frequencies available for broadcasting were far more limited than they are today. It was felt that this precious commodity should be used with discretion. In this situation it was natural for the idea of public-service broadcasting to arise.

The BBC became a public corporation in 1927, when there was very little broadcasting and, in the UK, little money with which to provide it. But almost everyone, in particular the nascent radio manufacturing industry, wanted it. So there was little opposition to the idea of establishing a licence "to install equipment for radio reception", the fee to be used to fund a broadcasting service. This is hardly the situation today, but a strong case can nevertheless be made in favour of maintaining a vigorous, independent public-service broadcaster. It has to be paid for, and to maintain its independence – a particularly important factor – a source of finance separate from government funds (taxes) and commercial funds (advertising, sponsorship etc.) is required. Hence the licence fee.

With each major step in the evolution of broadcasting, for example the introduction of extra channels as TV technology started to use higher frequencies, and then the introduction of cable networks and satellite transmission, it has been customary to look afresh at the licence and what it stands for, and question its need. The case for its continuation has, in the past, always been generally accepted. The case is no less strong today.

It would be decidedly less strong in the absence of a broadcaster able to provide high-quality public-service broadcasting. In this respect the responsibility that lies with the BBC and its governors is immense. Literally, public-service broadcasting and the BBC stand or fall together. It would be almost impossible today to build from scratch an independent broadcasting organisation with the standing and authority the BBC has achieved.

The question nevertheless persists: do we need it – especially with all those digital channels that seem to be capable of offering so much? Well actually they are a bit of a charade. All sorts of bits and pieces thrown together, the same films starting at half a dozen different times, and sports strewn across a number of channels. There's a hard centre of good broadcasting – there has to be otherwise people would simply switch off – accompanied by a load of dross. The BBC, with its public-service commitment, forms part of the hard centre. For cost reasons the dross now being added is unlikely to improve – the vast majority of viewing will remain with a handful of channels.

The case for maintaining the BBC's independence via the licence fee rests, above all else, on the need to preserve a source of information free from taint, corruption, spin doctoring, commercial distortion and other such factors. But an independent, unbiased source of information is not of itself sufficient for a complex medium such as television. Fortunately the BBC has had time to develop a cultural and technical depth that places it in the top rank in the broadcasting world. This is an important resource, worth every penny that's required to maintain it.

The problem that the BBC has today is how to continue to fulfil so many roles when its means are restricted. Should it lower its technical profile, pull back from general entertainment, concentrate on being an information centre? Some curtailment of its activities is probably inevitable, and has been a major concern of BBC management. There have been suggestions that the BBC should provide a sort of supplement to commercial TV, adding education, in-depth news and so on. But a scaled-down service of this nature would have little general impact. It is essential that the Corporation remains a full-blown broadcaster. In fact in this respect the BBC has been making life difficult for itself by establishing a number of new public-service and commercial channels despite its severe financial constraints. It's a difficult act that will present many problems for the present and future management.

You may not spend much time watching the BBC's output. But without it the general quality of broadcasting is likely to decline. We continue to need it, and the price is a small one to pay.

CORRESPONDENCE
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INDEXES AND BINDERS
Indexes for Vols. 38 to 47 are available at £3.50 each from SoftCopy Ltd., who can also supply an eight-year consolidated index on computer disc. For further details see page 217.
Binders that hold twelve issues of *Television* are available for £6.50 each from Television Binders, 78 Whalley Road, Wilpshire, Blackburn BB1 9LF. Make cheques payable to "Television Binders".

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SATELLITE FAULT FINDING GUIDE

NEW EDITION No. 5

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

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

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KIT2 £6.95 Pace - SS900,9200,9210,MRD920, Ferguson SRV1, Grundig GIRD2000,3000, Philips STU801, Network 900,9200, Bush IRD150, Nokia SAT1500, Maspro SRE250S,350S,450S, Alba SAT6600, Finlux SR5700, Thompson SRS4

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KIT5 £6.95 Amstrad SRX320,340 etc (export models)

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KIT7 £6.95 Churchill D2MAC decoder

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KIT9 £9.45 Pace MSS200,300,Apollo

KIT10 £13.11 Pace MSS500,1000

KIT11 £5.95 Ferguson SRD4

KIT12 £16.45 Echostar SR5500(early PSU with adjuster)

KIT13 £29.71 Echostar SR6500,7700,8700

KIT14 £23.95 Amstrad SRD600

KIT15 £7.36 Mimtec (Sorenson PSU type only)

KIT16 £5.95 Amstrad SRD700,SR950,SRX100,301,501,1002,2001,SRD2000,SAT250

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1N4002	0.04	2SC2310	0.52	2SK526	3.40	BC548C	0.14	BFR90A	0.68	BYV96E	0.53	MJE340	0.45	TA8205AH	4.50	TDA4605	3.39
1N4003	0.04	2SC2314	0.38	7407	0.69	BC550B	0.16	BFR91A	0.92	BYW56	0.31	MJF18004	2.05	TA8207	2.74	TDA4605-3	2.12
1N4004	0.11	2SC2335	1.12	7805	0.78	BC550C	0.09	BR100	0.18	BYW76	0.31	MJF18006	6.22	TA8210H	4.79	TDA46052	1.97
1N4005	0.06	2SC2482	0.35	7806	0.60	BC556A	0.14	BRX49	0.43	BYW95C	0.24	MJF18204	6.07	TA8215H	4.96	TDA4935	10.08
1N4007	0.04	2SC2500	0.33	7809	0.69	BC556B	0.14	BSX20	0.35	BYW96E	0.50	MN650	1.71	TA8216H	8.01	TDA4950	1.76
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1N4936	0.09	2SC2705	0.35	78L05	0.35	BC557B	0.18	BT151500R	1.12	BYX55600	0.23	MPSA42	0.12	TA8251H	24.66	TDA7263	13.45
1N5062	0.26	2SC2785	0.36	AF200	1.63	BC558B	0.18	BTA08400S	1.17	BZV10	1.37	MPSA56	0.23	TA8403K	2.31	TDA7394	6.44
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2SB560	0.43	2SD1878	2.63	BC239	0.04	BD911	0.52	BUZ71A	1.03	LA7835	3.51	STK7348	5.74	TDA2653A	4.70	TIP31A	0.41
2SB649A	0.77	2SD1879	2.23	BC258	0.09	BD912	0.63	BUZ77B	4.27	LA7837	8.53	STK73907	10.48	TDA2822M	1.37	TIP41C	0.65
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2SC1383	0.32	2SD400	0.34	BC327	0.10	BF258	0.04	BY133	0.08	LM317T	1.29	STR50103A	5.56	TDA3562A	6.62	TL072CP	1.03
2SC1740	0.16	2SD400F	1.20	BC238	0.14	BF324	0.18	BY184	0.33	LM324N	1.48	STR5142M	13.25	TDA3565	2.74	TL082	1.04
2SC1740S	0.84	2SD467	0.57	BC337	0.14	BF420	0.21	BY227	0.13	LM339N	0.50	STR54041	5.15	TDA3576B	10.31	TLP731	1.95
2SC1815	0.17	2SD669A	0.79	BC338	0.06	BF421	0.24	BY228	0.26	LM358N	0.52	STR5412	4.55	TDA3592A	4.60	TMP47C432AP	8189
2SC1815Y	0.12	2SD718	1.90	BC368	0.18	BF422	0.19	BY229	1.34	LM381	4.27	STR58041	3.42	TDA3603P	5.62		21.84
2SC1846	0.52	2SD837B	1.12	BC369	0.18	BF423	0.14	BY255	0.14	LM386N	0.57	STR59041	8.11	TDA3650	9.27	TMP47C434N	3555
2SC2023	3.18	2SD856	0.79	BC372	0.53	BF458	0.31	BY298	0.15	M293B1	21.34	STR6020	6.07	TDA3653B	1.54		16.63
2SC2120	0.69	2SD965	0.26	BC546A	0.11	BF459	0.43	BY299	0.18	M494B1	11.85	STR61001	10.86	TDA3653C	2.82	TOP204YAI	4.19
2SC2229	0.35	2SD965R	1.05	BC546B	0.12	BF469	0.35	BY399	0.16	M51182L	1.88	STRD4420	11.17	TDA3653CQ	2.57	U2829B	3.40
2SC2230	0.55	2SK1118	3.40	BC547	0.11	BF487	0.57	BY448	0.30	M54544L	2.48	STRD6008X	8.66	TDA3654	1.44	U4614B	5.78
2SC2235	0.36	2SK135	11.02	BC547A	0.04	BF494	0.12	BY476	1.00	M58655P	4.96	STRD6202	12.89	TDA3654Q	2.82	UC3842	0.74
2SC2236	0.36	2SK1507	5.56	BC547B	0.11	BF758	0.32	BYD14J	0.35	MC13002P	7.69	STV5730ST	4.00	TDA4500	4.66	UC3844	1.20
2SC2240	0.21	2SK241	0.69	BC548	0.11	BF759	0.38	BYD33D	0.12	MC1310P	0.85	STV9379	11.12	TDA4503	4.00	UPC1365C	1.95
						BF788	0.52	BYD33J	0.16	MC34063API	2.65	T6071V	2.99	TDA4505E	7.35	UPC1378H	15.33
						BF869	0.38	BYD33M	0.26	MCR100-8	0.45	T9053V	1.35	TDA4505M	11.97	UPC1394C	1.92
						BF871	0.41	BYV10-40	2.55	MJ15003	2.23	T9064V	1.87	TDA4510	2.74	UPC1488H	2.99
						BF960	0.30	BYV27200	0.43	MJ2955	0.77	TA7140P	0.99	TDA4600	2.14	UPC1498H	3.59
						BF970	0.43	BYV95B	0.21	MJE13005	0.86	TA7280P	2.74	TDA4600/2/3	2.82	UPC574J	0.30
						BF981	0.48	BYV95C	0.28	MJE18004	2.05	TA7281P	3.20	TDA4601	1.46	ZTK33B	0.28
																ZTX650	0.51

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What a Life!

Donald Bullock's column on the servicing scene – the sets, the customers and their complaints. All TVs this time. Also a couple of commendations

We managed to get through a good few electrolytics the other day. It all started with Mr Wu, who brought in a Bush 2114 colour portable. He put it on the counter and rubbed his finger tips together.

"This set has gone long" he smiled.

It seemed the normal shape to me, but I smiled back just as inscrutably. "Oh, er . . . light" I said.

"Can you please get the tlouble lectified by the weekend?" he asked.

My smile faded a bit as I drew up a job card. "Pop in next Fliday" I said.

Paul put the set on the set on the bench. "Shall I make it light?" he lisped.

The set was tlipping, er, tripping. He soon found that the 220µF, 160V HT reservoir capacitor C810 was dead short while C808, the 1,000µF, 25V reservoir capacitor for the supply to the audio output and line driver stages, was low at 400µF. When they had been replaced the set came to life then died. There was now a smell of burning.

Paul scanned the chassis and noticed that IC5, a 5V regulator on the far left remote control subpanel, looked well burnt. He placed a finger on it and howled. C22 (470µF, 6·3V) also looked off-colour. When checked it was found to have fallen to 0·1µF. Both were replaced.

This time the set started up, but it was stuck on channel 1 and wouldn't carry out any functions. IC5's demise had damaged the SAA1293 microcontroller chip IC1. Once this had been replaced the set worked normally – except for the fact that there was no sound.

A check on the audio/line driver supply arrangement showed that the voltages were all wrong. C409 (220µF, 25V) which decouples the supply to the line driver stage was down at 90µF, while C606 (1,000µF, 25V) which decouples the supply to the TDA2006 audio chip IC601 was low at 200µF. In addition IC601 was short-circuit between pins 3 and 4. Once replacements had been fitted the sound was back, but there was one other electrolytic to replace, C818 (1µF, 50) on the primary side of the TDA4601-type power supply – it gives trouble in these sets, going dly, er dry and open-circuit.

Smoking

Our next caller, Mr Moggie, always has a cigarette in his mouth. He struggled in with a Bush 2857NTX, a huge 28in. stereo set.

"I don't like this trade any more" I muttered as he eased the set on to the counter. He was too exhausted to speak, so he made some puffing noises and kept jerking his hand into the air. Words finally came to him.

"This set smoked like the devil, then suddenly banged and exploded" he said.

"Let that be a lesson to you" I replied.

Steven had a go at this one. Three electrolytics in the power supply had blown up: C925 (1,000µF, 25V), C926 (220µF, 160V), and C923 (2,200µF, 35V) which lives at the far right-hand corner of the main panel. After replacing them Steven gingerly started the set up via the variac, while monitoring the HT voltage. When it suddenly shot up to 190V he quickly switched off.

Time for a more detailed power supply investigation. C910 (47µF, 25V) and C908 (10µF, 50V) read all right, but Steven decided to replace them with 105°C types and also upgraded C910 to 50V. As everything alse seemed to be OK he decided to test the set again.

This time it worked normally, though the HT was slightly high at 146V. There was no difficulty in setting it at the correct 143V.

It's Gone Again

Mr and Mrs Trew sidled in. "It's our set again, Mr Pullet" he whined to Steven, "gone again. You mended it only the other day."

Steven tapped at his computer thing. "The other day was fifteen months ago" he announced.

"We're old-age pensioners" Mrs Trew piped, "and it's gone the same as before."

"No sound last time" said Steven, "has the sound gone again?"

They both nodded frantically. So Paul went out to their car to collect the set, an old Panasonic TC2113 (U3W chassis). He plugged it in and spun the volume control up. The booming sound made passers-by turn their heads. He spun it down again and looked at the Trews.

"It's not as good as it was" he said.

"And it's spoilt the picture, too" she said, "is it because you didn't fit the right part?"

We noticed that there was severe east-west cramping, then the power supply began to screech. The faults were not related. C809 (1µF, 250V), the small reservoir capacitor on the primary side of the power supply, had leaked and fallen in value to 0·0043µF. The cause of the cramping was the 2SD762 EW modulator driver transistor Q753, which was short-circuit base-to-emitter.

We charged the Trews a tenner and they loooked as though they'd been stung.

"I hope it lasts longer this time" he said.

Mrs Trew wagged her finger at us. "We're only pensioners" she said, "we'll see how it settles down."

A Mitsubishi Euro 4

Mrs Grunge came in followed by a panting Mitsubishi colour set with legs.

"This way, Oscar" she said. The set ran to the counter, then revealed her son behind it. "Move it along a bit for Mr Bullneck, Oscar." He moved it. "That's enough". She turned to me with a smile.

"It's gone again, Mr Bullring. I know it's not your fault, but it's not long since you mended it, is it? About eight weeks, maybe nine?"

Steven tapped away in the corner. "Last July twelve-month" he said.

"Doesn't time fly" she said. Then she and Oscar departed.

The set was a Mitsubishi CT2142BM. When Steven switched it on it slipped into standby instead of coming to life. When he pushed the standby button again it came to life but the picture settings were haywire. He reset them then switched the set off and on. The settings were again haywire.

Steven stared at the EEPROM chip IC702. "I've had this before" he commented, then checked for –31V at pin 2. The supply was low at –19V. A glance at the power supply revealed that C962 (10µF, 50V) had been leaking and was sitting in its dried-out electrolyte. Once it had been replaced the set was OK. C962 is used to smooth the –31V supply.

A Sound Problem

Mrs Bowler came in followed by her husband, who was struggling with a 25in. Sony set.

"Come on come on, hurry up" she said, "anyone would think it's heavy."

He put the set down on the counter. "Wait in the car" she told him. The set was a KVX2552U.

"This 'un's all right" she said, smacking the the left speaker, "but this 'un ain't. Buzzes."

We plugged the set in and switched it on. Both speakers sounded fine. We looked at her.

"I didn't say it allus buzzes" she said.

Half an hour later the left speaker started to buzz loudly. "Dry-joints on one of the TDA2050 audio output chips" Steven said. He was right. IC251 was very bady dry-jointed indeed. After resoldering it he looked at IC261, which drives the left-side speaker. It was as bad and received the same treatment.

"Did it buzz like I said?" Mrs Bowler asked when she came back.

"No" I said, "but we've fixed it."

She glowered at me. "You 'enta gettin' like 'im out there" she said, "I don't like Smart Alecs."

A Dead Samsung

Cassandra Grant wriggled in, pouting sadly. "It's blown up" she said, "can you get it from the car?"

Paul brought the set in. Though Thorn badged, it turned out to be a Samsung set fitted with the P68 chassis. And, as she'd said, it was dead.

The 2SD1651 line output transistor Q402 had failed and had blown the 1Ω safety resistor R826 in the HT feed. Before we replaced these items we measured the HT voltage. It had risen from the correct 125V to 200V. We decided to check the electrolytics on the primary side of the chopper power supply. This brought us to C852 (470µF, 16V), which had fallen in value to about 150µF. A replacement restored the HT voltage to its correct level and, after checking that it was fully adjustable, we replaced the blown components. The set then worked a treat.

"How can I thank you?" Cassandra cooed when she came to collect the set.

I gave her a weak smile and studied the cloud formation.

Another Giant

The next set to arrive came in the arms of Major Carruther's man Hodges. It was another giant, a 28in. NEI Model 2891FTXN (CE25 chassis).

"No picture Mr Ballcock" the major barked, "none at all. Nothing I say." He looked at his watch. "Back at five" he said, "come along Hodges."

We put the set on the bench and Steven advanced the setting of the first anode control. Up came a collapsed frame. The TDA3654 field output chip IC106 requires a 28V supply at pin 9. It was missing. The supply comes from rectifier D120, which is fed from a winding on the line output transformer. There are two resistors in series with the supply, R138 (0·22Ω safety) and R140 (1Ω, 0·25W). A simple one this time – R138 had gone open-circuit.

Steven replaced it and resoldered the joints at the pins of the TDA3654 chip. This is always a good idea with field output ICs. The set then produced a sparkling picture.

Major Carruther's face also sparkled when he returned at 5 o'clock precisely. "Take it away, Hodges old chap" he barked, then took some crisp notes from his mahogany-coloured wallet and placed them on the counter. "Enough?" he asked.

"Too much . . . " I faltered.

He wagged his finger. "Always happy to reward good service" he said before marching out.

Commendations

When in Spain I use a small FM transmitter that's plugged into the audio output sockets of my Pace PRD800 satellite receiver/decoder

I gave her a weak smile and studied the cloud formation.

to enable its reception of the BBC's Home Service (or Radio 4 as some newer fellows call it) to be picked up by an ordinary FM radio set anywhere around the house or in the garden.

The transmitter I had been using wasn't bad, but was a bit weak and tended to drift. Another one I tried suffered from inherent distortion. So I set about knocking up a crystal-controlled, 1W stereo model. There was difficulty with one component: I needed a 38kHz crystal, and such LF types are uncommon.

After various unsuccessful enquiries someone recommended a Surrey firm that was new to me. Vincent Jakomin of Q Electronic Design, Chessington, Surrey (0181 391 0545, fax 0181 391 5258) promised to look into the matter and found a factory that would cut one. I'm grateful to him for the excellect service he provided.

The transmitter turned out to be of very high quality and works a treat. I'm going to repeat the exercise for Radios 2 and 3, with two more receiver/decoders.

Incidentally whenever we need a service manual we phone Fryerns (01206 211 570) – Colin there moves heaven and earth to deliver the goods and has come up with everything we've asked for to date.

TELETOPICS

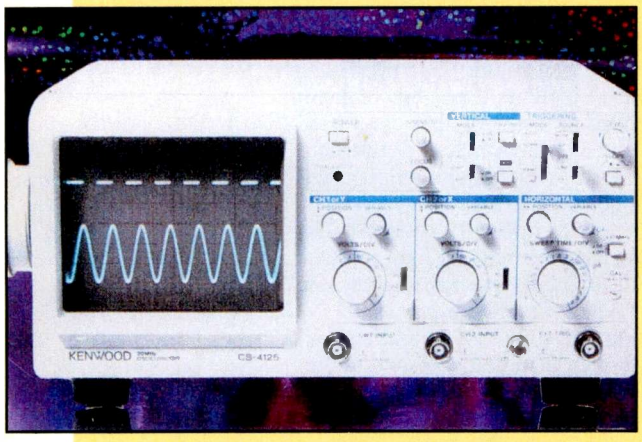
Digital TV Success

Digital TV seems to be going down well with the UK public. According to a Consumer Electronic Access Study conducted by MORI and Price Waterhouse Cooper, one in ten people expect to get a digital set-top box or an integrated digital TV set "at an early date" and one in five have decided to do so within six to twelve months. Two thirds expressed a preference for purchase rather than rental.

ONdigital's launch was marred by a shortage of STBs – while ONdigital's helpline received 75,000 enquiries during the first weekend, only some 5,000 STBs were understood to have been delivered to the trade. Philips, first to go into full production, announced that it would supply 20,000 STBs during the first week. Pace is now understood to be delivering over 1,000 STBs a day. Toshiba and Nokia STBs were due by the end of December, with Sony and Grundig yet to go into production. Hitachi was first with an IDTV set, launched before Christmas.

These initial low supply figures naturally upset the trade, which was left with little to offer potential customers. The question is whether the launch should have been delayed until adequate supplies of STBs were available. With the success of SkyDigital, the DTT operator obviously didn't want to be seen to be too far behind. Arguments over conditional-access systems delayed manufacturing plans.

According to Granada, which with Carlton Communications owns ONditigal, the latter expects to sign up 350,000 subscribers by the end of 1999 and to have a million subscribers by the end of the following year. Break-even will occur with two million subscribers, which is expected during 2001.



Kenwood Electronics has introduced two low-priced, high-specification scopes, Models CS4125 and CS4135. For just £299 the dual-channel CS4125 pictured above provides a 20MHz bandwidth and has a vertical sensitivity of 1mV/div. Sweep modes include normal trigger or automatic free-running, with x10 magnification to view detailed signal information. There's a comprehensive triggering range. Model CS4135 at £450 has the added advantages of a 40MHz bandwidth and a PDA voltage of 12kV, providing a very bright trace at even the fastest timebase speeds.

For further details phone 01923 655 291 or fax 01923 655 297.

Video News

Pioneer says that its new DVD Rewritable player could be launched in Japan this summer and be available in Europe the following year. DVD-RW is compatible with the DVD Video format and is intended as a replacement for the VCR. More details in next month's *Television*.

Some new and interesting video products are now available in Japan, including a series of dual-format VCRs. Sony's line-up includes Model WVD10000, a Digital Video/S-VHS deck that plays full-size DV, Mini-DV, S-VHS and VHS tapes. The deck can be used to copy digital recordings to analogue and vice versa. It costs the Japanese equivalent of about £1,650. Other dual-decks from Sony include the Hi-8/VHS WVBW3 and the Hi-8/S-VHS WVST1. JVC's dual-deck Model HRDVS1 incorporates Mini-DV and S-VHS mechanisms, also JVC's new S-VHS-ET system that enables S-VHS recordings to be made using standard VHS tape. Other companies now offering S-VHS-ET machines include Sony, Hitachi, Mitsubishi, Panasonic and Toshiba.

Sharp has launched two VCRs with built-in LCD screens to enable recordings to be viewed without the need for a TV set or monitor. The Sharp Models VLDC50, VLDC5 and VLDC5LTD use an electronic pen system that enables viewers to write captions on to an LCD screen: the image and caption appear on printed stickers.

Panasonic has launched two camcorders that can provide multiple picture-in-picture displays on their LCD screens: up to nine images can be displayed simultaneously.

Pioneer has launched two portable DVD players. One has a built-in 5·8in. screen while the other has to be connected to a TV set for viewing.

Toshiba is now marketing a number of TV sets with flat-screen plasma displays in Japan. Screen sizes range from 28 to 36in. A few of the sets are Hi-Vision HDTV models. Prices range from the Japanese equivalent of £700 to £2,650.

DTT Reception

Research company TBS says that the UK's DTT service is exceeding the initial coverage predictions – around 70 per cent by the end of 1998 and over 90 per cent by the end of 1999. TBS conducted a series of tests that involved more than a hundred domestic locations in the service areas of the Crystal Palace and Oxford transmitters, using a Philips DTX6370 set-top box. These two transmitters were chosen because both transmit the full complement of six digital multiplexes, but whereas all six can be received from Crystal Palace using existing aerials in the case of Oxford a group W aerial would theoretically be required to receive all six multiplexes in addition to the analogue channels.

Various types of external aerial were in use at the chosen locations, from ultra-modern ones to aerials installed for colour TV in the Seventies. There were also some damaged aerials. TBS says that in the vast majority of cases (over 90 per cent) in the Crystal Palace area existing outdoor aerials provided reception of all six multiplexes: in the remaining cases the aerials were either severely damaged or had fallen down, with poor analogue pictures as well. In some cases reception of all six multiplexes was possible with aerials that were below par by using an inexpensive low-noise amplifier. This approach also worked well in Oxford, compensating for the fact that one of the multiplexes is outside the existing aerial group.

TBS found that it was possible to receive the DTT services from Crystal Palace just outside Oxford, where analogue signals from Crystal Palace were very noisy even with a high-gain aerial system for the London group and a mast-head amplifier. TBS says this demonstrates that long-range DTT reception is feasible.

The results obtained with indoor aerials also exceeded expectations. In many parts of London perfect DTT reception was found to be possible using a small indoor aerial. In some cases a small set-top amplifier was required. At one ground-floor room in a house at Fulham perfect DTT reception was possible without an amplifier or even a piece of cable attached to the STB's aerial input: analogue signals were unwatchable under these conditions.

The COFDM modulation technique used for DTT was able to cope with aircraft flutter and mast-rocking, either eliminating these problems or readjusting automatically within about a second.

It was found to be very easy to connect the STB to a receiver with a scart socket: RF connection took slightly longer, an additional tuning step being required.

TBS concludes that up to 95 per cent of homes should be able to receive DTT economically by the millennium.

CPC has introduced a videoconferencing kit that includes everything required for the purpose and in addition provides high-quality data capture. Called the Grand Video Conferencing/Capture Kit, it gives low-cost access to the latest technology, with a video camera and capture card, a microphone and a software package.

The capture card has composite and S video inputs. Brightness, contrast, saturation, sharpness and true-display controls are provided, with full-motion video and still-image capture. As the card requires neither a VGA feature or video frame buffer, no extra costs are involved.

The video camera has a minimum horizontal resolution of 310 lines and a focus range of 100mm to infinity. Power is drawn from a PC keyboard connection and the output is composite video. The kit is easy to install and use and comes complete with extensive manuals and utility diskettes.

For further details phone CPC on 01772 654 455 or fax 01772 654 466.

Digital Round-up

The BBC has been testing its Digital Text service. Phase 1, offering 15-20 pages that can be called up by pressing 10 on the remote-control handset, started on November 1st. Phase 2 will provide up to 700 pages. The tests are due to be completed in February, after which the service will be given a new name and further services will be added.

A number of new channels have been added to the Astra 2A line-up. S4C Digital, Travel, QVC and Shop! use multiplex 1. Other channels carried in this multiplex include CNN International, The Cartoon Network and TNT. S4C will be included in multiplex 2 from early 1999.

The UK company Video Networks has developed a video-on-demand (VOD) service that uses ADSI (Asymmetric Digital Subscriber Line) technology to deliver digital TV pictures to homes via telephone lines. BT is testing the system in areas covered by the Hendon and West Hamstead exchanges.

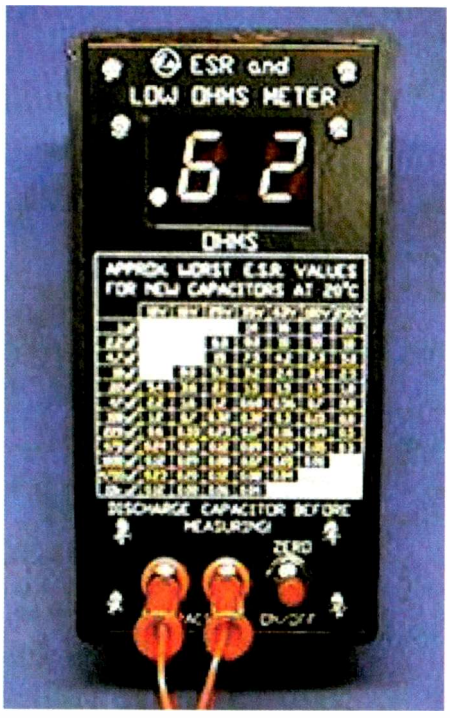
The current generation of SkyDigital STBs do not include a switch-channel timer. As a result, they cannot be used with a VCR to record more than one programme in the absence of the viewer. Thanks to Barry Fox of *ERT* for unearthing this fact. In addition, despite some information that has been released, the current generation of digital satellite and DTT STBs can provide baseband video outputs in only RGB and composite form, not S video. The latter option may be added at a later date – it would call for some chip redesign.

To help viewers, the BBC has been providing a lot of first-rate information on the new digital broadcasting services. Its initiatives include the creation of a website (www.bbc.co.uk/digital); screening a number of films that highlight the advantages of digital technology; establishing a hotline (0990 118 833) to handle requests for brochures and printed information and a Reception Advice Centre (0870 100 123) to deal with digital enquiries; and holding background briefings for journalists.

Pace is to use the NEC μPD61030 "Emma" chip in a number of second-generation digital STBs. The μPD61030 includes all the core elements required, such as demultiplexing and MPEG-2 decoding. It needs only the addition of memory, an appropriate front-end and interfacing components to achieve a full digital TV receiver. Highlights of the design include a MIPS16 processor with 100mips performance and a high-specification graphics generator. According to Pace, use of the chip will significantly improve performance while providing cost advantages over first-generation STBs.

Three UK manufacturers have developed digital radio hi-fi tuners. With five manufacturers having introduced in-car digital radio receivers, the BBC has been working with manufactures to encourage the production of domestic hi-fi units. Two of the tuners, from Arcam and Cymbol, have already been put into production. Meridian expects to start production in early 1999.

Test Report



The Aussie ESR Tester

Andy Barkley compares the two electrolytic capacitor ESR test meters currently available

In the June 1998 issue of *Television* Martin Pickering wrote an in-depth review of the Capacitor Wizard, a device that checks the ESR (Equivalent Series Resistance) of electrolytic capacitors. We've used a Wizard in our workshop for over a year now. Without doubt it's earned its keep, not just for ESR measurement but as a general-purpose low-ohms meter. It beats an ohmmeter hands down when probing a PCB for short-circuits, since one can check the electrolytics at the same time.

The Wizard is not the only ESR meter on the market however. Shortly after buying our Wizard we discovered, via the internet, an instrument designed by Bob Parker. Frustrated by electrolytic capacitor problems, this Australian engineer had designed an instrument himself. Although it's very different from the Wizard in concept and appearance, the end result is the same, i.e. by using either meter it's easy to identify unserviceable, high-ESR electrolytic capacitors, both in-circuit and out.

Building a Genie

Unlike the Wizard, Bob Parker's Australian meter does not have a catchy name. The box it comes in lists the contents as "K-7204 EA 1/96 ESR & Low Ohms Meter", which is quite a mouthful. We call it the Genie in the workshop, and that's the name I'll use in this review.

Once opened, the box reveals another big difference between the Wizard and Genie – the latter comes in kit form! With the exception of a 9V PP3 battery, the kit contains everything you require to build the meter. The construction notes are excellent. We built our Genie in under two hours using a soldering iron, side-cutters and screwdrivers. A variable DC supply is required to set the threshold point for the low-battery indicator accurately. In addition, if you are a stickler for accuracy you need a couple of resistors of known precision to calibrate the instrument, though 1 per cent devices are supplied with the kit.

Crocodile clips and 4mm plugs come with the kit. We use silicone rubber test leads fitted with needle-point probes however. In addition we've fitted four rubber feet to the box.

The Genie fits into a regular ABS hobby-type box that measures 130 x 68 x 40mm – it comes with the kit. The box's lid has been discarded in favour of a customised one. This is sprayed black and has accurately-punched holes for the screws, connectors and display. A table of typical ESRs for a wide range of electrolytic capacitors is silk-screened on the lid. There are two 0·5in. seven-segment displays, a multi-function push-switch and two 4mm sockets for the test probes.

The 'custom' parts – front panel, PCB and software – are all of a very high standard. We particularly liked the milled-edge on the red Perspex display window, so that its surface fits flush with the front panel. The whole thing looks very smart, with a Heathkit-type appearance.

Use

The Genie can be powered by an internal 9V PP3 battery or an external 9V supply. There's no connector for the latter in the kit, nor is the box drilled for a DC connector, but the instructions include details of how to modify the circuit to disable the low-battery indicator when external power is used.

We opted for battery-only operation and, as part of the calibration procedure, used our bench power supply to produce 7V to set the instrument's low-battery indicator threshold.

A single press on the push-button switches the Genie on. 'EA' is displayed momentarily, then a '–' in the left-hand seven-segment display. Short the probes together then push the button again to calibrate the unit for the test leads in use.

ESR measurement is carried out by connecting the test leads to each leg of the capacitor being tested. Its ESR is shown as two digits in the display. Although the Genie and the Wizard use quite different test signals,

correlation between the two instruments is very good. We have never had a capacitor pass with one and fail with the other.

The Works

The two meters use quite different approaches to ESR measurement. With both, an HF signal is applied to the capacitor being tested. So that no semiconductor junction is turned on, the signal amplitude is below 0·6V. The Wizard uses a sinusoidal 5mV RMS test signal, carrying out its ESR measurement by analogue techniques. The test signal used by the Genie appears to consist of bursts of very short-duration pulses. Each pulse has a duration of about 7µsec, the pulses within a burst being about 500µsec apart. Digital techniques are used to perform the measurement.

The heart of the Genie is a Z86E0408 microcontroller chip, which is supplied preprogrammed with the necessary firmware. Short-duration current pulses are applied to the capacitor being tested: the resultant voltage pulses are proportional to the capacitor's ESR. After a set time interval, the pulse amplitude is compared with the voltage developed across an internal capacitor that's charged by a set constant current. Counters and comparators within the microcontroller chip perform the timing and voltage measurement.

Genie or Wizard?

After the test you leave the probes open-circuit: the Genie will switch off automatically after a few minutes. We'd love the Wizard to do this because, although its power consumption is meagre, it has no indication of being on and we've frequently discharged its batteries by forgetting to switch it off at the end of the day. Both units have a low-battery warning. The Wizard uses a single red LED for the low-battery warning. The Genie shows a 'b' in its display.

The Genie measures resistances up to 99Ω, while the Wizard goes up to only 30Ω or so (on a logarithmic moving-coil meter). The Genie's extended range is of little use for ESR testing, since most of the electrolytic capacitors used in TV sets, VCRs etc. should have an ESR below 25Ω, but the ability to measure up to 100Ω accurately is useful when checking PCB tracks for short-circuits, dry-joints and the like. The Wizard bleeps when it measures ESR below about 1Ω – a useful feature when testing a number of capacitors on a PCB, as it means that the engineer can concentrate on the PCB without having to look at the instrument's display.

Although the Wizard has a more professional appearance than the Genie, we feel that in practice the Genie is more robust – mainly because it uses seven-segment LED displays rather than a fragile moving-coil meter. We've managed to drop both instruments. The Genie is unscathed, but the Wizard's meter cover is cracked. One comment Martin Pickering made was that he loves the Wizard's probes. We second this. They are slim, slightly flexible and never tangle – a dream to use.

Based purely on features, there's little to separate the instruments. Both will confidently indicate a high-ESR (i.e. dead) electrolytic capacitor. The Genie has one trump card however – so long as you don't mind self-assembly: while the Genie cost us a total of $71 (Australian), which at the time of writing is equivalent to about £30, the Wizard costs £169 (fully built).

Further Information

Martin Pickering's review of the Wizard appeared in the June 1998 issue of *Television*. It provides a recap on what ESR is. Two articles in the January and April 1993 issues of *Television*, All about Electrolytic Capacitors and A Simple ESR Meter for Electrolytics respectively, provide a detailed analysis of ESR and a simple ESR meter design.

The web site of ICHE, which markets the Capacitor Wizard in the UK, is http://www.iche.com/equip.htm

Bob Parker's web page is http://www.nlc.net.au/~bobp/esrmeter.htm It tells you all about him, the ESR meter, what ESR is, provides tips if you have difficulty building or using the meter, and has information on other useful items he has designed.

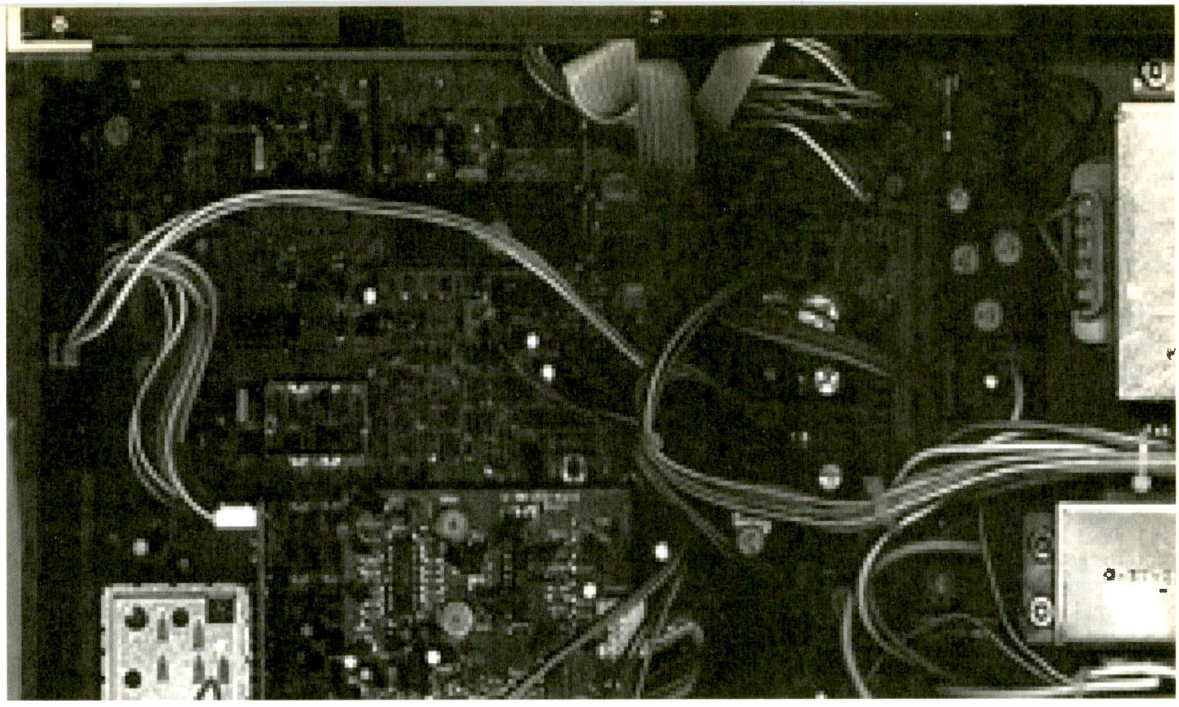
A newsgroup on the internet can be found at sci.electronics.repair Both ESR instruments receive frequent recommendations.

The Capacitor Wizard is available from ICHE, PO Box 142, Nottingham NG9 3RX. Telephone 0115 932 052, fax 0115 944 4004, e-mail tony@iche.com

The Genie ESR meter is available from Dick Smith Electronics. Fax +61 2 9805 0901. Send fax including credit card details, delivery address etc. Alternatively post to John Norris, National Sales Manager, Dick Smith Electronics Pty Ltd., PO Box 321, North Ryde, Sydney, NSW 2113 Australia.

Our company (ndB Electronic Services) bought a Capacitor Wizard by mail order from ICHE and faxed an order for the Aussie ESR meter to Dick Smith. It arrived nine days after the fax was sent.

The Genie is also available from SatCure, PO Box 12, Sandbach CW11 1XA at £49.95 + £2.50 P&P (UK) as a kit or £59.95 + £2.50 P&P (UK) ready built. Orders can be faxed to 01270 761 928. Allow 21 days for delivery.



Satellite Notebook

Reports from
Hugh Cocks
Chris Watton
Ian C. Beckett
and
Pete Gurney, LCGI

A Confused Pace SS9200

The owner of an elderly Pace SS9200 receiver phoned to say that no on-screen menus appeared following the remote control setup and 1 push-button sequence. As a result, retuning for new satellite channels was impossible. He had been away for a couple of months and had left the receiver plugged in during his absence. Not too long before his departure he'd done some tuning.

I suggested that he try setup and 1, 4, 7, the earlier SS9000 sequence, but this didn't produce anything either. Nor would trying to access the setup 2 (2, 5, 8 with the SS9000) installation menu. I ascertained that the front LED blinked when the setup button was pressed, so at least the remote control button wasn't to blame.

At this point I asked him to bring the receiver and the remote control unit to the workshop. When they arrived I found that the situation was exactly as the owner had described on the phone. I could however produce the parental channel lock on-screen indication by pressing the setup and status buttons, and the channel could be locked by entering the 1, 2, 3, 4 pin number. Apart from this however there was a complete absence of on-screen menus.

I tried the global reset procedure: press setup, P - -, 2, 3, store and channel up (up arrow) followed by channel down (down arrow) several times. There was no change. As a final try I did the reset-pin procedure – I held the front panel on/off button in and applied mains power. After several tries the menus appeared in the usual way!

The receiver was kept in a fairly cool spot, and appeared to be in excellent condition for its age. To be on the safe side I replaced the electrolytic capacitors in the power supply, though they were fairly new – the receiver had had a power supply repair about a year previously. **H.C.**

Amstrad VS1140

There was intermittent decoding, and "incorrect card" messages appeared at random. I also noticed that the picture was not quite what it should be, and that there were some odd white lines on the screen (satellite pictures only). A power supply fault was suspected, but the culprit turned out to be CA02 (470µF, 10V) on the decoder/signal board. **C.W.**

Digital Problem

We had an interesting problem recently with a Maspro SA7 system that produced a snowy picture. The symptom cleared when the terrestrial TV aerial was disconnected. Thinking that the receiver was faulty, we took it back to the workshop. Before we could look at it there was a call from another frustrated customer who had the same problem. Later that day yet another customer phoned, to say that there was no playback from his VCR.

All three pieces of equipment had been tuned to provide an output on ch. 34, which is now used for the BBC digital multiplex from the Oxford transmitter. With an ERP of 10kW, the signal is very strong in our area (Buckingham). Modulator retuning cured the problem.

This situation is likely to arise in other parts of the country as well. **I.C.B.**

Amstrad SRD2000

The complaint with this Pro-Logic receiver was no signal. Nowadays I normally make a point of measuring the LNB supply before connecting up. In this case it was at just over 28V, because IC602 (AMS42577) had failed.

This is not an easy device to obtain. Further research established that it's an LM2574NADJ, which is a straightforward switching regulator. It can be obtained from various sources. The one I used came from CPC, the order code being SCLM2574NADJ. After fitting it, RV600 had to be set up for the 17V output level. **P.G.**

Twisted LNB

The owner of a Pace satellite system said that on some channels his pictures were sparkly. On other channels they were fairly reasonable. When we called we found that this was a fair description.

The house had just been repainted and, looking at the LNB, the cause of the problem was obvious: the Continental Microwave LNB had been positioned dead vertical relative to the feed, the most 'natural' looking position to the untrained eye. During the course of the redecorating the painters must have knocked the LNB and reset it in this 'neat' position.

Unfortunately the LNB's skew angle was way out. Here in the Algarve we are quite far to the west of the satellite (the Astra 1 group). As a result there was a fair amount of crosstalk between the vertical and horizontal channels, which was causing sparklies with this analogue system. With a digital system there would almost certainly have been a total lack of pictures!

Some satellite installers still fail to appreciate the importance of setting the correct skew angle. With a wideband satellite meter approximately the same deflection is shown regardless, as the average amount of signal should be similar whatever the LNB's position. One installer here, who now installs digital systems, is very confused by the fact that incorrect LNB skew produces no pictures at all though his 'satellite meter' shows no difference in signal strength. **H.C.**

Twisted Connections

We received an urgent call from a house-management company to attend to a satellite system that wasn't working – it was installed in a holiday apartment.

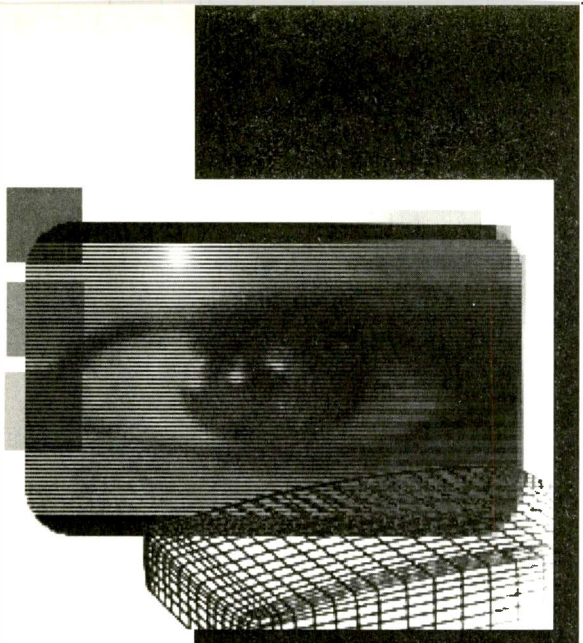
The receiver was connected to an IF distribution system, and a glance at the dish revealed that the system was an old single-polarisation Astra one. Some years ago we could pick up only the vertically-polarised Astra 1A signals here, and as a result a number of single-polarisation distribution systems were installed.

The receiver, which was of far eastern origin, produced a blue on-screen menu, but there were no pictures. When the IF cable was connected there was no increase in noise either. I connected an in-line satellite meter at the receiver end to check that the receiver was producing a supply for the LNB. In fact the receiver was working perfectly, but as soon as the cable to the roof was connected the meter produced a brief high-current reading then the receiver shut down the LNB supply. There was no on-screen warning to this effect – unlike the "LNB short-circuit" display you get with Pace models.

Up on the roof I found that the IF cable from the LNB disappeared into a plastic box from which several other cables emerged. There was no IF splitter inside. The IF feeder cables to two apartments where simply twisted together, along with the input feeder cable. The feeders to two other apartments were disconnected.

The source of the short-circuit was soon established. It was in the feed to the other apartment connected via the 'twisted-pair' arrangement. Thus the whole system was shorted. As the other apartment was unoccupied, I was unable to find the actual cause of the short.

I installed a two-way IF splitter with in-line power-passing diodes. The short in the unoccupied apartment then no longer loaded the system, and the cable could be connected to a receiver once the short-circuit had been fixed. I put a note through the letterbox to tell the owner about the problem – but haven't heard anything to date! **H.C.**



Monitors

Reports from
Chris Hawkins
and
Ian Field

Quadram CM1401/Bull DMU1965

At switch on this monitor produced a sound like a model aircraft engine – but it didn't manage to take off! Checks in the power supply showed that the HT voltage, which is normally 135V, had dropped to about 20V. When the line output transistor and the LOPT's primary winding were unsoldered the HT voltage returned to normal: with the transformer reconnected it took a dive. A replacement transformer put matters right. **C.H.**

Nech H566

This monitor's display consisted of a fine horizontal line at the bottom of the screen. As I didn't have a circuit diagram, some time was spent scrutinising the PCB. Eventually R633, which is connected to guard function pin 3 of the TDA8351 frame output chip U602, was found to be open-circuit. Guessing its value from the remaining halves, I popped a 68Ω, 0·5W resistor in.

At switch on a normal display was produced, but to be on the safe side I replaced U602 and its supply filter capacitor C626 (100µF, 50V) as well. **C.H.**

Tatung TM3401

Although its power supply was making efforts, this monitor kept stalling. A tap on the monitor seemed to instigate the fault. I eventually found that a small ferrite-beaded link in the line output transistor's base drive circuit was dry-jointed. A quick dab with the soldering iron cured the fault. **C.H.**

Elonex SV14LR

Although the power supply was providing incorrect output voltages there would have been something on the screen if the heater voltage had been correct. It was very low at 1·3V, because C823 (470µF, 16V) had given up.

The other odd effects stemmed from the same cause. The optocoupler LED (I802) obtains its anode voltage from the rail smoothed by C823, via R819 (120Ω). All that ripple was confusing I803 (LM431).

If replacing C823 fails to raise the 84V supply close enough to its correct value, check all the other electrolytics on the secondary side of the chopper circuit for bulging or running warm/hot before tweaking the set-HT preset R823. If the heater voltage is outside the range 6·3-6·8V with the 84V supply correct, there is probably still a 'soft' electrolytic somewhere in the power supply. **I.F.**

Digital VRC16HA

The sides of the raster were jagged. It appeared to be an intermittent/dry-joint type of fault, as any movement of the timebase panel varied the severity of the symptom. The cause of the trouble was C220 (10µF, 250V) however. It's in the width modulator (not EHT PWM control) driver bias bootstrap/decoupling circuit. Despite the sensitive nature of the fault, stressing the capacitor mechanically had little effect. But a replacement cured the fault. It might be an idea to add this capacitor to the list of items to be replaced as a matter of routine.

You sometimes get a severe disruption to the line scanning, several times per frame, with these monitors – the horizontal scan can decay to a wiggly vertical line. The cause is usually C35 (100µF, 100V) on the power supply panel. Failure of this capacitor often leads to the following condition: the monitor does not start up initially but, if left, starts up with a severely disrupted scan which gradually clears to normal over the course of about five-ten minutes. If C35 is prodded with a plastic trimming tool the monitor may shut down. **I.F.**

Matters Arising

Last time I mentioned the **Escom EM1448LR** (see page 546, June 1998 issue) I promised to report on the correct value of R448 when one of these monitors came along with this resistor undamaged. I can now do this: the value is 22Ω. R448 is in series with L405 between the TDA4950 EW correction chip and the EW modulator diodes. It's usually destroyed beyond recognition when the 0·68µF, 250V MKT capacitor C417 self-destructs.

With this latest EM1448LR the yellow lead (vertical output) at the scan plug had come adrift from the plug moulding, the result being a blank screen. Before I completed this repair I upgraded the 0·68µF capacitor to 400V. I don't think the original capacitor is being subjected to excessive voltage peaks: it's just that the 400V type is larger, with more surface area to dissipate heat, and thus runs less stressfully.

The **Acorn 4000** was referred to in the November issue (page 61) as a monitor – this was an editing fault. It's in fact the Acorn 32-bit RISC base unit, which is separate from the monitor. It may be helpful to note that if the original power supply is beyond repair a generic PC power supply module can be patched in, using the original Acorn motherboard power connector. Several ultra-slim (not 100 per cent compatible) PCs use power supply modules of a very similar size. There is no reason why such a unit shouldn't be adapted for the purpose. **I.F.**

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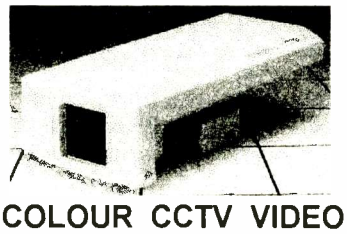

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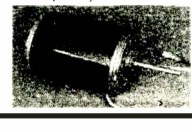

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Launch of Hot Bird 5

Eutelsat concentrates its TV services at the 13°E orbital slot. Hot Bird 5 completes the transponder complement at this location. Peter Brough reports on the launch

At 10.50 p.m. GMT on October 9th Eutelsat's Hot Bird 5 satellite was successfully launched from Cape Cabaveral via an Atlas IIA rocket. It's the fifth and final satellite to be positioned at 13°E, and is equipped with an interesting new technology – Skyplex.

The 13°E Slot

In 1992 Eutelsat decided to co-locate a series of satellites at the 13°E orbital position. The advantage of co-locating satellites is that a fixed receiving dish which points in the relevant direction will be able to pick up a wide range of TV and radio signals, providing a much increased choice of channels.

The first satellite to operate at 13°E was Eutelsat I F1, which was launched in 1983. In 1992 the decision was taken to modify the last satellite in the Eutelsat II series, increasing its EIRPs: renamed Hot Bird 1, it was sent to join II F1 which had replaced I F1 at 13°E. There followed Hot Bird 2 in November 1996, Hot Bird 3 in September 1997, Hot Bird 4 in February 1998 and now Hot Bird 5 which has replaced II F1. There are now 98 Eutelsat transponders available at 13°E, enabling over ninety analogue or up to 900 digital TV channels or any combination of these to be transmitted from this location. The frequency range covers the full spectrum from 10·7-12·75GHz.

At present about 320 TV channels are being transmitted at 13°E, 42 analogue and 273 digital. They include BBC World, Eurosport, Euronews and MTV2.

Although Astra is the dominant satellite TV system in the UK, Hot Bird transmissions have many viewers in France and, in particular, Italy. According to Eutelsat some 70·6 million homes are now receiving Hot Bird services.

Hot Bird 5

Hot Bird 5 is the fourth high-power TV satellite to be built for Eutelsat by the Anglo-French company Matra Marconi Space. It had a launch mass of three tonnes and is equipped with 22 Ku-band transponders. Table 1 summarises Hot Bird 5's characteristics.

The Superbeam and Widebeam powers mentioned in the table refer to the two types of beams Hot Bird 5 can use to cover specific zones. Widebeams can cover the whole of Europe from the Azores in the west to Kazakhstan in the east while the Superbeam is focused on Europe and North Africa. A 50cm dish can be used to receive Hot Bird 5 signals in Central Europe. Moscow requires a 70cm dish, Dubai a 90cm dish and Kazakhstan a 1·2m dish.

Skyplex

Hot Bird 5 is equipped with very interesting technology called Skyplex, which was developed by Eutelsat and the European Space Agency. It enables a series of TV and multimedia data streams to be sent from various locations to Hot Bird 5 which can bundle them to provide a single DVB-compliant (Digital Video Broadcasting) multiplex for downlinking to dishes that feed TV receivers, set-top boxes or PCs. Skyplex was first tested with Hot Bird 4, and was demonstrated at the International Broadcasting Convention at Amsterdam last autumn.

Hot Bird 5 carries three Skyplex units, two of which are for back-up. The units can receive up to eight uplink carriers with bit rates of 2 or 6Mbits/sec. These are demodulated then multiplexed into a single stream and format for DVB transmission. The downlink data rate is 27·5Mbits/sec for broadcasting use, though slightly higher rates can be used for other applications such as tele-medicine.

Eutelsat says that Skyplex can be used for a number of purposes including regional and local programming, outside broadcasts, business TV, satellite radio and as an internet gateway. It should be attractive to smaller broadcasting organisations whose channels are carried in the multiplex of a major broadcaster. Instead of using microwave or fibre-optic links to send programming to a ground-based multiplexer, signals can be uplinked directly to the satellite.

The Launch

The remnants of Hurricane George, which swept through the Florida coast, delayed the launch of Hot Bird 5. A small technical problem added to the delay. The total delay was two days.

The launch was from Complex 36B at Cape Canaveral, using an Atlas IIA rocket which has a diameter of 3m and a length of almost 27m. Its Rocketdyne MA-5A boosters provided a thrust of 490,000lb. The plan was to take Hot Bird 5 to an altitude of 80 nautical miles then, after two engine burns separated by a fifteen-minute coast, place it in geosynchronous orbit. Separation from the rocket took place approximately 28 minutes after the launch, which was managed by International Launch Services.

Table 1: Hot Bird 5 data.

Orbital position	13°E
Dimensions	2·8m high, 1·7m long, 2·5m wide
Solar array span	27·9m
Design lifetime	14 years
DC power, end of life	5·5kW
Payload power	4·9kW
No. of transponders	22
Band coverage	10·95-11·22, 11·53-11·7 and 12·5-12·61GHz
Bandwidths	Eight 36MHz, twelve 33MHz and two 72MHz transponders
EIRPs	Superbeam 53dBW, Widebeam 50dBW, at beam centre

The launch timetable was as follows: T135 launch tower roll back; T105 30-minute hold; T91 cryogenic tanking begins; T14 final weather briefing; T5 another 15-minute hold; T5 resumption of countdown to lift-off.

A pre-flight briefing was held on the morning before the planned launch. While there appeared to be no problems with the satellite or the launch vehicle, the weather didn't look too good. In fact the lift-off chance was said to be 40 per cent. The forecast for the following day was even worse. During the day the weather went from hot, sunny skies to dark cloud with heavy showers.

The launch window when Hot Bird 5 could be lifted off was around 70 minutes. The storms were a particular concern, since launch regulations state that there must be a delay of at least 30 minutes should there be lightning – after a storm the atmosphere is highly charged, which can damage the on-board electronics.

The launch was full of tension, with the countdown stopped on two occasions. Eventually, with just seven minutes of the launch window left, the rocket blasted off.

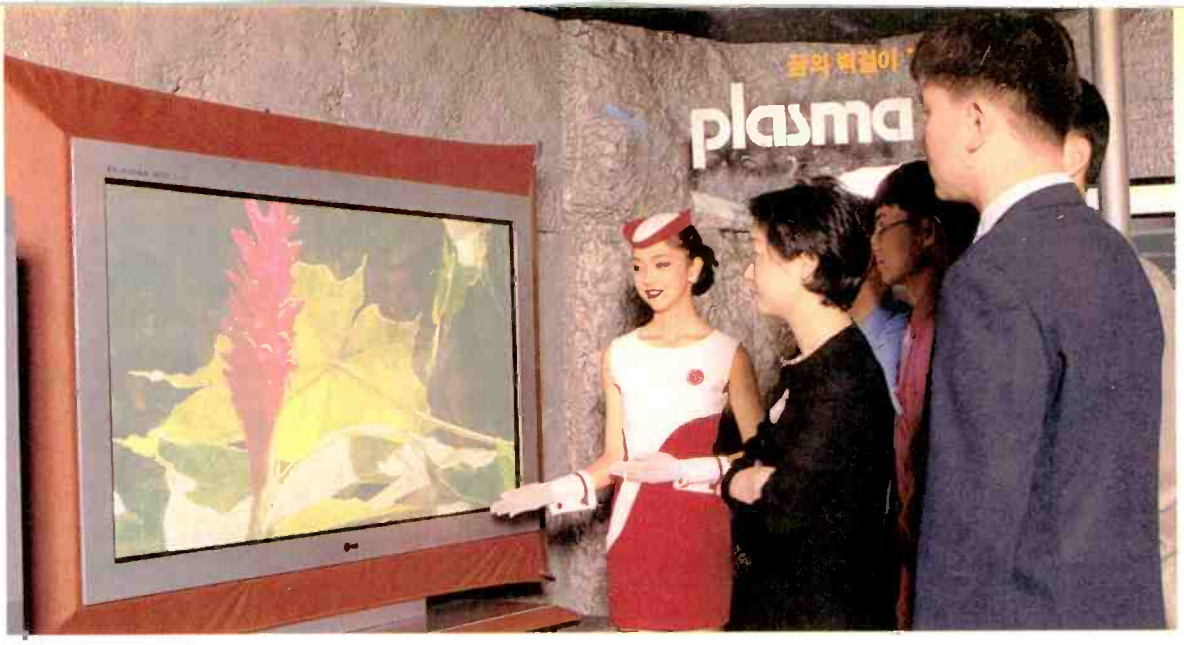
Operation

Hot Bird 5 was brought into operation after several weeks of testing. Eutelsat II F1 was then moved to 36°E, the transfer of channels from II F1 to Hot Bird 5 taking place on the night of November 9/10th. Several channels, including BBC World, Euronews, MBC and Viava, were affected by the change and now broadcast on different frequencies.

The Future

Now that the Hot Bird slot is full, what next? Eutelsat plans to launch its Europsat craft next year (2000) but its intended location, 29°E, is controversial to say the least. SES is operating Astra 2A at 28·2°E and plans to position Astra 2B there. Eutelsat says it had booked 29°E for Europsat years ago, but SES argues that the booking lapsed because the position was not used in time. In early 1998 Eutelsat tested Hot Bird 4 at 29°E before moving it to 13°E.

An International Telecomunications Union radio regulatory board has ruled in favour of SES, but an appeal has been made. Eutelsat would like to share the 28/29°E slot with SES. At the moment however there seems little chance of an agreement between the two organisations being reached.



George Cole has been in Korea recently to survey the electronics scene there. Whilst in Korea he paid visits to leading manufacturer LG and to the KES

LG and the Korean Electronics Show

The Korean company LG has come a long way since its launch in 1958. In those days it had some 300 employees. Today over 33,800 people work for the company in Korea and its 56 overseas branches. Last year the company changed its brand name and logo from GoldStar to LG. The company has ambitious plans to become one of the world's leading multimedia companies by the year 2005. I recently had the opportunity to see some of the technologies it is investing in for the future.

The first thing you notice when you fly into Korea is the company's huge presence – there are LG petrol stations, lifts and cloths. LG's headquarters are at massive twin-tower buildings in what has come to be known as the "Manhattan of Seoul", a district where many major companies and banks are located.

LG's president and chief executive officer John Koo has announced a plan known as "Leap 2005". The aim

The Korean Electronics Show

The latest Korean Electronics Show (KES) was held at Seoul's Convention and Exhibition Centre (Conex) from last October 21st. The five-day show, for both trade and public, naturally featured major Korean companies. But overseas companies, including Philips and Sharp, were also present.

Displays, TVs and Home Cinema

Projection TV sets and large, flat-screen displays were all the rage at KES. Philips showed a 54in. CRT projection set. The massive receiver had a 160° viewing angle and attracted a lot of attention. LG's large stand featured lots of flat-screen TV sets and monitors, including 17-29in. flat TVs and the 64W, a high-definition projection model.

Samsung showed a 30in. TFT LCD which is claimed to be the world's largest made from a single panel of glass – most large LCDs are made from two or more glass panels that are welded together. The company also showed a 42in. VGA colour plasma display with 852 x 480 x RGB pixels, a pixel pitch of 1·08mm, contrast ratio of 40:1 and 350W power consumption. The display is just 3·5in. deep and weighs 35kg.

Daewoo showed many interesting products on its massive stand, including a mighty 48in. digital rear projector and a 32in. plasma display panel. There were many CRT-based products. Amongst these were a 32in. flat tube set and an HDTV receiver with a Dolby AC-3 decoder and a PC connection. An

Daewoo's multimedia TV set.

is to achieve annual sales of over £46 billion. This is quite a target, especially when you consider that LG's sales reached £6bn in 1997 and the Far East is suffering from a massive economic slump. The company's believes that it is on track to achieve its aims however, and has decided to focus on four major markets. These are: multimedia, including VCRs, camcorders, CD-ROM drives and video tape; displays, which takes in colour tubes, TV sets and monitors; LCDs; and what are referred to as "living systems" such as refrigerators and microwave ovens. The company spends about five per cent of its revenue on research and development.

Displays

LG has passed the 100-million mark in CRT production. It believes that the TV sets and monitors of the future will use several display technologies. Sang-Han Yoon, director of LG's main TV plant at Kumi, thinks that LCD technology will be mainly used for displays less than 20in., with CRTs continuing to be used in the 21-37in. sector. Larger displays will use plasma technology. LG is not working on the Plasma Addressed LCD (PALC) technology advocated by Sharp, Sony and Philips.

During a visit to the TV division's production line I met Kwang-Cheol Joo, a research engineer who helped develop LG's integrated digital TVs. LG is working with Pace to produce integrated digital satellite and digital terrestrial sets. Mr Joo said that the DTT integrated set would have a slot at the rear of the chassis for a digital satellite converter module (dubbed a "side car").

LG's television demonstration room contains many items, from an old black-and-white set complete with valves made in 1966 to a prototype 120in. HDTV projector with 1,000-line scanning – and very nice it looked too.

LG is promoting its Digital Eye range of TV sets in Korea. They adjust the picture brightness to the current viewing conditions automatically. Some of the larger

LG's plasma display.

sets in this range have a motorised plinth that moves the set up to 15° in either direction, a feature that will no doubt be welcomed by couch potatoes. One set has a twin tuner and provides multiple picture-in-picture displays. Up to thirteen pictures can be displayed on the screen at the same time. Almost any combination of pictures seems to be possible – for example you can have a strip of seven pictures that run down the left-hand side and across the bottom of the screen with a larger picture filling the rest of it.

LG demonstrated a smart-looking touch-screen control system for adjusting the volume and picture settings – it reminded me of the control panels you find with some microwave ovens. A 24in. Wide Flatron flat-CRT set produced an excellent-quality picture. There were plenty of projection TV sets, with screen sizes ranging from 28 to 40in. LG plans to launch a 50in. model later in 1999. Widescreen TV is becoming popular in Korea, and now accounts for 55 per cent of the market.

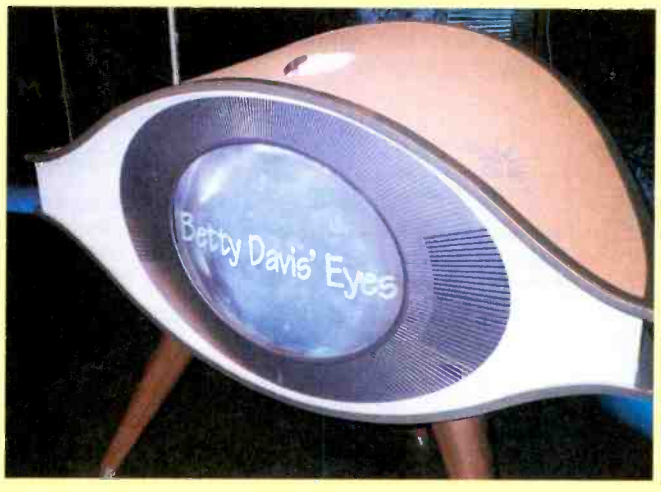
We were shown a 28in. internet TV set with a built-in web browser and modem, and a 32in. multimedia set

interactive multimedia TV model (see photo) offers viewers a shopping mall, games, e-mail and a video-on-demand facility.

An intriguing display at the Daewoo stand presented a number of unusual-looking sets. They were part of the Image 98 Proposed Design campaign. There were round and diamond-shaped screens. The one that got my vote was "Betty Davis's Eyes", with a screen the shape of a human eye.

3S Technology presented its Around Sound system, though the background noise at the show made it difficult to assess this properly. Around Sound is similar to technologies such as JVC's 3D Phonic, Virtual Dolby and systems from Hitachi, Sanyo, Panasonic and others that aim to provide multi-channel sound from a single pair of speakers.

Around Sound provides five-speaker sound by adding three phantom-sound sources – centre, rear left and rear right. The company says that its system is comparable with Dolby AC-3, THX and DTS, but I suspect that this is a bit of an exaggeration. It uses an AV-200CAP encoder that sits between the



Novel TV designs were on display at the Daewoo stand. This one is was called "Betty Davis's Eyes".

AV source, such as a VCR, and the TV set, or between a stereo TV set and an AV amplifier. The technology is interesting: 3S says it's even possible to put text in the audio data stream for display at the bottom of a TV screen.

VCRs and DVDs

Philips and Samsung both had DVD players on their stands. Philips also showed the CDR870 CD-Recorder. Daewoo's VCRs included the Fiance range, which have VHS decks with orange and silver, and purple and silver panels. Daewoo plans to launch Models DVT40 and DVT58 next year: these VCRs will include a colour noise reduction system and diamond head drums, which are claimed to last twice as long as standard drums.

A 32X CD-ROM drive developed by LG.

with a built-in. 33.6K modem and a keyboard for sending e-mail messages.

Fifteen inch LCD displays mingled with 17in. plasma ones: LG promises a 21in. version later in 1991 and is developing a 29in. version.

LG has developed a 50in. plasma display panel designed for HDTV pictures. It uses a selective erase technique that's claimed to cut the number of drive ICs required by half and the manufacturing cost by about thirty per cent. LG says that the technique provides high-resolution performance without the polarised division of data. A multi-functional IC enables the panel to handle NTSC and computer images simultaneously. The panel can be connected to an audio or video source, such as a DVD player, directly. The contrast ratio is said to be 100:1, with 256 grey-scale definition and 16·7m colours. Size is 1,254mm wide, 755mm high and 85mm deep, the weight being 39kg. Mass-production is expected to start in 2001, with monthly output reaching 10,000 units.

Video

LG produces some four million VCRs annually. There are about 4,000 people in the VCR division, a quarter of them in R and D. Most of the VCRs are VHS models, but LG is looking at D-VHS.

LG says that sales of DVD players in Korea have been disappointing. Production of the players has now ceased.

The company is one of the largest CD-ROM drive manufacturers in the world, and is developing 32x and 40x high-speed drives. Drives that offer a 48x speed are seen as being the next step – NEC is rumoured to be making a 60x version. According to LG the biggest problem in developing higher-speed CD-ROM drives is noise-level reduction.

LG makes Divx (Digital Video Express) players for the US company Circuit City. Divx is a sub-format of DVD with special discs. A Divx disc costs a few dollars to buy and is designed to be used like a rental video tape: the disc can be played for about 48 hours, after which the data becomes scrambled and can be read again only after paying an additional fee. Divx has been available for some time in the USA: there is at present no sign of it reaching the UK. LG has been developing a second-generation Divx player.

The Future

LG has a number of products on the drawing board, including HDTV sets that should be ready by next year. These could be followed, in 2005, by 30in. LCDs, 55in. PDP (plasma) panels, 3DTV and video-on-demand provision for cable TV. There is plenty of new and better video technology to look forward to during the early part of the new millennium.

Acknowledgement

My thanks to the staff at LG Korea and LG UK for their help when researching this feature.

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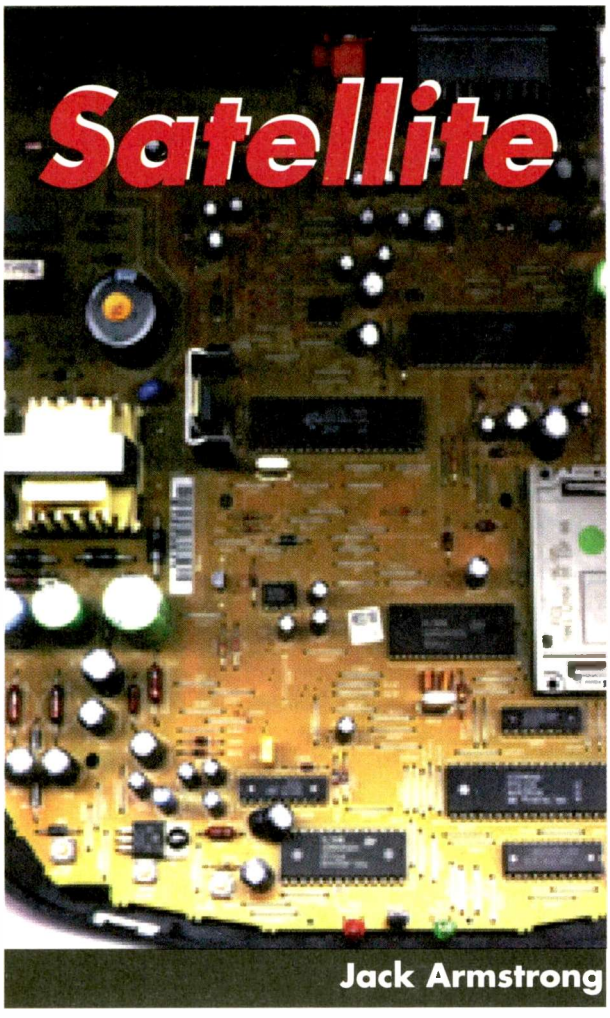


Workshop

Jack Armstrong

Amstrad SRD510

Used analogue receivers have been selling well since digital satellite TV took off in the UK. This is partly because SkyDigital doesn't provide Eurosport, CNN, The Cartoon Channel and those naughty German channels, also because a lot of fairly modern, used analogue receivers have appeared on the market at rock-bottom prices. I took advantage of an offer and bought several ex-rental Amstrad SRD510 receivers. A couple of them had been butchered, but most were repairable.

One had a blank screen with good audio. I traced the cause of this fault to R5, a 12kΩ resistor in the voltage divider chain that produces a 2V reference supply for IC1 in the energy-dispersal clamp circuit. As usual, the resistor was covered with black, corrosive glue and had gone open-circuit. This type of fault is quite common. So, before even switching on the multimeter, I look for resistors covered with glue.

The same symptom can be caused by dead electrolytic capacitors or a faulty C-band switch. This switch is provided to invert the video signal, but sits unused for the life of the receiver. Result? – one cheap switch with oxidised contacts.

Pace Apollo

David Snell of Sky-View in Hereford sent me the following information on a faulty Pace Apollo receiver. The symptoms were small portions of the picture 'tearing' sideways and poor contrast unless it was set to 7 or 8 in the installation menu.

The remedy is to replace C216 (100µF), which is next to the graphics chip. David says that the severity of the symptoms decreased as the receiver warmed up.

This capacitor (and many others) is included in Relkit 9 from SatCure (01270 753 311). The same problem could arise with the **Pace MSS200 and MSS300**.

Grundig GSR1 Mk 2

This receiver is a cheaper version of the Grundig GRD150. It has a PCB that's different from the one in the Omni chassis used in the Minerva and Matsui variants. Last week the first one I've seen came along. I'm still puzzled by the fault.

Both red and green LEDs lit permanently, and the only response to button presses was a slight dimming of the LEDs. When I removed the cover I saw that all the large electrolytics were bulging. As this suggested that the power supply's output voltages had all gone high, I replaced every faulty capacitor then applied power while monitoring the 5V output. It was perfect, but the symptoms remained the same.

I put the lid back on quickly, in case I was tempted to spend more time on the receiver. The customer had set a £35 limit on the cost, so now was the time to give up!

It seems to me that some of the ICs had been damaged by the excess voltages. If anyone has come across this problem with a Grundig receiver, I'd be interested to know the cause. There was no obvious fault on the primary side of the circuit, so why had the output voltages risen so high that the electrolytics had been damaged? I suspect foul play!

BT SVS260

This one worried me because the hairdryer didn't bring back even a flicker of a "please insert card . . ." message. I spent nearly an hour fitting the Relkit 17 components, but there were still no messages. Everything was OK once I'd replaced the glue-encrusted 28MHz crystal.

After scraping away all traces of glue from the main board and screwing everything back together I found that the front panel didn't light up, though the LED on the decoder board did. On a hunch, I replaced the 4MHz crystal. This brought the box back to life, but the following day the long-suffering owner returned with the complaint that it was once more dead.

Sure enough the front panel display didn't light up. I checked the new crystal, which wasn't oscillating. Then I noticed still more glue between the pins of the microcontroller chip. A quick scrape with a pin got the receiver up and running again. The owner trudged away, muttering to himself – he didn't seem at all grateful.

Notes on the Amstrad SRD510

The Amstrad SRD510 and later models such as the SRD540/545/550 suffer from a common problem: the plug that connects the outputs from the power supply to the main board is unreliable. As a result you get intermittent faults that can cause the LEDs to flash, or the remote control handset to be ignored, or a squealing noise from the power supply. There's a simple way of proving that the connector is at fault: watch the decoder messages move about on the screen when you tap the receiver.

A temporary fix is to spray the white power supply connector with WD40 (disconnect the mains supply first!) then move it up and down several times. The workshop cure is to solder a short wire between the little metal box on the power supply board and the test pin

labelled "0V" on the card reader board. After this it's essential to adjust the 5V supply by turning RV600 anticlockwise. Connect a voltmeter between the tuner's earth braid and the power supply connector, third pin from the front. Adjust RV600 for a reading of 4·95V. Take care – high voltages are present on the primary side of the power supply.

Another problem is that the audio disappears when the user selects MAC instead of PAL in the menu. This is a global setting that affects all channels. Simply reselect PAL and press exit. You might need to press standby twice before the sound will return.

If you need to connect a D2-MAC decoder to the SRD510, you will have to modify a standard scart-to-scart lead. Label one plug cover "receiver end" then remove it. Pull out connector number 12 and discard it. Pull out connector number 19 and push it back into position 12. The video output from the scart lead is now MAC de-emphasised, and can be used with most D2-MAC decoders – pin 10 provides a 'flat' baseband output. Select MAC in the D2-MAC decoder's set-up menu – do not select MAC in the SRD510's menu.

An SRD510 can be modified to operate a Global ADX Plus automatically. Locate the big microcontroller chip inside the receiver, at the centre of the main PCB. Connect pins 4 and 20 together, counting anticlockwise from the notch – solder fine, insulated wire between them.

The menu will now include an option for "dish A/B", as in the SRD520. Plug the ADX Plus connector on to pin 14 of the SRD510's decoder scart socket. If the socket is being used by a decoder, you will have to remove pin 14 inside the scart plug and push the ADX connector into that position. You can then, by selecting and storing dish A or dish B in each channel menu, set the ADX to work as each channel is selected. An added bonus is that the SIS button also now works.

Pace MSS100

Last time this girl brought me her Pace MSS100 receiver the power supply was tripping. It didn't take long to trace the cause to one of the rectifier diodes on the secondary side of the chopper transformer. Once D11 (UF5402) had been replaced everything was OK. This time there were no decoder messages and no transparent menus (the ones without a blue background).

Suspecting a sync problem, I replaced the PTV111 chip. This was a lucky guess, curing the fault. It's interesting that I've never had failure of this chip with a BT SVS250 type receiver, despite the fact that a heatsink radiates heat down on to it!

I understand that a dud 503kHz resonator will produce identical symptoms.

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

jack@netcentral.co.uk

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

Test Case 433

Why is the workshop always so busy during the run-up to Christmas? TV and VCR reliability does not vary with the season, and people probably don't use their equipment more at this time of the year. It could be that customers put up with faults that don't actually prevent their equipment working, then bring it to us in fear that it might break down completely during the holiday. Or may be they dig out TV sets and VCRs which have been set aside unused and find that they don't work. Whatever the reason, we always get a lot of repairs to do in December. If only this volume would continue throughout the year!

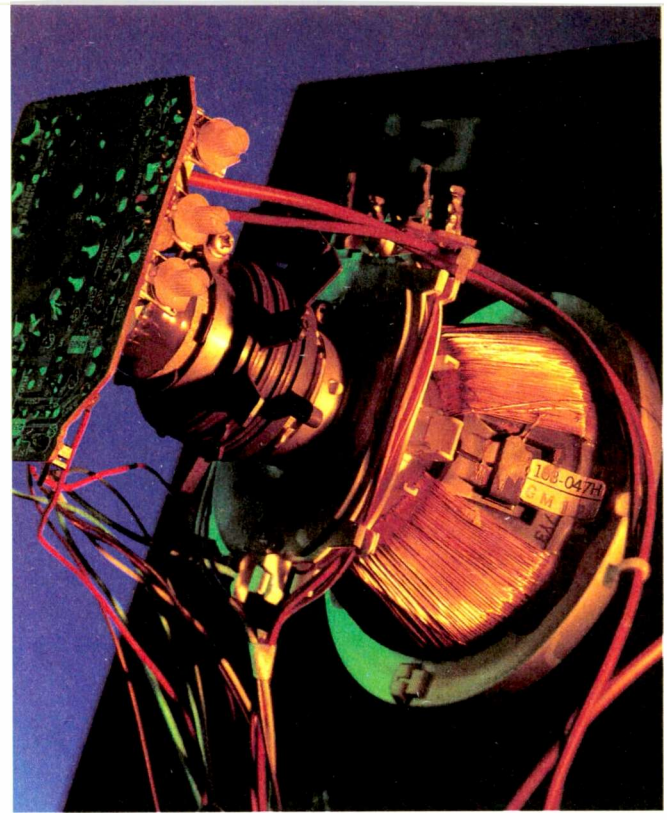
At times like this it's more irritating than usual to find that the fault symptom written on the job card bears no relation to what the machine actually does. In this case it said "poor picture and sound, wow on sound" on the job card. When the machine, an Hitachi VTF250E VCR, was plugged into the mains supply it didn't show the slightest sign of life – even though the fuse in the mains plug and the 1·6A one inside the VCR were both intact. In fact this first fault was one that the customer would not have been aware of: it's not uncommon with certain sorts of switch-mode power supply, and Resident Workshop Sage soon sorted it out. What in fact was the problem, and how was it solved? That's your starter for ten, to borrow a television phrase!

Having managed to power the machine, Sage inserted a cassette and asked the machine to play it. The picture was marred by waves of noise and mistracking, which were accompanied by violent sound pitch changes. Clearly the capstan speed was wildly wrong, and varying. At this point Sage was called to reception to advise yet another customer on how to use his new purchase: the questions could all have been resolved by simply reading the instruction book, but there you are! An advisory service is an important part of our sales operation, and gives us an edge over the box-shifters.

When Sage returned to the bench the Hitachi VCR was running normally, maybe because it had by now warmed up. But within a few minutes the capstan slowed, faltered and almost stopped. Then its speed returned to about normal. Isn't this the sort of problem you just love to get when you are busy and the customer wants his equipment back quickly?

Sage removed the machine's bottom cover and laid a fingertip on the capstan flywheel: only light pressure was required to stop the motor, after which it could be felt to 'flutter' somewhat. Well, capstan motor failure is not exactly unknown with Hitachi VCRs, so Sage ordered a replacement and thought no more about the matter – until the new one arrived. Fitting it presents no difficulties and, provided you don't forget to connect it up and refit the reel drive belt, the machine then generally works.

Not this time! Its performance was the same as before – with very weak capstan drive, speed variations and intermittent operation. Plainly the motor that now sat on the bench had not been the culprit, and the diagnosis had been too hasty. It didn't take long to find the real cause of the trouble however. What was it? For the solution, turn to page 217.



TV and PC monitor specifications differ considerably. We know all about the former: Ray Porter, M.Sc., C.Eng., M.I.E.E. provides some basic information on the latter

A look at monitor specifications

The first personal computers used monitors to display text only. As their programs offered mathematical manipulation or word processing, it was not necessary to be able to resolve fine detail or colours.

Display Standards

Greater sophistication in application programs soon followed. As a result, 'graphics' displays were required, enabling picture-like elements to be displayed. It was necessary to be able to program the co-ordinates and the colour of the displayed spot easily and show finer detail, i.e. more pixels were required.

These higher demands were met by enhancing the display memory and driver system in the computer, with corresponding enhancement of monitor performance. Earlier display system standards were based on the Colour Graphics Adaptor (CGA) and Enhanced Graphics Adaptor (EGA) specifications. To be usable, current PC software requires the use of a Video Graphics Adaptor (VGA) or Super VGA (SVGA) monitor drive system in the computer. The VGA format was introduced in 1986 as the first 'higher-resolution' specification.

Display systems have been continually improved. Besides the well-known IBM standards mentioned above, the Video Electronics Standards Association (VESA) has devised others.

Table 1 shows the resolution, in terms of the number of horizontal x vertical pixels, of the most commonly used monitor display standards – and, for comparison, the very high-resolution Sun standard. Resolution is determined by four factors: the scanning system (number of lines, and whether interlaced or progressive), the video bandwidth, the screen dot pitch and the refresh rate of the display memory in the computer.

Table 1: Resolution of standard monitor displays.

Standard	*Pixels (horizontal x vertical)*
CGA	640 x 200
EGA	640 x 350
VGA	640 x 350, 640 x 400, 640 x 480, 720 x 400
SVGA	800 x 600
VESA	640 x 350, 640 x 400, 640 x 480, 720 x 400, 800 x 600, 1,024 x 768
Mac II	840 x 480
8514A	1,024 x 768
Sun	1,600 x 1,280

Monitor Specifications

A typical multi-standard analogue colour monitor specification is shown in Table 2. An important feature is power saving, which is not found in TV receivers. Power saving is usually controlled by the associated computer, which may or may not have power-saving software installed. The idea is to stop EHT generation when the sync pulses cease to arrive.

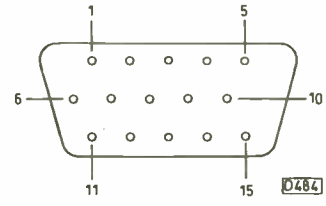


Fig. 1: Pin connections for the 15-pin mini D-type monitor plug.

1	Red video signal	8	Blue earth
2	Green video signal	9	NC
		10	Digital earth
3	Blue video signal	11	Jumper to pin 10
4	Jumper to pin 11	12	NC
5	Self-test	13	Line sync
6	Red earth	14	Frame sync
7	Green earth	15	NC

Table 3 provides basic details of the Display Power Management System (DPMS) developed by VESA.

Table 2: Typical multi-standard analogue colour monitor specification.

CRT: 14in. semi-tint, non-glare screen; deflection angle 90°; dot pitch 0·28mm.

Video input: Analogue RGB direct drives, positive-going at 0-0·7V ±0·05V. Input impedance 75Ω.

Sync input: Separate line and frame at TTL level.

Scanning: Line 31·5, 35·5, 38 and 48kHz; frame 50-90Hz.

Display area: 245mm (H) x 183mm (V) recommended. Adjustable.

Resolution: 640 x 350, 640 x 480, 720 x 400, 800 x 600, 1,024 x 768 pixels (H x V).

Misconvergence: 0·3mm at centre, 0·4mm at corners.

Consumption: 70W maximum with standard tube, 76W maximum with low-radiation tube.

An alternative system monitors the presence of the blue video input.

Connection to the monitor is usually via a flying lead with good HF performance. The connections for the standard 15-pin mini D-type plug are shown in Fig. 1.

Common Formats

Table 4, with Fig. 2, lists line and frame frequencies and sync pulse specifications for the more common display standards.

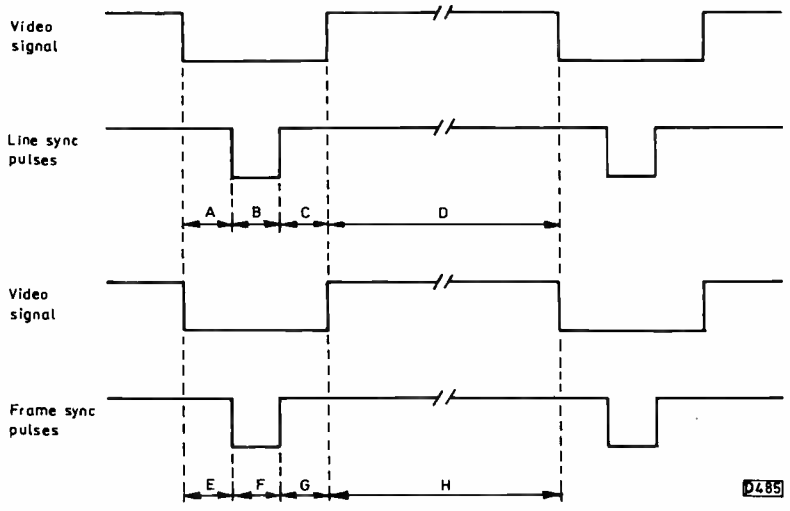


Fig. 2: Line/frame sync pulse specifications – see Table 4.

Table 3: DPMS specification.

Mode	*Line sync*	*Frame sync*	*Consumption*	*Recovery time*
On	Normal	Normal	Normal	–
Standby	No pulses	Normal	<15W	<3sec
Suspend	Normal	No pulses	<15W	<3sec
Off	No pulses	No pulses	<15W	<3sec

Notes: (1) When the sync is normal or the computer is switched on, the monitor automatically switches to the on mode.

(2) No line sync pulse is defined as <10Hz with <25% duty cycle. Normal pulse rate for line sync is defined as >10kHz with <25% duty cycle.

(3) No frame sync is defined as <10Hz with <25% duty cycle. Normal pulse rate for frame sync is defined as >20Hz with <25% duty cycle.

(4) The power saving function must work with PCs that have power saver software. The monitor automatically goes to off when the PC is turned off.

Table 4: Sync and timing details for common display standards.

Standard	*VGA*	*VGA*	*VGA*	*SVGAI*	*SVGAII*	*VESA*	*VESA*	*VESA*	*VESA*	*8514A*
No. of lines	350	400	480	600	600	350	400	480	600	768
Line frequency kHz	31·4	31·3	31·4	35·1	37·8	37·8	37·8	37·8	48	35·5
Line sync front porch, A µs	0·6	0·7	0·6	0·6	1	0·22	0·22	0·22	1·1	0·1
Line sync width, B µs	3·8	3·8	3·8	2	3·2	1·2	1·2	1·2	2·4	3·9
Line sync back porch C µs	1·9	1·9	1·9	3·5	2·2	4·6	4·5	4·6	1·2	1·2
Active line period D µs	25·4	25·4	25·4	22·2	20	20·3	20·3	20·3	16	22·8
Frame frequency Hz	70	70	59·9	56·2	60	84·1	84·1	72·8	71·9	86·9
Frame sync front porch, E ms	1·1	0·3	0·3	0·02	0·03	0·9	0·2	0·2	0·49	0·01
Frame sync width, F ms	0·06	0·06	0·06	0·05	0·1	0·07	0·07	0·07	0·12	0·11
Frame sync back porch, G ms	1·9	1·1	1	0·6	0·6	1·6	1	0·7	0·7	0·5
Active frame period, H ms	11·1	12·7	15·2	17	15·8	9·2	10·5	12·6	12·4	10·8
Sync polarity (L/F)	+/–	–/+	–/–	free	free	+/–	–/+	–/–	free	free
Dot frequency (MHz)	25·1	28·3	25·1	36	40	31·5	35·4	31·5	50	44·9

Servicing

The Mitsubishi EE4 chassis

The EE4 chassis is used in sets that have 'M5' in their Model number, e.g. CT21M5B. There are several pitfalls for those not familiar with the operation of the chassis. Russ Phillips provides a guide to its technical features and fault diagnosis

The EE4 chassis is fitted in Mitsubishi M5 series TV sets, e.g. Models CT21M5B and CT21 M5BT. It's very similar to the EE3 chassis used in AV1 series TV sets. An EEPROM is used to store various parameter values, including the tube drive and deflection adjustments. The service mode also has to be entered when you want to vary the tube's first anode voltage. This can make life interesting when the necessary information is not available.

The Power Supply

The chopper power supply is based on the TEA2261 control chip IC901, see Fig. 1. When power is applied, the mains input is rectified by D901-4 which charge the reservoir capacitor C904. A DC supply of about 320V is thus generated for the S2000N chopper transistor Q901, fed via pins 8 and 5 of the transformer (T901). R922, R901 and R902 provide a start-up supply of 6-7V for pins 15 and 16 of IC901, via R915 and R923 respectively.

IC901's internal oscillator runs at about 12kHz initially, determined by C911 and R912. Pulses at the same frequency emerge at pin 14 to drive the base of Q901. The mark-space ratio of the waveform at pin 14 is very low to start with. It increases as C910 charges. As a result the power supply has a slow-start effect, since the output voltages are proportional to the mark-space ratio of the waveform at pin 14. Once the power supply is running, D905 rectifies the waveform at pin 1 of T901, charging C905 to 12V. This voltage takes over the supply to pins 15 and 16 of IC901.

The waveform at pin 17 of T901 is rectified by D951 which charges C952 to provide the HT supply (B+) for the line output stage, with smoothing by L951 and C953. The HT voltage is 122/145V depending on tube size. Pin 11 of the transformer feeds rectifier D953 which charges C960 to provide the 24V supply for the audio amplifier. D952, which takes its feed from pin 15 of T901, charges C955 to 11-12V. This is fed to pin 1 of the TDA8137 5V regulator IC951, which provides a constant output at pin 7 and, at pin 6, an output which is switched on/off by the voltage at pin 3 (from the microcontroller chip IC701) to give on/standby control.

The 11-12V supply is also fed to the error amplifier circuit which is based on transistor Q951, with feedback to IC901 via the optocoupler PC951. When the phototransistor in PC951 is switched on by the internal LED, it switches Q902 on via R914. R913 is then connected in parallel with R912 and the frequency of the oscillator in IC901 rises to about 30kHz. The power supply then reaches its full output.

R916/7/8 and L901 are incorporated to limit Q901's switch-on current. D907 and C914 enable Q901 to be switched on and off at the rapid rate required with a switch-mode power supply. Failure of C914 or D907 can destroy Q901 and may also kill the line output transistor Q552.

D906, L905, C917 and R921 form a snubber network to prevent damage to Q901 by the large back-EMF generated when it switches off.

Note that C905 can remain charged when the set is disconnected from the mains supply. It's charged to only a low voltage and doesn't constitute a safety hazard, but you may get misleading readings if C905 isn't discharged before meter tests are carried out on the primary side of the power supply.

Regulation

The power supply's output voltages are determined by the voltage at pin 6 of IC901. This voltage is controlled by Q951 via PC951 and R906. If the voltage at pin 6 rises, the mark-space ratio of the waveform at pin 14 is reduced and the output voltages fall. The opposite happens when the voltage at pin 6 falls. Q951 monitors the HT supply via its base bias network, which consists of R954, VR951 (DC set) and R955. The emitter of Q951 is held at a constant 6·2V by zener diode D955. Should the HT voltage rise, Q951's conduction increases, the bias on the phototransistor in PC951 is increased, and the voltage across its emitter load resistor R904 and thus at pin 6 of IC901 rises. The HT output is then reduced as described above.

Overvoltage Protection

If the HT voltage rises to an unacceptably high level – this can happen if, for example, the line oscillator stops – the voltage at pin 6 of IC901 will rise above the normal range. When this occurs, IC901 shuts off the output to Q901 until the voltage at pin 6 falls to an acceptable level. Because of the high values of the reservoir

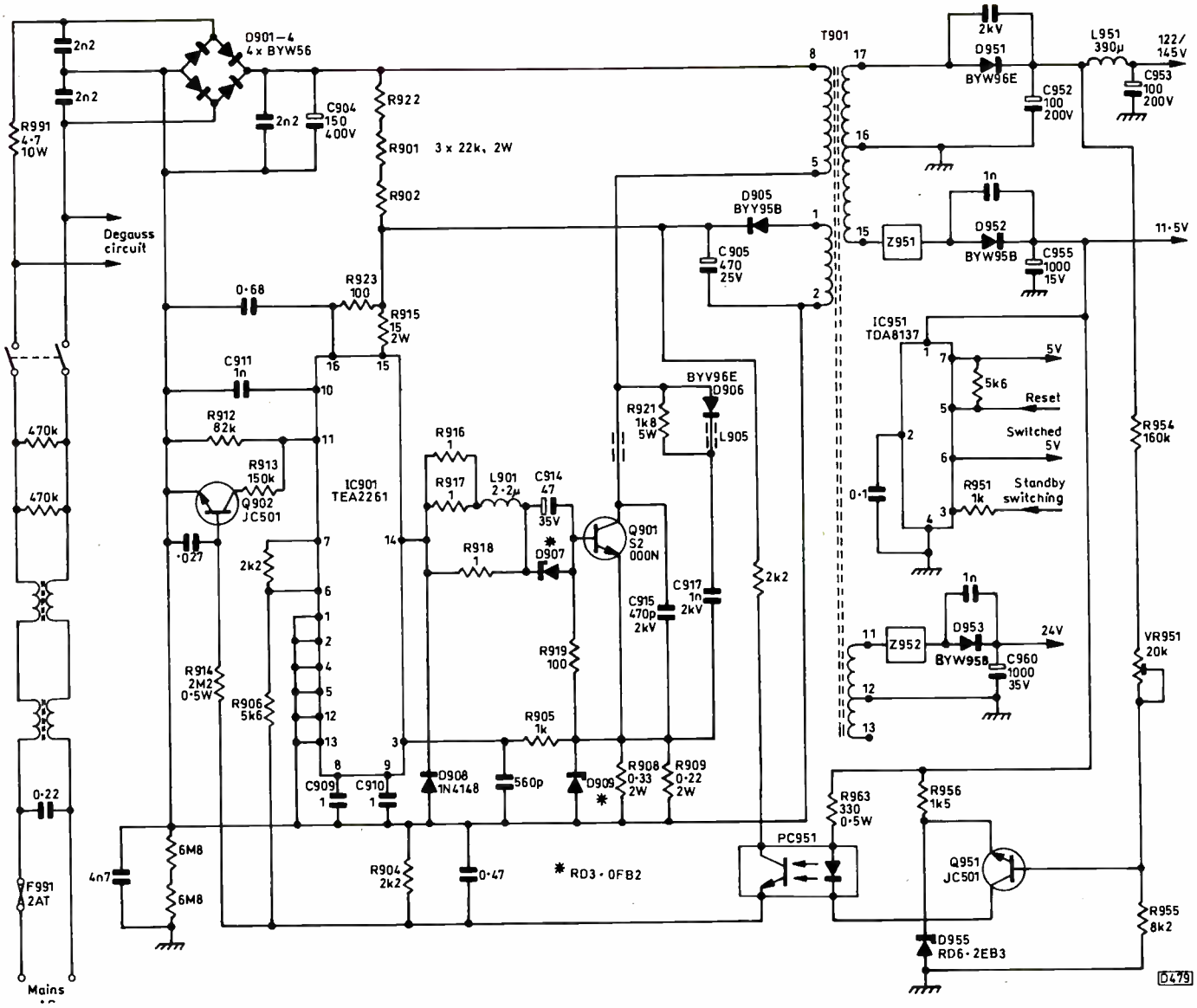


Fig. 1: Circuit diagram of the chopper power supply used in the Mitsubishi EE4 chassis.

capacitors on the secondary side of the supply, the output voltages will decay gradually. If the fault condition is still present when IC901's output at pin 14 restarts, it will shut down again. This can go on indefinitely. When the power supply is operating in this stop-start fashion, DC voltages measured with a meter will appear to be normal but a check on the waveform at pin 14 of IC901 will show short bursts of pulses with gaps where the power supply shuts down.

IC901 has a secondary level of overvoltage protection which is based on the voltage at pin 16. In normal operation the voltage at this pin is about 12V. If the voltage across C905 rises to 15V, IC901 shuts down and C909 is charged to 2-3V. IC901 is then locked in its shut-down state and cannot run until C909 has been discharged. This can be done by disconnecting the set from the mains supply for at least one minute. If, to facilitate fault diagnosis, you want to stop C909 charging, connect a 100Ω resistor across it.

Excess Current Protection

R908/9 monitor the current demand at the secondary side of the power supply: the voltage developed across these two resistors is proportional to Q901's collector current, which is in turn proportional to the secondary side current flow. The voltage across R908/9 is fed via R905 to IC901's current sensing pin 3.

IC901 has two excess-current protection levels. Normally the voltage at pin 3 is very low. When it rises to the first protection threshold level, IC901 reduces Q901's on time to reduce the output voltages while slowly charging C909. Should the voltage across C909 reach 2-3V, IC901 will lock in its shut-down state as described above. When the fault on the secondary side of the power supply is more serious, if the line output transistor is short-circuit for example, IC901's drive to Q901 will be cut off and C909 will charge to lock IC901 in its off state.

D909 is included to protect the power supply in the event of Q901 going short-circuit. If D909 wasn't present and Q901 went short-circuit, there would be a high voltage at pin 3 of IC901. The IC and possibly other components would be damaged. In normal operation D909 has no effect. Should Q901 go short-circuit, the idea is that D909 prevents the voltage at pin 3 of IC901 rising above 3V before the mains fuse F991 blows. In

practice the surge-limiting resistor R991 frequently fails before F991 when this fault occurs. Should Q901 fail, D909 must also be replaced.

Standby Operation

In the standby mode pin 12 of the microcontroller chip IC701 is at 0V. As a result, there is no switched 5V output at pin 6 of IC951. This output supplies the set's signal circuitry, including the line oscillator. As the line oscillator is not in operation, the power supply's output voltages rise. The power supply then operates in the stop-start manner described earlier. The output voltages will measure correctly when checked with a meter, but only IC701 and its associated components will be working.

Deflection Circuits

The field and line oscillators are both within the MC44031 chip IC201, which Mitsubishi called the "video chroma jungle" (VCJ) – it contains all the video processing circuitry, including the luminance and chrominance delay lines and the sync separator.

The line drive output, a squarewave with an amplitude of 0·62V peak-to-peak, appears at pin 12. It's fed via R501 and the inverter transistor Q501 to the base of the line driver transistor Q551 (2SC2482). The signal at the collector of this transistor has a peak-to-peak amplitude of some 146V. It drives the base of the BU2506 line output transistor Q552 via the step-down transformer T552. The line deflection circuitry is conventional. Q552 incorporates the efficiency diode.

The field drive signal appears at pin 7 of IC201. It's fed via R401 to pin 1 of the TDA8171 field output chip IC401. The output from this device appears at pin 5 and drives the field scan coils via L401. The earthy end of the scan coils is returned to chassis via C410/1 and R406/7. There's also a vertical-position circuit here, with drive from pin 34 of IC201. This output is fed to Q451 and Q450, which apply a DC voltage to the junction of the scan coils and C410/1 to control the vertical position of the picture.

Tuning System

These sets have both manual and automatic tuning. I would strongly recommend that the manual system is always used, as there can be tuning-drift problems with automatic tuning. In both cases tuning is carried out using the remote control unit. The microcontroller chip IC701 controls the tuning voltage by producing, at pin 55, a squarewave output whose mark-space ratio is proportional to the required tuning voltage. These pulses are fed to an active integrator circuit consisting of Q701, R106/7/8 and C101/2/3. Its output, which varies from 0-32V, is applied to pin 2 of the tuner (TU101).

The tuner requires a 5V supply at pin 6 and receives an AGC input at pin 1 from pin 23 of the STV8224 IF chip IC101.

IC101 also produces an IF AGC voltage at pin 22 and an AFT voltage at pin 2. These voltages are fed to pins 56 and 53 respectively of IC701, which uses them for signal detection when tuning. With a good signal, IC701 will also receive a sync detect signal from IC201 and a station ID code from the text decoder via the I2C bus (pins 26 and 27). The AFT voltage at pin 53 of IC701 is also used to fine tune TU101 by adjusting the main tuning voltage. Thus the AFT circuit in TU101 is redundant.

Audio Section

The audio section of the EE4 chassis is very straightforward. The audio output at pin 14 of IC101 is fed to pin 5 of the audio output chip IC351 via C356 (10µF, 25V) and R356 (10kΩ). Pin 8 of IC351 drives the speaker via C359 (1,000µF, 35V). When the voltage at pin 3 of IC351 is low, the audio output is muted. Pin 3 is controlled by pin 8 of IC701 via Q312. IC701's mute output pin is normally at 0V. The voltage at this pin rises, switching Q312 on, when for example the set is not tuned in correctly.

IC351 is normally type TDA7253. In some sets however it is type TDA7263, part no. 270P259010. The correct type must be used, as the two are not interchangeable.

The Service Mode

The set must be switched on to enter the service mode. Press and release the service switch, S701, which is next to the aerial socket. You can use a small screwdriver to do this without having to remove the set's rear cover. Then, within five seconds, press button 9 on the remote control unit. It is then possible to switch between option adjustment (identifiable by the software display) and VCJ adjustment. In both cases buttons 2 and 8 select the adjustment code, buttons 4 and 6 adjust the data value, button 1 cancels all data adjusted since the last set of data was written into the EEPROM, and button 0 writes the data into the EEPROM.

The correct values for the option adjustments are shown in Table 1.

When the VCJ adjustment mode is selected, three sets of alphanumeric characters are displayed. The left-most pair should read 00. If not, adjust the first anode (screen) voltage control on the line output transformer until this reading is obtained. The middle pair of characters is the adjustment code, see Table 2. The right-most pair is the value to be set – some vary with tube size. Table 2 shows starting values. When the EEPROM (IC702, type ST24C04) has been replaced or initialised, start with the values shown in Table 2. These values give a viewable picture which can then be optimised.

When a new EEPROM is fitted, or the data in IC702 has become corrupted, it must be initialised. The procedure is as follows. Switch the set off. Leave it off for

Table 1: Option adjustment values.

Model	*TUN*	*ATS*	*STD*	*SYS*	*AVI*	*AVD**	*SPK**	*TXT*	*EEP*	*FFT*	*HTL+*
CT21M5B	0	0	1	0	0	0	0	0	1	0	1
CT21M5BT	0	1	1	0	0	0	0	2	1	1	1
CT25M5BT	0	1	1	0	0	0	0	2	1	1	1

*Software version 1.40 only. +Software versions 2.XX.

Table 2: Starting values for VCJ adjustments.

Code	*Adjustment*	*21"*	*25"*
00	Height	–08	+08
01	Field correction	See note 1	
02	Parabola amplitude	00	–15
03	Parabola tilt	00	–20
04	Field linearity	+15	+16
05	Corner correction	–31	–26
06	Width	00	–22
07	Matrix	–07	–07
08	Vertical shift	–4	+2
09	Line phase	+10	+12
0A	Blue drive	+01	+01
0B	Green drive	+05	+05
0C	Red drive	+14	+14
0D	Contrast	+22	+22
0E	Brightness	–09	–09
0F	Saturation	–05	–05
10	Tint	00	00
11	Sharpness	See note 2	
12	Luma delay PAL	111	111
13	Luma delay Secam	111	111
14	Height, 60Hz	00	00
15	Parabola amp, 60Hz	00	00
16	Width, 60Hz	00	00
17	Field shift, 60Hz	00	00
18	Line phase, 60Hz	00	00
19	Line phase, text	00	00
1A	Line phase Secam	00	00
1B	Line phase forced RGB	00	00
1C	Parabola amp 16:9	00	00
1D	Luma delay NTSC358	111	111
1E	Luma delay NTSC443	111	111

Note 1: Always adjust the field correction to –31.
Note 2: The value of the sharpness adjustment 11 depends on the microcontroller chip's suffix (IC701). Set to 100 if the suffix is A10, to 001 if the suffix is B10.

at least one minute. Then turn the set on while holding the service switch (S701) in. Keep the service switch in for at least three-five seconds. Finally release the service switch and turn the set off.

The EEPROM will then be reset to its default values. Turn the set on, enter the service mode as previously described, then set the adjustments to the values shown in the tables. Note that all the adjustments stored in the EEPROM will need to be set correctly and all the stations will have to be tuned in.

Fault History

There were some teething troubles with these sets, especially with the auto-tuning circuitry. For this reason I strongly advise that the auto-tune facility is ignored and that the sets are manually tuned instead. If you have a set that suffers from tuning drift, especially with channels above 39, add a 180kΩ, 0·25W resistor and a 1N4148 diode in series between pins 2 and 6 of the tuner unit, with the diode's cathode connected to pin 6 and the resistor connected to pin 2.

There are two modifications, depending on which version of IC701 is fitted, for sets that suffer from intermittent standby. If IC701 has the suffix A10, cut the print at pin 3 to enable a 1kΩ resistor to be added between pin 3 and the junction of D711/R710/C719 and add a 10nF capacitor between pin 3 and chassis. If IC701 has the suffix B10, remove the blue b-b link wire that connects C719 to the 12V rail and add a 10nF capacitor between pin 3 and chassis.

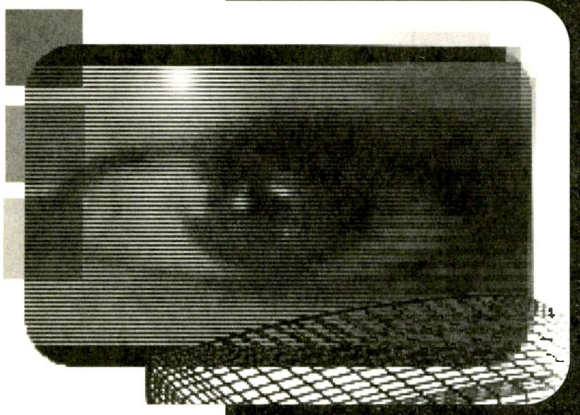
If the green LED is lit but there's no picture, sound or line drive, check the line output transistor Q552. If it's short-circuit and the power supply works when Q552 is disconnected, change R213, R214 and R746 to 1kΩ, change C702 to 10µF and C955 to 3,300µF. Then replace Q552 and C914. After carrying out this modification it may be necessary to initialise the EEPROM and adjust all the settings stored in it.

Power supply kit AVM5-KIT (Mitsubishi part no.) should be fitted in the event of failure of Q552. It has two new capacitors to be added, new-value resistors to fit in positions R713 (changed to 1kΩ) and R758 (changed to 5·6kΩ) and replacements for Q552, Q901, R991 and D909. Replace C914 and check D907 – they are in Q901's base drive circuit.

If Q6E3/4/5 are fitted on the CRT base PCB, remove them to increase the contrast at high brightness levels. But keep them – they are widely used in Mitsubishi TV sets.

If the fusible resistor R516 (connected to pin 3 of the LOPT) goes open-circuit with the 25in. model, it's worth replacing the EW correction chip IC551 (TEA2031A) as well since this is frequently the cause of R516 going open-circuit. Failure of IC551 may simply mean no EW correction.

Should Q901 fail, always check C914 and D907.



TV Fault Finding

Reports from
Philip Blundell, AMIIE
Kevin J. Green, TMIIE
Brian Storm
Graham Richards
Pete Gurney, LCGI
Colin J. Guy
Martyn Davis
Terry Lamoon
Andy Barkley and
Giles Pilbrow

Philips G90 Chassis

This 21in. set was dead with the standby LED flashing. So I checked the HT voltage, which was low and pulsing – it should be 95V. The feed to the line output stage was disconnected, a dummy load was connected in its place, and a variac was brought into operation to reduce the mains input voltage. Tests could now begin.

I soon established that the 95V supply was trying to rise but the protection circuit was coming into operation. Cold checks in the HT monitoring circuit led to the culprit: R3632 (15kΩ) was open-circuit. Other possible causes of this fault are C2630 (47µF) or R3668 (150Ω) going open-circuit. **P.B.**

Mitsubishi CT21A5STX (Euro 14SF chassis)

If you have tuner unit problems, such as no signals or intermittent loss of the signals, before ordering a new tuner look inside the existing one. Use a magnifying glass to examine the area around the PLL IC. You could well find that the insulated lead which runs beside this IC is dry-jointed. **P.B.**

Philips CP90 Chassis

The customer provided a valuable clue to the cause of the fault when he mentioned that the set had previously gone dead (the LED had gone out) when it had been switched to standby. The set was now permanently dead, with a whistling sound from the power supply.

There was no 95V HT voltage. The feed to the line output stage was disconnected, by removing the scan coil plug, and a dummy load was connected in its place. There was still no 95V supply. In view of the customer's comment about the standby problem, I decided to use a scope to monitor the voltage at pin 10 of the chopper transformer T5763. It pulsed high at switch on, triggering the protection thyristor Thy6696. C2703 (330µF), which is connected to pin 10 of the transformer, had dried up. **P.B.**

Philips 28PT8413 (MD2.22AA chassis)

The complaint was of thick black lines on the picture – but they were extremely intermittent. I eventually traced the cause of the trouble to the system control/text module connections to the main PCB. The connector pins at S56/7 had oxidised under the solder joints. I cleaned them with a fibre brush then resoldered them. This cured the problem. **K.J.G.**

Sony KVX2972

No channels could be stored and the geometry was all to pot. The LEDs at the front were flashing an error code that meant SDA line low. The cause of the trouble was the 5·6V zener diode D071, which was leaky. **K.J.G.**

Panasonic Alpha 4 Chassis

A not uncommon fault symptom with these sets is intermittent lines across the picture, as if there is a line sync problem. The symptom is often seen at switch on when the set is cold. The cause is almost certain to be a faulty UHF tuner. **B.S.**

Panasonic TX29AD1DP

There was an intermittent field output problem with this second-generation Dolby Pro-Logic set. One or two horizontal thin black lines would appear near the bottom of the screen. After spending several hours checking various components I cured the fault by replacing D507 and D508. They are type MA723TA5. **B.S.**

Panasonic Z5 Chassis

The picture had no colour content and, despite extensive checks around the video processing IC, no cause of the fault was apparent. Many days later I discovered that the culprit was the EEPROM chip IC1205. It contains set-up data for initialising the IF/video/sound/timebase generator chip IC601, and can be the cause of a number of strange video faults.

This is not immediately obvious from the service manual, and illustrates the problems that the unsuspecting service engineer faces when trying to guess what data is stored inside such chips. Hopefully service manuals will one day provide test procedures for the 'hidden' digital data within these ICs. **B.S.**

Hitachi C2118T (G7PS Mk 2 chassis)

The size of the picture fluctuated intermittently. When this occurred the 112V HT supply varied in sympathy. After various checks in the power supply I came to suspect C906 (4·7µF, 250V) in the error detector circuit. When it was checked the reading obtained was 0·93µF. A replacement cleared the fault. **G.R.**

JVC C140EK

Intermittent loss of channels, going to standby and tuning drift were the reported symptoms. They came and went when the SBX station selector

thick-film module was heated and cooled. There are three surface-mounted electrolytics on the right-hand side of this module. The one that was the cause of the trouble was C015 (22µF, 6·3V). I decided to replace the other two as well – C014 (3·3µF, 50V) and C016 (0·47µF, 50V). **G.R.**

Hitachi C2118T (G7PS Mk 2 chassis)

The fault report said no tuning. Checks showed that R044 (12kΩ, 0·5W) in the feed to the 30V tuning voltage stabilising zener diode ZD002 was open-circuit. I fitted a high-stability 1W replacement **G.R.** (See also letters – *editor.*)

Bush 2920T

The sound was OK but there was no picture. Checks showed that the line drive was missing because the secondary winding on the line driver transformer was open-circuit. The transformer's pins had not been cleaned sufficiently prior to being soldered during manufacture. Cleaning and resoldering cured the fault. **P.G.**

Alba CTV6682

This set had occasionally failed to switch on. Now it was dead all the time. I've not had much trouble with the power supply in these sets, and this fault proved to be more easy to cure than I expected. When the chassis was removed the cause of the trouble was obvious: the chopper transformer was dry-jointed at every pin. Resoldering cured the fault.

Beware – the smoothing block tends to remain charged in this fault condition. **P.G.**

Ferguson T14R (TX805 chassis)

Several of these portables have appeared in the workshop recently because they refused to start up. The cause has been that one of the three start-up resistors RP44/42/41 has gone open-circuit. It's a well-known fault. Note however that while the circuit diagram in the manual shows the value of these resistors as 68kΩ I have come across some variations. So check the colour code before replacement. **P.G.**

Sony KVM2531 (AE1C chassis)

This set had an intermittent colour problem. It would sometimes work all right for days, then revert to monochrome. I thought I'd traced the cause of the trouble to the 8·867MHz reference oscillator crystal, but a week later the fault was back. I replaced the colour decoder chip, but this did nothing other than prove that the original one was OK. The cause of the fault was eventually found to be the reference oscillator's trimmer capacitor CT302. It had developed an intermittent fault internally. **P.G.**

Goodmans 1450T

This set seemed to be dead and, to make life more interesting, I'd no circuit diagram. In fact the power supply was running and, after a few checks, the cause of the fault was traced to loss of the line drive output from the AN5601 chip IC301, which had no voltages at all at its pins. This IC has a start-up supply, via R323, which was open-circuit. It's marked 8·2kΩ and a replacement of this value restored normal operation. **P.G.**

Sony KV25F1U

This set was quite new when it started to produce a blue picture at times. The fault occurred on a more regular basis over a few weeks. Eventually the set switched itself off and arrived at my workshop.

At switch on a very bright blue raster appeared, and within two seconds the set tripped because of excessive beam current. A check at the tube's blue cathode produced a reading of 1·5V before the inevitable trip. The very low voltage reading made me a little suspicious about the cause, and disconnecting the cathode altogether proved the point: there was an internal short within the tube.

Clutching at straws, and working on the basis that the situation couldn't get any worse, I had a go at clearing the short, using a 200µF capacitor charged to 300V and a small current-limiting resistor with the CRT base removed. The short vanished at the first attempt, after a tiny flash inside the neck of the tube. That was some months ago and the set has not returned, though the happy customer was warned that it might. **P.G.**

Grundig GT1402 (G1000 chassis)

The fault description with this set said no text. In fact the symptoms were a little more unusual. When the text mode was selected the effect was exactly like no luminance, a desaturated chroma display still being present. In the mix mode there was very slightly reduced contrast, the picture remaining normal in every other way, while changing channels failed to bring up a text channel identification at the bottom of the picture. Measurements were rather inconclusive: the waveforms were largely as they should be, and no voltages are given in this part of the circuit. In fact everything seemed to be operating correctly.

Scope checks showed that data was present at the RGB output pins of the text processor chip IC650 with the set in the text mode. By carefully observing the waveform when selecting different pages via the remote-control unit, I saw that the data changed as the page updated. So I turned my attention to the MC44007 Y/C processor chip IC800.

The fast-blanking input at pin 21 seemed to alter, though no measurements are given for this signal. The fault lay in this area however. The blanking signal is generated by IC650, leaving at pin 19. Before reaching IC800 it's buffered by TR653, a surface-mounted BC847 transistor. Because this device had a very slight base-to-emitter leak, the switching voltage it produced was 3·8V instead of the correct 4·5V. Why this should have blanked the luminance and left the chroma signal remains a mystery. **P.G.**

Toshiba 255T7B

There was no sound or picture. When the first anode control was turned up a blank raster appeared. Video was present at the output from the tuner and was traced to pin 6 of the scart switching chip QV01. It failed to emerge from the chip, whose supply was missing. The cause was CV08 (1,000µF) short-circuit and RV11 (180Ω) open-circuit. **C.J.G.**

Grundig CUC3400 etc Chassis

I've recently had several of these sets in which the cause of tripping, sometimes intermittently, has been the set-HT preset R637. **C.J.G.**

Hitachi CPT1471 (NP82C2 chassis)

This ageing portable had suddenly stopped working, after producing excellent pictures for years. The owner considered it to be worth repair. On test the set tripped a few seconds after switch on. As there was not anything obviously amiss, I decided to disable the trip. The set then ran, but with reduced width and height and a horrible squealing from the line output transformer.

The cause of the trouble was R772, the 10Ω safety resistor in the LOPT-derived 50V supply to the field output stage. It had gone high in value. **C.J.G.**

Mitsubishi CT25M1TX

This set appeared to be dead but when the HT supply was checked with a scope it was seen to jump to over 200V before the power supply shut down. The cause of the fault was the regulator error-sensing transistor Q953, which was open-circuit emitter-to-base. **C.J.G.**

Toshiba 2500DBT

The cause of poor field linearity was eventually traced to C317 (2·2µF), which is mounted next to the field output chip's heatsink. A 105°C type capacitor is called for in this position. **C.J.G.**

Ferguson A14R (Thomson TX80 chassis)

No results and a loud buzzing noise was caused by the track between pin 6 of the chopper transformer LP03 and RP50 being open-circuit. No PCB damage was apparent and a link between the two points brought the set back to life. **C.J.G.**

Hitachi G8Q Chassis

The excellent kit that Chas Hyde used to sell to repair these sets is no longer available, so if you get a blown up power supply replace all the following items (CHS order codes in brackets): D906 (1N4148), D907 (BYV10), IC901 (UC3844), Q901 (SGSP222), Q902 (SGSIF344), R910 (12001LS) 0·5Ω 7W, TH902 (12001GT), ZD902 (ZTE2S1) if fitted and ZD901 (BZX79C). In addition, check the mains bridge rectifier and the various small electrolytics. **C.J.G.**

Toshiba 2100TBT

The display consisted of just two inches of lines at the top of the screen. Replacing C313 (100µF, 35V) cured the fault. It's the flyback boost capacitor in the field output stage, between pins 3 and 6 of the AN5515 chip Q303. **M.D.**

Philips 28PW6332 (MD1.2 chassis)

There was EW bowing in the 4:3 picture mode. In the Super Zoom mode the top and bottom thirds of the picture were perfect but the centre section was folded over, producing a double-image effect with line tearing. The fault would come and go, with the line output transformer ringing loudly when it was present. The cure was to replace the processing chip IC7119 on the small-signal panel.

Dry-joints at connector S11 can be the cause of various intermittent picture faults. **M.D.**

GoldStar CF25C28F (PC58A chassis)

The basic fault was field collapse, which with this chassis usually means replacing the TDA8350Q field/EW output chip IC351. When I did this however there was severe EW distortion with no adjustment in the service mode. The clue was that C359 and L351 in the EW modulator drive circuit were extremely hot. The print by the buffer transistor Q351 had fractured. Bridging it cured this second fault.

It seems that after the initial fault had occurred the owner had left the set running for some considerable time, hoping that it would 'right itself'! This had probably caused excessive heat which had resulted in the print fracture. **M.D.**

Hitachi C1411T

There was a multiple fault list with this portable, including no text, no remote control operation and channel skipping. On investigation I found that text could be called up but not displayed, which then made the normal remote control functions wrong. I concentrated on this aspect and carried out some checks around the text chip IT01. Its 5V supply was OK, but the crystal oscillator wasn't working. Once a new crystal (XT01) had been fitted everything worked correctly. **T.L.**

Sony KVX2172U

The LED was flashing, with long intervals between each flash, but there was virtually no power. Now with these sets you can check which area may be faulty by counting the seconds between each LED flash. When I consulted the service manual it told me that the set had a field timebase fault. I homed in on this area and noticed that two of the pins of the field output chip IC1501 were dry-jointed. Once they'd been resoldered the set worked perfectly. Moral: always consult the manual first! **T.L.**

Grundig CUC7303

This set had no power and there were some very odd voltages in the power supply area. I noticed that when the mains switch was pushed in it would arc at one connection. This suggested a dogy switch, but when I removed it I found that one of the pins had bent over completely and had never been attached to the PCB print. How the set had managed to work for several months before a fault was reported escapes me. But all I had to do was to straighten the pin and reinsert the switch in its correct position. **T.L.**

Matsui 21V1N

The mains fuse in this set had blown quite dramatically. A few cold checks soon revealed that D60011/12/13/14/23/24 were all short-circuit. So was the BUZ90 chopper transistor. For good measure I replaced the power supply chip (IC60030) as well. After that everything was OK. **T.L.**

Sony KVM16TU

The picture was intermittent and the OSD showed occasionally. I did some gentle PCB tapping and got a reaction around the IF module. After removing it then cleaning and resoldering several bad joints the set worked correctly – proved by a soak test lasting several days. **T.L.**

Matsui 1402

Intermittent picture flicker was the complaint with this small portable. When I watched it closely in the workshop I saw that the field scan was trying to collapse. Dodgy presets are a problem with this model. When relevant ones were touched the fault appeared. Once the sensitive presets had been replaced the set worked perfectly. **T.L.**

Akai CT2870N (Nokia Compact D-E chassis)

The problem with this set was low-level, noisy, buzzing sound. I decided to check, with the invaluable aid of our Capacitor Wizard, the capacitors in the RF/IF module. The culprit turned out to be C242 (0·47µF, 63V) which is connected to pin 5 of the TDA2556 quasi-parallel sound IF chip IC202.

In addition to the Akai model this chassis is used in **ITT-Nokia** sets and the **Pioneer** SD21/25/28AVI range. **A.B.**

Goodmans 2880B (Ferguson TX92 chassis)

There was perfect sound and vision with a scart socket input but the set wouldn't tune in any stations. I called up the tuning menu and selected the search mode. Pin 40 of the microcontroller chip had the correct signal, one with a mark-space ratio that increases as the on-

screen tuning indicator moves up the band, but the tuning voltage at pin 6 of the tuner module was stuck at 33V. The cause of the problem was the BC847B surface-mounted transistor TH01, which was short-circuit base-to-emitter. **A.B.**

Sony KVS2942U (AE2F chassis)

This set partially operated but the supply line voltages were all very low. The power supply worked correctly when unloaded, but the output voltages fell as soon as a dummy load was connected. R641 (1MΩ) on the primary side of the power supply was the cause. R642 should also be replaced. **G.P.**

Sony KVX2162U (AE2 chassis)

This set would start up then shut down, with the B LED flashing thirteen times. This indicates a field timebase problem. But when D1504 in the vertical protection circuit was removed the set still failed to come to life. So attention was turned to the X-ray protection circuit, which comes into operation when there's excess line scan current or excessive flyback voltage. The cause of the problem turned out to be the 18kΩ chip resistor R895, which was open-circuit. It's part of a potential divider that monitors the line flyback pulses. **G.P.**

Toshiba 2835DB (C3SS chassis)

This set was completely dead because the audio output chip IC670 was short-circuit. Note that a short or heavy load on the audio supply will shut the set down, because it will also load the supply used to power the optocoupler. The power supply will therefore go into the overvoltage condition. **G.P.**

Quickies

Hitachi CS2552TA: This set wouldn't start up properly from cold. C622 (470µF, 16V) had dried up.

Matsui 1436: Field collapse, either permanent or intermittent, can be caused by the height potentiometer VR702. It goes open-circuit.

Panasonic Alpha 3 chassis: There was no green in the teletext display – D3309 was open-circuit. D3308 or D3310 could cause a similar problem with the other colours.

Matsui 6091: There was no colour because C331 had gone open-circuit. I also replaced C332. They are both 22nF, Mylar capacitors.

Mitsubishi CT14MS1BM: Whenever the main PCB was flexed the picture would shift over to the right. There was a dry-joint at one end of R527, which is near the LOPT.

Questar CTR14: The relay clicked but the set wouldn't come out of standby. R652 (390kΩ) was open-circuit.

Matsui 1402: The cause of intermittent loss of line lock when warm was traced to C484 (2·2µF tantalum bead). **G.P.**

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0.5A	FUSE84	30p
0.63A	FUSE85	30p
0.8A	FUSE86	30p
1A	FUSE87	30p
1.25A	FUSE88	30p
1.6A	FUSE89	30p
2A	FUSE90	30p
2.5A	FUSE91	30p
3.15A	FUSE92	30p
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680 pF	2000v	CAP04	95p	2200 pF	2000v	CAP11	130p
820 pF	3000v	CAP05	150p	3300 pF	2000v	CAP12	145p
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10 µF	16v	CAP17	110p	4.7 µF	50v	CAP25	110p
22 µF	16v	CAP18	110p	10 µF	50v	CAP26	130p
47 µF	16v	CAP19	130p	22 µF	50v	CAP27	180p
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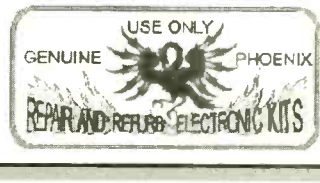


SEE PAGE 199 FOR MORE NEW ARRIVALS

TRANSISTORS/LINEAR ICs

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
BC107	8p	BD434	30p	BU126	65p	BUV48AF	325p	MJ4502	300p
BC108	8p	BD435	31p	BU128	125p	BUV48C	250p	MJ10012	300p
BC109	8p	BD436	30p	BU133	125p	BUV50	425p	MJ11015	250p
BC109C	10p	BD437	28p	BU137	150p	BUV61	1000p	MJ11016	300p
BC140	20p	BD438	36p	BU180	100p	BUV70	200p	MJ11032	800p
BC142	20p	BD439	40p	BU184	100p	BUV90	175p	MJ11033	800p
BC143	20p	BD440	40p	BU204	65p	BUW93	375p	MJ15003	250p
BC147	8p	BD441	40p	BU205	70p	BUW11A	200p	MJ15004	300p
BC149	8p	BD533	50p	BU206	100p	BUW11AF	225p	MJ15015	250p
BC159	8p	BD534	38p	BU207	150p	BUW12	125p	MJ15016	350p
BC160	30p	BD535	38p	BU208	70p	BUW12A	150p	MJ15022	400p
BC171	10p	BD536	38p	BU208A	75p	BUW12F	250p	MJ15023	400p
BC172	10p	BD537	40p	BU208AT	200p	BUW13A	200p	MJ15024	400p
BC177	14p	BD538	40p	BU208B	200p	BUW32A	500p	MJ15025	700p
BC178	14p	BD643	50p	BU208D	130p	BUW48	550p	MJE340	25p
BC179	14p	BD645	50p	BU209	90p	BUW49	550p	MJE350	80p
BC182	7p	BD647	50p	BU225	120p	BUW50	400p	MJE520	30p
BC182L	7p	BD649	50p	BU226	120p	BUW81A	150p	MJE2955T	65p
BC183	7p	BD675	40p	BU312	90p	BUW84	75p	MJE3055T	65p
BC183L	7p	BD676	40p	BU325	55p	BUW85	85p	MJE13004	100p
BC184	7p	BD677	38p	BU326A	75p	BUX10	150p	MJE13005	80p
BC184L	7p	BD678	40p	BU406	60p	BUX11	200p	MJE15027	100p
BC212	7p	BD679	40p	BU406D	85p	BUX12	150p	MJE13009	100p
BC212L	7p	BD680	40p	BU407	55p	BUX20	350p	MJE15028	200p
BC213	7p	BD681	45p	BU407D	75p	BUX21	450p	MJE15029	200p
BC213L	7p	BD682	45p	BU408	60p	BUX22	450p	MJE15030	250p
BC214	7p	BD705	50p	BU408D	75p	BUX23	900p	MJE15031	400p
BC214L	7p	BD707	50p	BU409	85p	BUX37	220p	MJF18004	125p
BC237	7p	BD709	50p	BU412	175p	BUX39	450p	MJF18004	175p
BC238	7p	BD711	50p	BU413	175p	BUX40	210p	MJF18204	350p
BC239	7p	BD736	50p	BU414B	250p	BUX41	200p	OC28	350p
BC300	20p	BD826	50p	BU415A	170p	BUX42	200p	OC29	250p
BC301	20p	BD828	50p	BU426A	70p	BUX47A	220p	OC35	350p
BC302	20p	BD839	55p	BU433	120p	BUX48A	150p	OC36	250p
BC303	20p	BD897	50p	BU500	100p	BUX55	800p	S2000A3	175p
BC304	25p	BD899	50p	BU500D	225p	BUX80	180p	S2000AF	90p
BC327	7p	BD977	50p	BU505	90p	BUX81	160p	S2055A	175p
BC328	7p	BDX33	60p	BU505D	90p	BUX84	50p	S2055AF	175p
BC337	7p	BDX37	100p	BU505DF	90p	BUX85	50p	S2530A	100p
BC338	7p	BDX44	100p	BU506	100p	BUX86	50p	TIP29	15p
BC441	28p	BDX47	60p	BU506D	70p	BUX87	50p	TIP29A	22p
BC446	8p	BDX54C	75p	BU506DF	100p	BUX98A	350p	TIP29C	25p
BC477	18p	BDX62C	150p	BU508A	60p	BUZ71	75p	TIP29E	40p
BC516	22p	BDX63C	175p	BU508AF	60p	BUZ71AF	100p	TIP30	25p
BC537	25p	BDX64C	175p	BU508APH	60p	BUZ72A	100p	TIP30C	25p
BC546	8p	BDX65	80p	BU508D	75p	BUZ72AF	100p	TIP31A	22p
BC547	8p	BDX66C	175p	BU508DF	85p	BUZ73A	150p	TIP31C	27p
BC548	8p	BDX67C	275p	BU508DR	130p	BUZ73AF	60p	TIP32	24p
BC549	8p	BDX71	70p	BU508V	110p	BUZ76A	110p	TIP32A	21p
BC550	8p	BDX77	175p	BU508VF	100p	BUZ80	135p	TIP32C	28p
BC556	8p	BDX87C	175p	BU526	75p	BUZ80AF	200p	TIP33	50p
BC557	8p	BDX88C	150p	BU536	100p	BUZ83	200p	TIP33C	60p
BC558	8p	BDW24	55p	BU546	125p	BUZ90A	180p	TIP34	65p
BC559	8p	BDW93	50p	BU603	125p	BUZ91A	260p	TIP34C	60p
BC560	8p	BDW94	50p	BU606D	225p	BY448	20p	TIP35C	65p
BC637	20p	BDY29	225p	BU608D	120p	BYT11	25p	TIP36C	65p
BC639	20p	BDY56	225p	BU626	120p	IRF120	225p	TIP41A	20p
BC640	20p	BDY58	500p	BU705	130p	IRF130	475p	TIP41C	22p
BCY33	200p	BDY90	125p	BU706DF	175p	IRF140	550p	TIP42A	20p
BCY34	200p	BDY92	100p	BU706F	150p	IRF230	550p	TIP42C	22p
BCY70	16p	BF137	35p	BU724A	100p	IRF240	425p	TIP47	40p
BCY71	16p	BF167	30p	BU801	70p	IRF250	375p	TIP48	40p
BCY72	16p	BF181	18p	BU806	70p	IRF330	600p	TIP50	60p
BD115	30p	BF183	20p	BU807	60p	IRF340	325p	TIP51	80p
BD124P	50p	BF195	7p	BU807F	75p	IRF350	750p	TIP52	80p
BD131	25p	BF199	8p	BU808DF	210p	IRF450	650p	TIP54	85p
BD132	25p	BF200	16p	BU810	110p	IRF510	110p	TIP102	70p
BD133	50p	BF225	30p	BU824	60p	IRF520	110p	TIP105	65p
BD135	20p	BF240	16p	BU826	120p	IRF530	120p	TIP106	65p
BD136	20p	BF245	25p	BU826A	160p	IRF540	120p	TIP107	65p
BD137	20p	BF254	15p	BU902	110p	IRF610	120p	TIP110	40p
BD138	20p	BF255	12p	BU903	110p	IRF611	120p	TIP111	40p
BD139	20p	BF256	18p	BU910	80p	IRF620	160p	TIP112	35p
BD140	20p	BF257	18p	BU912	100p	IRF630	110p	TIP112H	50p
BD144	90p	BF259	18p	BU920	100p	IRF640	300p	TIP115	30p
BD157	38p	BF262	25p	BU922	110p	IRF642	200p	TIP116	30p
BD166	30p	BF270	18p	BU930	130p	IRF650	200p	TIP117	30p
BD175	30p	BF273	15p	BU932	175p	IRF710	150p	TIP120	37p
BD177	30p	BF311	21p	BU941	250p	IRF720	150p	TIP121	35p
BD179	32p	BF336	20p	BU2508A	100p	IRF730	125p	TIP122	30p
BD181	45p	BF337	20p	BU2508AF	110p	IRF740	125p	TIP125	30p
BD182	60p	BF338	20p	BU2508D	130p	IRF820	110p	TIP126	40p
BD184	60p	BF362	30p	BU2508DF	120p	IRF830	110p	TIP127	35p
BD187	30p	BF367	13p	BU2520AF	170p	IRF840	110p	TIP130	30p
BD201	33p	BF371	17p	BU2520DF	225p	IRF9140	1000p	TIP131	30p
BD202	38p	BF421	18p	BU2525A	325p	IRF9510	150p	TIP132	30p
BD203	42p	BF422	21p	BU2525AF	220p	IRF9511	150p	TIP136	40p
BD204	42p	BF423	25p	BU2527AF	400p	IRF9520	150p	TIP137	65p
BD222	31p	BF455	12p	BUF405A	200p	IRF9530	200p	TIP162	110p
BD225	31p	BF458	19p	BUH315	200p	IRF9531	200p	TIP141	65p
BD232	31p	BF462	50p	BUH315D	175p	IRF9540	240p	TIP142	75p
BD233	30p	BF471	28p	BUH515	200p	IRF9541	200p	TIP145	50p
BD234	32p	BF472	28p	BUH515D	250p	IRF9610	120p	TIP146	70p
BD235	28p	BF479	30p	BUH517	275p	IRF9620	110p	TIP147	80p
BD236	30p	BF494	16p	BUH517D	175p	IRF9622	200p	TIP150	90p
BD237	21p	BF495	16p	BUH715	425p	IRF9630	180p	TIP151	60p
BD238	24p	BF595	18p	BUT11A	35p	IRF9640	280p	TIP2955	50p
BD239	30p	BF596	18p	BUT11AF	35p	IRFD9220	100p	TIP3055	50p
BD240	40p	BF615	30p	BUT12	80p	IRFBC30	150p	TIPL760	100p
BD241A	40p	BF617	30p	BUT13	310p	IRFBC40	250p	TIPL762A	200p
BD243A	50p	BF760	40p	BUT18	80p	IRFP140	250p	TIPL763A	200p
BD244	50p	BF763	40p	BUT18AF	65p	IRFP150	300p	TIPL791A	80p
BD245	50p	BF870	22p	BUT30V	1700p	IRFP240	300p	2N2369	15p
BD246A	50p	BF871	22p	BUT56A	65p	IRFP250	280p	2N2646	40p
BD265	45p	BF960	38p	BUT76A	80p	IRFP350	325p	2N2904	20p
BD267	45p	BF961	35p	BUT90	1300p	IRFP450	325p	2N2905	20p
BD269	45p	BF964	38p	BUT92	1200p	IRFP460	775p	2N2906	18p
BD278	50p	BFQ232	75p	BUV18	650p	IRFP9140	1450p	2N2907	18p
BD311	100p	BFQ252A	60p	BUV20	650p	IRFP9240	350p	2N3019	28p
BD314	100p	BFR90	85p	BUV21	400p	IRFPC50	600p	2N3053	18p
BD315	150p	BFR91	99p	BUV23	475p	IRFRC20	250p	2N3054	40p
BD317	150p	BR100	14p	BUV24	350p	IRFZ20	65p	2N3055	38p
BD331	40p	BR103	37p	BUV25	110p	IRFZ42	275p	2N3055H	50p
BD332	40p	BR303	85p	BUV26	150p	IRFZ44	160p	2N3440	45p
BD361	60p	BU105	80p	BUV27	125p	MJ2501	100p	2N3441	175p
BD362	60p	BU108	100p	BUV28	110p	MJ2955	55p	2N3442	85p
BD370	30p	BU109	80p	BUV37	175p	MJ3000	100p	2N3771	85p
BD371	30p	BU110	90p	BUV46A	75p	MJ3001	100p	2N3772	90p
BD410	50p	BU111	100p	BUV47	120p	MJ4032	175p	2N3773	100p
BD433	28p	BU124	60p	BUV48A	175p	MJ4035	175p	2N3819	29p

Part	Price
4N35	50p

RECTIFIER DIODES

BY127	8p
BY133	8p
BY164	40p
BY179	35p
BY184	32p
BY206	11p
BY207	20p
BY227	19p
BY228	28p
BY298	15p
BY299	18p
BY329-1200	150p
BY448	20p
BYT11	25p
BYT13-1000	30p
BYV96E	25p
BYW96E	36p
BYX10	15p
BYX55/600	25p
IN4001	3p
IN4002	3p
IN4003	3p
IN4004	3p
IN4005	3p
IN4006	3p
IN4007	4p
IN4148	2p
IN5400	9p
IN5401	8p
IN5402	8p
IN5403	8p
IN5404	8p
IN5405	11p
IN5406	12p
IN5407	12p
IN5408	12p
RGP10	25p
RGP15	25p
RGP30	16p
SR2M	50p

I.C. SOCKETS

8 PIN	4p
14 PIN	5p
16 PIN	6p
18 PIN	9p
20 PIN	10p
22 PIN	12p
24 PIN	13p
28 PIN	13p
40 PIN	15p

ZENER DIODES

400 mWatts

2V7 to 39V	5p

1.3 Watts

2V7 to 39V	9p

VOLTAGE REGULATORS

7805	18p
7806	18p
7808	25p
7812	18p
7815	25p
7818	25p
7824	25p
7905	25p
7906	30p
7908	30p
7912	30p
7915	30p
7918	30p
7924	30p
78L05	24p
78L08	24p
78L12	24p
78L15	24p
78L18	24p
78L24	24p
79L05	35p
79L08	35p
79L12	35p
79L15	35p
LM309K	100p
LM317T	100p
LM323K	350p
78H08KC	800p
79H12KC	700p
79HGKC	800p

LEDs

3mm

RED	5p
YELLOW	8p
GREEN	8p

5mm

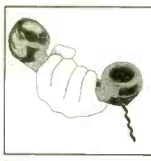
RED	5p
YELLOW	8p
GREEN	8p

RECTANGULAR LEDs

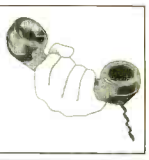
5mm x 2.5mm

RED	5p
YELLOW	8p
GREEN	8p

Part	Price
LINEAR ICs	
AN203	210p
AN210	165p
AN211	150p
AN214Q	170p
AN217P	95p
AN228	280p
AN252	150p
AN259	250p
AN262	140p
AN271	230p
AN274	250p
AN277B	400p
AN278	60p
AN301	330p
AN302	650p
AN303	250p
AN304	360p
AN315	210p
AN316	350p
AN337	600p
AN360	100p
AN362	140p
AN363	150p
AN366	150p
AN610	160p
AN3211K	375p
AN3215	350p
AN3231K	300p
AN3236K	450p
AN3310K	325p
AN3312	350p
AN3313	300p
AN3320K	450p
AN3331K	450p
AN3792	300p
AN3794	325p
AN3814K	450p
AN3821K	600p
AN3822K	600p
AN3830K	800p
AN3990K	300p
AN3991K	400p
AN5010	250p
AN5011	225p
AN2020	80p
AN5025	250p
AN5033	400p
AN5034	400p
AN5070	125p
AN5071	100p
AN5111	450p
AN5132	250p
AN5135NK	400p
AN5138NK	350p
AN5151	400p
AN5210	675p
AN5215	100p
AN5222	200p
AN5250	160p
AN5256	150p
AN5260	300p
AN5262	175p
AN5265	80p
AN5315	600p
AN5352	600p
AN5411	450p
AN5421	150p
AN5429	420p
AN5431	275p
AN5435	125p
AN5436N	160p
AN5512	100p
AN5515	160p
AN5520	550p
AN5521	100p
AN5560	350p
AN5601K	750p
AN5612	200p
AN5613	200p
AN5615	300p
AN5620	250p
AN5622	275p
AN5625	400p
AN5630	375p
AN5633	350p
AN5635N	330p
AN5640	500p
AN5700	90p
AN5701	150p
AN5710	100p
AN5712	180p
AN5720	70p
AN5722	140p
AN5730	160p
AN5732	120p
AN5750	75p
AN5753	130p
AN5763	250p
AN5790	240p
AN5791	225p
AN5836	450p
AN5862K	225p
AN5900	130p
AN608P	125p
AN620	250p
AN6130	130p
AN6135	120p
AN6209	350p
AN6250	50p
AN6247	200p
AN6270	400p
AN6300	600p
AN6306	380p
AN6310	200p
AN6320	180p
AN6326N	250p
AN6332	320p
AN6340	600p
AN6341	200p
AN6342	325p
AN6344	440p
AN6345	400p
AN6346	350p
AN6350	610p
AN6352	450p
AN6356	300p
AN6359	500p
AN6360	320p
AN6362	400p
AN6363	375p
AN6367NK	400p
AN6368	275p
AN6371	350p
AN6387	480p
AN6550	100p
AN6551	50p
AN6552	45p
AN6554	80p
AN6555	50p
AN6605	35p
AN6612	60p
AN6650	45p
AN6651	45p
AN6652	45p
AN6671K	425p
AN6676	600p
AN6780S	80p
AN6870	450p
AN6875	150p
AN6878	65p
AN6879	225p
AN6880	75p
AN6882	300p
AN6884	200p
AN6888	150p
AN6889	100p
AN6913	60p
AN700	650p
AN7010K	250p
AN7025K	90p
AN7060	175p
AN7062	300p
AN7072	250p
AN7081K	200p
AN7105	170p
AN7106K	135p
AN7110	75p
AN7111	100p
AN7112	45p
AN7114	120p
AN7115	110p
AN7116	90p
AN7117	65p
AN7120	100p
AN7130	75p
AN7131	90p
AN7133N	325p
AN7134	300p
AN7140	170p
AN7141	70p
AN7142	80p
AN7145	195p
AN7146	210p
AN7147	180p
AN7148	140p
AN7149	160p
AN7154	180p
AN7156	240p
AN7158	310p
AN7160	350p
AN7205	35p
AN7213	40p
AN7216	175p
AN7218	60p
AN7220	85p
AN7222	75p
AN7223	105p
AN7224	75p
AN7225	175p
AN7254	150p
AN7256	250p
AN7273	75p
AN7310	60p
AN7311	90p
AN7312	70p
AN7315	40p
AN7330	110p
AN7362	200p
AN7363	225p
AN7410	150p
AN7411	50p
AN7414	275p
AN7415	70p
AN7470	100p
AN8053	200p
AN8275	250p
AN8370	1000p
AN8377	400p
AN8387	350p
BA222	65p
BA225	100p
BA314	40p
BA301	55p
BA311	80p
BA313	60p
BA333	80p
BA335	55p
BA338	80p
BA340	75p
BA343	60p
BA336	175p
BA401	60p
BA402	50p
BA511	145p
BA514	160p
BA516	150p
BA518	150p
BA521	100p
BA524	240p
BA526	180p
BA527	95p
BA532	100p
BA534	220p
BA536	150p
BA546	180p
BA612	120p
BA614	70p
BA618	55p
BA631	280p
BA656	110p
BA658	350p
BA681A	350p
BA682A	300p
BA683A	300p
BA684	400p
BA685	400p
BA715	45p
BA718	45p
BA728	55p
BA806	220p
BA843	130p
BA1310	160p
BA1320	75p
BA1330	120p
BA1332	60p
BA1350	130p
BA1355	125p
BA1356	100p
BA1360	160p
BA1404	120p
BA1604	125p
BA2266A	250p
BA3306	60p
BA3308	70p
BA3312	60p
BA3402	90p
BA3406AL	120p
BA3416BL	80p
BA3422	350p
BA3505F	140p
BA3506A	70p
BA3516	120p
BA3520	130p
BA3521	225p
BA3704	200p
BA3706	75p
BA3812L	80p
BA3822LS	80p
BA3824LS	75p
BA3920	300p
BA4110	75p
BA4210	85p
BA4220	60p
BA4234L	70p
BA4236L	110p
BA4402	45p
BA4403	220p
BA4405	80p
BA4412	50p
BA5101	350p
BA5102	140p
BA5115	75p
BA5115L	75p
BA5204	200p
BA5208AF	110p
BA5402	180p
BA5406	180p
BA5408	180p
BA5413	225p
BA6104	250p
BA6109	110p
BA6110	225p
BA6125	75p
BA6137	55p
BA6138	130p
BA6146	150p
BA6149LS	700p
BA6154	60p
BA6208	175p
BA6209	85p
BA6218	85p
BA6220	55p
BA6222	130p
BA6227	50p
BA6229	130p
BA6235	50p
BA6238A	130p
BA6239A	130p
BA6247	150p
BA6248	140p
BA6259	170p
BA6280AF	300p
BA6290A	200p
BA6294	250p
BA6302A	150p
BA6304	120p
BA6305	140p
BA6321	250p
BA6328	250p
BA6334	75p
BA6410	220p
BA6411	250p
BA6418N	100p
BA6435S	425p
BA6993	150p
BA7001	150p
BA7004	200p
BA7007	200p
BA7021	180p
BA7022	350p
BA7025L	100p
BA7107	475p
BA7212S	200p
BA7252S	150p
BA7604N	100p
BA7751LS	150p
BA7752	250p
BA7755	150p
BA7767AS	155p
BA8504	350p
BA15218	60p
CA3140E	38p
CNX62A	50p
CNX82A	60p
CNX83A	80p
CX136	600p
CX139A	750p
CX141	750p
CX145	725p
CX150B	325p
CX175	325p
CX187	825p
CX804A	775p
CX867	575p
CX868	525p
CX877	300p
CX7925B	550p
CXA2001SA	600p
CXA20106A	75p
CX20109	140p
CX20187	700p
CXA1001AP	1600p
CXA1019P	150p
CXA1019S	225p
CXA1044P	550p
CXA1044BP	475p
CXA1081	275p
CXA1081M	250p
CXA1081S	300p
CXA1082AS	1000p
CXA1191M	250p
CSA1209P	400p
FT5754M	600p
FT5764M	250p
HA1124	125p
HA1125	120p
HA1137W	150p
HA1151	175p
HA1197	130p
HA1199	130p
HA1201	225p
HA1202	125p
HA1319	200p
HA1338	300p
HA1339A	350p
HA1367	300p
HA1377	120p
HA1384	600p
HA1388	320p
HA1389	210p
HA1392	120p
HA1394	170p
HA1396	650p
HA1397	200p
HA1398	175p
HA1406	120p
HA11123	350p
HA11211	170p
HA11215	350p
HA11219	280p
HA11221	180p
HA11225	130p
HA11235	100p
HA11244	375p
HA11247	375p
HA11251	120p
HA11412	600p
HA11414	300p
HA11423	110p
HA11440	250p
HA11485BN	400p
HA11702	330p
HA11703	400p
HA11706	280p
HA11710	500p
HA11713	250p
HA11715	250p
HA11716	480p
HA11718	700p
HA11724	850p
HA11741NT	950p
HA11744	330p
HA11745	330p
HA11749	350p
HA11751	1500p
HA11752	325p
HA11839NT	375p
HA11847	700p
HA12002	220p
HA12003	150p
HA12005	180p
HA12010	300p
HA12016	120p
HA12017	100p
HA12026	125p
HA12038NT	140p
HA12044	350p
HA12045	280p
HA12047	450p
HA12058	320p
HA12088	375p
HA12116	130p
HA12411	175p
HA12412	175p
HA12413	70p
HA12430	200p



PLEASE PHONE US FOR TYPES NOT LISTED AS WE HAVE OVER 50,000 ITEMS IN STOCK. QUOTATIONS GIVEN FOR LARGE QUANTITIES



LINEAR ICs

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
HA13001	650p	LA2800	350p	LA7096	200p	LF353	48p	MC3302	50p	SAB3029	525p	STK3102 II	530p	STK5478	380p	STR16006	500p	TA7281	200p
HA13002	200p	LA3120	200p	LA7113	275p	LF355	60p	MC3401	45p	SAB3035	275p	STK3106	2500p	STK5479	300p	STR17006	500p	TA7282	160p
HA13006	400p	LA3150	200p	LA7116	125p	LF357	70p	MC3423P	100p	SAB3036	725p	STK3122 III	725p	STK5481	470p	STR20005	450p	TA7210	200p
HA13007	300p	LA3160	120p	LA7123	1300p	LF398	300p	MC3488AP	250p	SAB3037	700p	STK3152 II	900p	STK5482	285p	STR20012	450p	TA7283	200p
HA13108	280p	LA3161	40p	LA7210	60p	LH2426S	600p	MC34063AP	300p	SAB3042	825p	STK3156	500p	STK5483	440p	STR20015	450p	TA7284P	400p
HA13117	175p	LA3210	65p	LA7212	150p	LM301	26p	MN1220T	600p	SAB3064	130p	STK4017	400p	STK5486	450p	STR30110	330p	TA7288	220p
HA13118	140p	LA3226	60p	LA7214	150p	LM311	35p	MN1226	450p	SAB3209	225p	STK4019	480p	STK5487	525p	STR30115	275p	TA7291P	200p
HA13119	140p	LA3246	75p	LA7220	125p	LM319	165p	MN1228	600p	SAB3210	250p	STK4021	380p	STK5488	480p	STR30120	400p	TA7292P	325p
HA13127	350p	LA3300	140p	LA7222	110p	LM324	30p	MN1276	1300p	SAB6456	125p	STK4024 II	550p	STK5490	450p	STR30123	450p	TA7294P	450p
HA13128	400p	LA3301	110p	LA7224	150p	LM335Z	120p	MN1280	70p	SAB8048	225p	STK4025	530p	STK5632	450p	STR30125	550p	TA7299	200p
HA13130	450p	LA3361	100p	LA7225	250p	LM339	35p	MN3004	600p	SAB8051AP	700p	STK4026	480p	STK5720	400p	STR30130	250p	TA7302P	75p
HA13135	500p	LA3365	70p	LA7292	275p	LM348	50p	MN3005	2000p	SDA2003	450p	STK4028	550p	STK5725	450p	STR40090	350p	TA7303	70p
HA13139	600p	LA3370	70p	LA7294	200p	LM358	45p	MN3011	4000p	SDA2004	325p	STK4032 II	1050p	STK5730	450p	STR40115	600p	TA7307	100p
HA13150A	1150p	LA3373	70p	LA7295	160p	LM380	80p	MN3101	110p	SDA2005	700p	STK4034 X	925p	STK6316	300p	STR41090	330p	TA7310	100p
HA13151	875p	LA3375	300p	LA7297	120p	LM381	150p	MN3102	110p	SDA2007	300p	STK4036	470p	STK6324B	500p	STR43111	950p	TA7312	120p
HA13403	400p	LA3376	80p	LA7305A	350p	LM382	130p	MN3207	375p	SDA2008	400p	STK4038	680p	STK6327	1200p	STR44115	475p	TA7313	70p
HA13406W	400p	LA3380	300p	LA7308	70p	LM386	60p	MN3208	950p	SDA2112	450p	STK4040 II	650p	STK6328A	800p	STR45111	550p	TA7314	175p
HA13408	350p	LA3390	250p	LA7311	200p	LM387	100p	MN6030B	350p	SDA2120	200p	STK4042 II	800p	STK6431	850p	STR50020	350p	TA7315	200p
HA13412	600p	LA3400	250p	LA7320	120p	LM389N	105p	MN6163A	700p	SDA2131	225p	STK4044	950p	STK6607	400p	STR50092	550p	TA7317P	120p
HA13426	500p	LA3401	90p	LA7323	325p	LM393	45p	MTA001M	600p	SDA2208	450p	STK4046	950p	STK6722	725p	STR50103A	260p	TA7320P	200p
HA13432	400p	LA3410	150p	LA7330	350p	LM431	50p	NE555	20p	SDA4212	775p	STK4048	1280p	STK6732	1000p	STR50113	500p	TA7322	130p
HA13441	450p	LA3430	135p	LA7331	250p	LM710	45p	NE556	40p	SDA5241	725p	STK4050 II	1600p	STK6822	900p	STR50115	500p	TA7323	80p
HA17524	250p	LA3600	60p	LA7332	225p	LM723	40p	NE558	80p	SDA5243-2	450p	STK4060	510p	STK6922	1000p	STR51041	500p	TA7234	75p
KA2102	100p	LA3605	100p	LA7340	300p	LM741DIL	18p	NE565	110p	SDA5343	1450p	STK4065	650p	STK6932	525p	STR50213	500p	TA7325	90p
KA2130	150p	LA3607	125p	LA7376	150p	LM741MET	45p	NE567	115p	SDA5640	200p	STK4101	500p	STK6962	275p	STR53041	400p	TA7326	200p
KA2131	110p	LA4030	180p	LA7391	550p	LM747	55p	NE571	290p	SDA5642	450p	STK4111	500p	STK6972	490p	STR54041	320p	TA7328	110p
KA2206	150p	LA4031	140p	LA7520	200p	LM1017	200p	NE592	85p	SGSF444	500p	STK4112	500p	STK6981B	600p	STR55041	450p	TA7330P	80p
KA2209	125p	LA4032	140p	LA7530	200p	LM1035N	350p	NE5532P	140p	SGFS465	500p	STK4121	480p	STK6982	600p	STR56041	550p	TA7331P	80p
KA2210	230p	LA4051	160p	LA7535	175p	LM1040N	650p	SAA1000	350p	SLA4031	750p	STK4122	560p	STK6982H	600p	STR58041	250p	TA7333	100p
KA2212	65p	LA4100	85p	LA7545	160p	LM1203	225p	SAA1004	650p	SLA7020M	450p	STK4131	480p	STK7216	420p	STR59041	300p	TA7335	85p
KA2213	130p	LA4101	80p	LA7550	275p	LM1203AN	225p	SAA1005	325p	STA301A	200p	STK4132 II	600p	STK7217	400p	STR60001	525p	TA7336	180p
KA2214	100p	LA4102	100p	LA7555	150p	LM1875T	330p	SAA1006	300p	STA341M	180p	STK4133 II	750p	STK7225	500p	STR80145	475p	TA7337P	175p
KA2224	50p	LA4110	120p	LA7620	500p	LM1881N	375p	SAA1008	450p	STA401A	220p	STK4141 II	420p	STK7226	600p	STR81145	375p	TA7339P	175p
KA2244	75p	LA4120	270p	LA7680	675p	LM1886	250p	SAA1010	400p	STA403A	270p	STK4142	530p	STK7251	500p	STR90120	425p	TA7341	250p
KA2261	100p	LA4138	105p	LA7681	650p	LM1889	300p	SAA1024	250p	STA405A	280p	STK4147 II	1450p	STK7253	450p	STRD1206	500p	TA7342P	70p
KA2263	100p	LA4140	60p	LA7710	250p	LM1894N	200p	SAA1025	250p	STA431A	250p	STK4151	680p	STK7308	350p	STRD1406	600p	TA7343	120p
KA2264	100p	LA4142	65p	LA7800	90p	LM1895N	275p	SAA1026	400p	STA432A	220p	STK4152	650p	STK7309	400p	STRD1706	360p	TA7347P	120p
KA2284	75p	LA4145	65p	LA7801	100p	LM2901N	35p	SAA1027	400p	STA434A	270p	STK4161	650p	STK7310	470p	STRD1806	360p	TA7348P	125p
KA2309	175p	LA4160	100p	LA7802	300p	LM2902N	40p	SAA1029	150p	STA435A	270p	STK4162	550p	STK7348	400p	STRD1816	350p	TA7349P	175p
KA2401	150p	LA4162	110p	LA7806	260p	LM2903N	40p	SAA1042	325p	STA441C	220p	STK4164 II	1175p	STK7356	425p	STRD1906	550p	TA7354P	65p
KA2412	225p	LA4178	150p	LA7808	250p	LM3900	40p	SAA1043P	675p	STA451C	280p	STK4171	900p	STK7358	440p	STRD3035	300p	TA7357	340p
KA2912	125p	LA4180	150p	LA 7820	100p	LM3909	100p	SAA1044	400p	STA456C	240p	STK4172 II	680p	STK7402	560p	STRD4412	500p	TA7358	85p
KA2913A	175p	LA4182	180p	LA7823	200p	LM3911N	200p	SAA1056	300p	STA471	210p	STK4181	680p	STK7404	600p	STRD4420	550p	TA7359P	90p
KA2914A	200p	LA4190	300p	LA7824	130p	LM3914	160p	SAA1057	375p	STA901M	280p	STK4182 II	750p	STK7406	650p	STRD4512	400p	TA7361	125p
KA22427	100p	LA4192	140p	LA7830	90p	LM3915	160p	SAA1058	225p	STK0025	420p	STK4191	700p	STK7408	675p	STRD5441	475p	TA7362	150p
KIA6213S	60p	LA4200	130p	LA7831	85p	LM3916	270p	SAA1060	375p	STK0029	1000p	STK4192	700p	STK7410	1500p	STRD5541	450p	TA7364P	175p
KIA6210AH	400p	LA4201	120p	LA7832	130p	LM8363	320p	SAA1061	250p	STK0039	600p	STK4211 II	1000p	STK7458	1250p	STRD6008	575p	TA7366P	65p
KIA6281H	250p	LA4260	230p	LA7835	150p	LM8560	175p	SAA1062	250p	STK0040	520p	STK4211 V	800p	STK7554	600p	STRD6009E	450p	TA7368P	35p
KIA6283K	150p	LA4261	300p	LA7837	150p	LM13600	150p	SAA1063	250p	STK0049	510p	STK4221 II	1200p	STK7561	650p	STRD6018	450p	TA7373F	150p
KIA6299H	210p	LA4265	125p	LA7838	200p	LM13700	125p	SAA1064	275p	STK0050	440p	STK4231 II	1050p	STK7562	1000p	STRD6602	475p	TA7374	175p
KIA7227CP	200p	LA4270	300p	LA7850	225p	LM18293	500p	SAA1070	550p	STK0059	620p	STK4241	1050p	STK7563	800p	STRD6601	650p	TA7376P	100p
KIA7313	45p	LA4282	350p	LA7851	200p	M491BB1	800p	SAA1073	325p	STK0060	820p	STK4241 V	1250p	STK7573	400p	STRM6545	900p	TA7378P	60p
L149V	300p	LA4420	140p	LA7910	150p	M494B1	700p	SAA1075	350p	STK0070	1100p	STK4272	500p	STK7576	1500p	STRM6546	900p	TA7401	250p
L165V	250p	LA4422	130p	LA7913	90p	M5265P	200p	SAA1086	175p	STK0080	1000p	STK4273	550p	STK7703	1000p	STRM6549	500p	TA7402P	200p
L200	200p	LM4425A	200p	LA7930	350p	M50115P	320p	SAA1089	325p	STK011	330p	STK4301	500p	STK8050	1600p	STRS5741	800p	TA7403	325p
L272	200p	LA4430	130p	LA7940	200p	M50117P	500p	SAA1101	700p	STK015	440p	STK4311	650p	STK8250	500p	STRS5941	750p	TA7404	150p
L272M	110p	LA4440	200p	LA7953	300p	M50119P	525p	SAA1124	200p	STK016	760p	STK4332	365p	STK8260	1200p	STRS6307	600p	TA7405P	200p
L290B	225p	LA4445	200p	LA9200	300p	M50422P	750p	SAA1130	550p	STK025	650p	STK4352	500p	STK8280	1850p	STRS6308	600p	TA7411AP	150p
L291B	300p	LA4446	170p	LB1205	170p	M50461	350p	SAA1250	280p	STK050	1600p	STK4362	450p	STK73405 II	550p	STRS6309	600p	TA7415P	350p
L292	750p	LA4460	120p	LB1216	150p	M50784	300p	SAA1251	380p	STK077	520p	STK4372	600p	STK73410	350p	STRS6707	1000p	TA7417AP	225p
L293B	225p	LA4461	120p	LB1258	100p	M50786	500p	SAA1271	400p	STK078	1800p	STK4392	500p	STK7340 II	500p	STRS6708	575p	TA7521P	350p
L293C	325p	LA4466	225p	LB1268	70p	M50790	600p	SAA1274	280p	STK080	550p	STK4412	450p	STK73605	375p	TA7054	190p	TA7607	200p
L293D	225p	LA4470	300p	LB1274	85p	M51014L	120p	SAA1290	750p	STK082	2000p	STK4432	600p	STK73907	700p	TA7061	115p	TA7608	360p
L293E	250p	LA4475	225p	LB1290	120p	M51143AL	110p	SAA1293	550p	STK084	600p	STK4773	820p	STK78617	2400p	TA7062	200p	TA7609	170p
L294	475p	LA4476	225p	LB1292	110p	M51161	300p	SAA1294	800p	STK085	900p	STK4793	800p	STR370	300p	TA7066	120p	TA7611	210p
L295	450p	LA4480	225p	LB1405	70p	M51161P	250p	SAA1300	200p	STK086	1000p	STK4803	1000p	STR371	400p	TA7075P	300p	TA7612	300p
L297	525p	LA4485	300p	LB1407	130p	M51162P	250p	SAA1310	200p	STK0100	900p	STK4813	800p	STR380	350p	TA7089	300p	TA7613AP	90p
L298	400p	LA4495	250p	LB1409	200p	M51164AL	80p	SAA1350	275p	STK0100II	1200p	STK4833	850p	STR381	390p	TA7102P	500p	TA7614	170p
L465A	525p	LA4496	250p	LB1412	300p	M51166P	300p	SAA1351	750p	STK420	400p	STK4843	720p	STR383	410p	TA7119	150p	TA7616	300p
L482	400p	LA4498	275p	LB1415	100p	M51182L	110p	SAA1900S	475p	STK430	500p	STK4853	1700p	STR384	350p	TA7120	55p	TA7621	300p
L497B	525p	LA4500	200p	LB1416	85p	M51191L	85p	SAA3004	400p	STK433	400p	STK4863	700p	STR440	800p	TA7124	250p	TA7622	420p
L702B	400p	LA4505	220p	LB1426	125p	M51231P	200p	SAA3006P	225p	STK435	375p	STK4873	1100p	STR441	950p	TA7130P	85p	TA7628	110p
L702N	325p	LA4508	200p	LB1450	110p	M51308SP	550p	SAA3007P	130p	STK436	430p	STK4893	1000p	STR442	1600p	TA7137	60p	TA7629	220p
L2720	150p	LA4510	100p	LB1615	270p	M51310AP	900p	SAA3008P	200p	STK437	600p	STK4913	900p	STR450A	700p	TA7140	100p	TA7630	200p
L2722	175p	LA4520	170p	LB1620	210p	M51316P	300p	SAA3010P	300p	STK439	500p	STK5314	475p	STR451	800p	TA7141	825p	TA7632	400p
L4960	325p	LA4550	200p	LB1622	220p	M51320	200p	SAA3027P	375p	STK441	680p	STK5315	500p	STR452	600p	TA7150P	250p	TA7640	90p
L6203	600p	LA4555	120p	LB1630	80p	M51356P	400p	SAA3049P	550p	STK443	700p	STK5322	500p	STR453	500p	TA7157	100p	TA7641	140p
L6210	250p	LA4557	150p	LB1639	300p	M51358P	150p	SAA4700	425p	STK457	470p	STK5323	800p	STR454	1300p	TA7172P	150p	TA7642	480p
L6221AS	300p	LA4558	125p	LB1640	150p	M51365P	350p	SAA5000	200p	STK459	560p	STK5324	450p	STR455	550p	TA7193	320p	TA7645P	65p
L6506	300p	LA4570	130p	LB1641	75p	M51366P	360p	SAA5010	220p	STK460	660p	STK5325	370p	STR456	470p	TA7200	200p	TA7646AP	450p
LA1130	240p	LA4571	175p	LB1642	150p	M51381P	200p	SAA5012	400p	STK461	600p	STK5326	750p	STR457	600p	TA7205	1200p	TA7679	475p
LA1135	120p	LA4581	175p	LB1645	100p	M51384AP	750p	SAA5020	350p	STK463	950p	STK5330	850p	STR470	400p	TA7207	150p	TA7680AP	200p
LA1145	200p	LA4597	125p	LB1648	200p	M51387P	600p	SAA5030	440p	STK465	900p	STK5331	300p	STR1096	275p	TA7208	125p	TA7681AP	425p
LA1150	150p	LA4620	400p	LB1649	190p	M51392P	300p	SAA5040A	280p	STK501	550p	STK5332	180p	STR1195	350p	TA7210	200p	TA7687AP	100p
LA1170	90p	LA4630	325p	LB3500	125p	M51393AP	350p	SAA5040B	400p	STK561	450p	STK5333	650p	STR1229	325p	TA7214	220p	TA7644BP	480p
LA1177	130p	LA4700	350p	LC4966	65p	M51395AP	450p	SAA5041	550p	STK563	415p	STK5335	350p	STR2005	400p	TA7217	145p	TA7645P	65p
LA1180	75p	LA4705	400p	LC7011	500p	M51397AP	425p	SAA5042	425p	STK583	500p	STK5336	350p	STR2012	400p	TA7220	220p	TA7658	100p
LA1185	150p	LA5005	90p	LC7060	600p	M51436P	350p	SAA5050	650p	STK760	600p	STK5337	500p	STR2013	300p	TA7222	90p	TA7659P	400p
LA1186	35p	LA5112	200p	LC7120	350p	M51496P	275p	SAA5051	400p	STK770	400p	STK5338	295p	STR2015	550p	TA7223	210p	TA7660P	325p
LA1201	75p	LA5511	50p	LC7130	300p	M51533	300p	SAA5052	500p	STK772	650p	STK5339	400p	STR2024	575p	TA7225	300p	TA7666P	100p
LA1205	75p	LA5512	50p	LC7131	260p	M51544	150p	SAA5054	500p	STK772B	480p	STK5340	350p	STR2105	600p	TA7226	290p	TA7668	100p
LA1207	120p	LA5522	45p	LC7132	400p	M51848	150p	SAA5230	850p	STK780	575p	STK5342	245p	STR2124	675p	TA7227	700p	TA7672	400p
LA1210	140p	LA5523	150p	LC7137	450p	M54523P	200p	SAA5231	170p	STK795	450p	STK5343	380p	STR3105	525p	TA7230	100p	TA7676AP	450p
LA1222	80p	LA5524	80p	LC7181	350p	M54563P	200p	SAA5240PA	600p	STK1039	460p	STK5353	400p	STR3113	225p	TA7232	95p	TA7679	475p
LA1230	130p	LA5527	150p	LC7185	350p	M58494	500p	SAA5243PE	360p	STK1040	640p	STK5361	375p	STR3115	400p	TA7233	120p	TA7680AP	200p
LA1235	130p	LA5530	65p	LC7191	300p	M51516	260p	SAA5244AP	950p	STK1049	700p	STK5362	400p	STR3123	400p	TA7237	300p	TA7681AP	425p
LA1240	80p	LA5531	65p	LC7207	275p	M51518	200p	SAA5246AP	380p	STK1050	650p	STK5372	260p	STR3125	480p	TA7238	400p	TA7687AP	100p
LA1245	110p	LA5537	45p	LC7215	160p	M51995P	250p	SAA5246P	750p	STK1060	700p	STK5373	375p	STR3130	500p	TA7240	160p	TA7688	150p
LA1260	75p	LA5655	175p	LC7217	350p	M51977P	300p	SAA5250P	750p	STK1070	850p	STK5391	375p	STR3135	250p	TA7241	185p	TA7698	400p
LA1261	75p	LA5658	225p	LC7218	250p	M52307P	900p	SAA5351	375p	STK1080	940p	STK5392	500p	STR3212	275p	TA7242	190p	TA7699	600p
LA1265	125p	LA5665	250p	LC7230	700p	M54646AP	400p	SAA7000	550p	STK2025	620p	STK5421	450p	STR3214	275p	TA7243	320p	TA7705	300p
LA1266	130p	LA5667	200p	LC7267	550p	MB3708	275p	SAA7020	600p	STK2028	500p	STK5422	375p	STR3215	275p	TA7245	225p	TA7709P	150p
LA1267	150p	LA5700	300p	LC7351	200p	MB3712	600p	SAA7210P	1300p	STK2029	480p	STK5431	550p	STR3315	275p	TA7245BPO	200p	TA7719P	200p
LA1354	225p	LA6339	35p	LC7364	200p	MB3713	130p	SAA7220PA	550p	STK2030	1000p	STK5434	570p	STR4090A	650p	TA7248P	575p	TA7727P	125p
LA1363	90p	LA6355	50p	LC7432	425p	MB3714	225p	SAA7274P	600p	STK2038	700p	STK5436	500p	STR4142	450p	TA7250B	325p	TA7750	200p
LA1364	200p	LA6510	150p	LC7522	350p	MB3715	250p	SAA7280P	1450p	STK2048	950p	STK5441	400p	STR4211	315p	TA7251BP	325p	TA7757	200p
LA1365	120p	LA6515	150p	LC7535	300p	MB3722	200p	SAA9050	450p	STK2058IV	1600p	STK5443	575p	STR4512	400p	TA7256P	225p	TA7769	130p
LA1368	220p	LA6520	175p	LC7537AN	400p	MB3730	900p	SAA9057	475p	STK2101	1050p	STK5446	350p	STR5015	500p	TA7259P	225p	TA7772P	150p
LA1369	200p	LA6531	250p	LC7537N	450p	MB3731	220p	SAB0600	600p	STK2110	550p	STK5451	390p	STR5100	550p	TA7262P	400p	TA7784	250p
LA1385	170p	LA7007	400p	LC7560	750p	MB3732	240p	SAB0601	525p	STK2125	580p	STK5461	500p	STR5214	475p	TA7263P	325p	TA7792P	250p
LA1503	120p	LA7011	220p	LC7565	300p	MB3735	400p	SAB0602	625p	STK2129	750p	STK5462	500p	STR5315	575p	TA7265AP	300p	TA7796P	75p
LA1805	175p	LA7016	45p	LC7582E	300p	MB3756	160p	SAB1009BP	225p	STK2139	675p	STK5464	300p	STR5412	280p	TA7267	220p	TA8101N	230p
LA1810	130p	LA7018	100p	LC7800	175p	MB3759	200p	SAB1016	600p	STK2155	900p	STK5466	500p	STR6020	270p	TA7267BP	120p	TA8105N	140p
LA1851	300p	LA7019	130p	LC7815H	175p	MB3771	110p	SAB1046P	350p	STK2230	470p	STK5467	400p	STR7001	600p	TA7269	260p	TA8110AP	110p
LA2000	150p	LA7033	400p	LC7818	280p	MB3773	110p	SAB2015P	525p	STK2240	740p	STK5468	300p	STR9005	400p	TA7270	170p	TA8119P	70p
LA2001	200p	LA7042	280p	LC7820	325p	MB8719	360p	SAB2016P	150p	STK2250	650p	STK5471	900p	STR9012	300p	TA7271	220p	TA8122AN	250p
LA2101	270p	LA7046	300p	LC7821N	250p	MC1391	120p	SAB2022P	525p	STK3041	370p	STK5472	375p	STR10006	450p	TA7272	260p	TA8127N	100p
LA2110	150p	LA7051	130p	LC7822N	160p	MC1455	45p	SAB3012	675p	STK3042	375p	STK5473	480p	STR11006	325p	TA7273	300p	TA8132AN	200p
LA2200	190p	LA7053	130p	LC7881B	135p	MC1488	35p	SAB3013	200p	STK3044	950p	STK5474	500p	STR12006	450p	TA7274	210p		
LA2205	150p	LA7054	350p	LC7881M	325p	MC1489	35p	SAB3017	320p	STK3062	500p	STK5476	350p	STR13006	500p	TA7279P	325p		
LA2211	350p	LA7060	150p	LF347	110p	MC1496	65p	SAB3021	450p	STK3082	550p	STK5477	450p	STR15006	500p	TA7280	190p		

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Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
TA8164P	100p	TDA1180	120p	TDA2760	400p	TDA4661	225p	TDA8391	675p	UPC1004C	130p	2SA771	90p	2SA1177	25p	2SB561	30p	2SC738	15p
TA8184P	350p	TDA1185A	190p	TDA2780	600p	TDA4670	475p	TDA8395	360p	UPC1009	950p	2SA773	50p	2SA1179	20p	2SB562	20p	2SC739	150p
TA8189P	130p	TDA1190	80p	TDA2791	275p	TDA4680	350p	TDA8405	550p	UPC1018	170p	2SA777	35p	2SA1182	20p	2SB564	15p	2SC761	110p
TA8200AH	325p	TDA1200B	80p	TDA2795	150p	TDA4685	275p	TDA8415	650p	UPC1020	200p	2SA778	100p	2SA1184	120p	2SB566	90p	2SC762	150p
TA8201AK	300p	TDA1220	50p	TDA2822M	60p	TDA4700A	750p	TDA8416	625p	UPC1023	60p	2SA781	150p	2SA1185	200p	2SB596	50p	2SC783	85p
TA8205	220p	TDA1235	300p	TDA2824	85p	TDA4714C	350p	TDA8417	550p	UPC1024H 2	75p	2SA786	25p	2SA1186	500p	2SB598	30p	2SC790	50p
TA8207K	175p	TDA1236	240p	TDA2840	200p	TDA4716C	450p	TDA8421	300p	UPC1025	230p	2SA794	50p	2SA1198	40p	2SB600	500p	2SC792	380p
TA8210	260p	TDA1251	150p	TDA3047	100p	TDA4718A	250p	TDA8425	500p	UPC1026	95p	2SA798	30p	2SA1201	40p	2SB601	60p	2SC805	225p
TA8211AH	200p	TDA1270	150p	TDA3048	130p	TDA4725	750p	TDA8432	550p	UPC1028	90p	2SA812	15p	2SA1202	25p	2SB605	25p	2SC828	20p
TA8214K	260p	TDA1327	200p	TDA3082	200p	TDA4800	300p	TDA8433	600p	UPC1031H	150p	2SA814	60p	2SA1204	225p	2SB631	40p	2SC829	15p
TA8215	300p	TDA1405	50p	TDA3083	200p	TDA4810	500p	TDA8440	300p	UPC1032	60p	2SA816	70p	2SA1206	60p	2SB632	45p	2SC839	20p
TA8216H	300p	TDA1410	220p	TDA3190	100p	TDA4814A	300p	TDA8442	200p	UPC1035C	110p	2SA817	20p	2SA1207	25p	2SB633	80p	2SC867	900p
TA8217P	120p	TDA1412	35p	TDA3301B	1600p	TDA4850	475p	TDA8443	350p	UPC1043C	125p	2SA825	20p	2SA1208	70p	2SB641	12p	2SC870	100p
TA8220AH	500p	TDA1506	275p	TDA3310	120p	TDA4851	325p	TDA8444	200p	UPC1158H	70p	2SA836	20p	2SA1209	100p	2SB647	20p	2SC897	175p
TA8221AH	600p	TDA1508	175p	TDA3410	150p	TDA4852	325p	TDA8451	325p	UPC1161	110p	2SA837	200p	2SA1210	120p	2SB648	45p	2SC900B	30p
TA8225H	475p	TDA1510	170p	TDA3420	200p	TDA4860	200p	TDA8452	200p	UPC1167	125p	2SA839	110p	2SA1215	600p	2SB649	35p	2SC930	15p
TA8225L	475p	TDA1512	140p	TDA3501	300p	TDA4866	275p	TDA8453	350p	UPC1170	150p	2SA841	20p	2SA1216	550p	2SB673	100p	2SC936	300p
TA8227	250p	TDA1514A	325p	TDA3502	360p	TDA4881	200p	TDA8461	950p	UPC1173	200p	2SA844	20p	2SA1217	100p	2SB676	85p	2SC941	15p
TA8229K	200p	TDA1515A	200p	TDA3504	300p	TDA4935	300p	TDA8490	225p	UPC1176C	120p	2SA847	25p	2SA1220	75p	2SB688	90p	2SC944	140p
TA8400P	200p	TDA1516Q	350p	TDA3505	275p	TDA4940	200p	TDA8540	250p	UPC1178H	250p	2SA854	30p	2SA1221	70p	2SB703	90p	2SC945	10p
TA8410K	200p	TDA1517	150p	TDA3506	260p	TDA4942	200p	TDA8702	275p	UPC1180C	200p	2SA861	45p	2SA1222	50p	2SB705	200p	2SC950	40p
TA8410P	200p	TDA1519	200p	TDA3507	450p	TDA4944	175p	TDA8703	500p	UPC185H2	400p	2SA872	25p	2SA1226	25p	2SB707	200p	2SC959	225p
TA8432	200p	TDA1519A	200p	TDA3510	200p	TDA4950	100p	TDA8708	600p	UPC1186	80p	2SA872A	50p	2SA1227	250p	2SB716	20p	2SC980	40p
TA8605N	350p	TDA1520	275p	TDA3520	250p	TDA5030A	100p	TDA8730	225p	UPC1187	150p	2SA879	30p	2SA1232	180p	2SB718	60p	2SC982	20p
TA8606N	350p	TDA1521	210p	TDA3530	250p	TDA5140A	200p	TDA8732	300p	UPC1188H	350p	2SA884	100p	2SA1237	25p	2SB727	100p	2SC983	120p
TA8607P	320p	TDA1522	110p	TDA3540	200p	TDA5330T	300p	TDA8735	175p	UPC1191	300p	2SA885	35p	2SA1238	30p	2SB733	75p	2SC1000	20p
TA8611AN	250p	TDA1524	200p	TDA3541	175p	TDA5331T	200p	TDA8740	625p	UPC1197	140p	2SA886	45p	2SA1239	30p	2SB734	35p	2SC1001	950p
TA8615N	480p	TDA1526	225p	TDA3560	260p	TDA5332T	150p	TDA8741	550p	UPC1198H	200p	2SA887	20p	2SA1240	45p	2SB737	20p	2SC1008	20p
TA8628N	350p	TDA1534	2000p	TDA3561	300p	TDA5500	400p	TDA8808T	325p	UPC1210	150p	2SA893	15p	2SA1242	80p	2SB739	22p	2SC1010	225p
TA8631	500p	TDA1540	420p	TDA3561A	300p	TDA5600	450p	TDA8809T	350p	UPC1215V	125p	2SA896	25p	2SA1244	120p	2SB744	55p	2SC1012	75p
TA8632N	550p	TDA1541	500p	TDA3562	260p	TDA5660P	250p	TDA9045	300p	UPC1222	130p	2SA899	40p	2SA1245	55p	2SB750	60p	2SC1013	170p
TA8644N	425p	TDA1542	250p	TDA3562TF	300p	TDA5700	200p	TDA9080	400p	UPC1225H	220p	2SA900	45p	2SA1246	80p	2SB753	100p	2SC1014	140p
TA8646	375p	TDA1543	200p	TDA3563	350p	TDA5701	200p	TDA9102C	250p	UPC1227V	225p	2SA904	20p	2SA1248	35p	2SB754	80p	2SC1030	150p
TA8653N	1500p	TDA1552Q	350p	TDA3564	325p	TDA5708	275p	TDA9403	130p	UPC1228HA	45p	2SA907	650p	2SA1249	100p	2SB764	30p	2SC1046	250p
TA8659AN	900p	TDA1553AQ	325p	TDA3565	220p	TDA5709	375p	TDA9500	750p	UPC1230	200p	2SA909	500p	2SA1252	20p	2SB765	70p	2SC1047	20p
TA8690N	700p	TDA1555Q	375p	TDA3566	280p	TDA5800	850p	TDA9503	550p	UPC1237HA	70p	2SA912	70p	2SA1253	30p	2SB772	25p	2SC1050	280p
TA8691N	450p	TDA1557Q	300p	TDA3567	350p	TDA5820	370p	TDA9513	225p	UPC1238	120p	2SA913	100p	2SA1256	30p	2SB774	50p	2SC1051	250p
TA8701AN	275p	TDA1558Q	300p	TDA3569	300p	TDA5832	125p	TDA9800	225p	UPC1241H	150p	2SA914	90p	2SA1257	30p	2SB775	100p	2SC1061	85p
TA8718N	550p	TDA1560Q	675p	TDA3570	375p	TDA5850	175p	TDA9821	200p	UPC1242H	150p	2SA915	30p	2SA1258	70p	2SB776	110p	2SC1069	175p
TA8720	525p	TDA1571	300p	TDA3580	300p	TDA5930	225p	TEA0652	150p	UPC1245V	130p	2SA916	30p	2SA1261	150p	2SB788	35p	2SC1070	65p
TA8739P	450p	TDA1572	175p	TDA3586	750p	TDA6100Q	150p	TEA0653T	80p	UPC1270H	250p	2SA921	40p	2SA1262	110p	2SB791	130p	2SC1079	300p
TA8872N	450p	TDA1574	125p	TDA3590	250p	TDA6101Q	120p	TEA0655	300p	UPC1274V	250p	2SA928A	25p	2SA1263	280p	2SB794	40p	2SC1080	225p
TAA550	25p	TDA1576	170p	TDA3591	360p	TDA6111Q	225p	TEA0665	300p	UPC1277	240p	2SA933	30p	2SA1264	280p	2SB795	45p	2SC1096	40p
TBA120S	40p	TDA1578A	210p	TDA3592A	300p	TDA6200	750p	TEA1002	650p	UPC1278	240p	2SA934	30p	2SA1265	200p	2SB810	15p	2SC1098	120p
TBA396	70p	TDA1579	130p	TDA3601Q	375p	TDA6600-2	700p	TEA1007	120p	UPC1288V	230p	2SA935	40p	2SA1283	50p	2SB816	160p	2SC1106	180p
TBA520	120p	TDA1589	275p	TDA3602	225p	TDA6610-2	1100p	TEA1009	100p	UPC1297CA	325p	2SA937	20p	2SA1284	60p	2SB817	175p	2SC1114	415p
TBA530	100p	TDA1591	275p	TDA3611	450p	TDA6612-2	900p	TEA1015P	110p	UPC1298	320p	2SA939	140p	2SA1286	60p	2SB819	60p	2SC1115	280p
TBA540	90p	TDA1596	200p	TDA3640	350p	TDA7000	170p	TEA1017	280p	UPC1313H A	100p	2SA940	50p	2SA1289	50p	2SB822	40p	2SC1116	290p
TBA560	90p	TDA1598	160p	TDA3645	400p	TDA7010T	120p	TEA1019	130p	UPC1316C	70p	2SA942	60p	2SA1290	150p	2SB824	60p	2SC1124	270p
TBA800	40p	TDA1600	200p	TDA3651	200p	TDA7020T	175p	TEA1024	150p	UPC1318	300p	2SA949	70p	2SA1293	110p	2SB825	135p	2SC1161	110p
TBA810AS	40p	TDA1602A	400p	TDA3652	500p	TDA7021T	200p	TEA1035	200p	UPC1330HA	80p	2SA950	18p	2SA1294	450p	2SB826	75p	2SC1162	30p
TBA820	55p	TDA1670A	200p	TDA3652-TX10	800p	TDA7050	100p	TEA1039	150p	UPC1335V	320p	2SA951	60p	2SA1295	500p	2SB827	200p	2SC1164	600p
TBA820M	35p	TDA1675	200p	TDA3653	85p	TDA7052	120p	TEA1045	300p	UPC1350	115p	2SA952	30p	2SA1301	260p	2SB828	200p	2SC1165	750p
TBA920	100p	TDA1701	500p	TDA3654	80p	TDA7053	200p	TEA1060	225p	UPC1352C	450p	2SA953	60p	2SA1302	300p	2SB829	200p	2SC1166	100p
TBA950	100p	TDA1771	200p	TDA3654Q	85p	TDA7056	200p	TEA1061	175p	UPC1360C	200p	2SA954	30p	2SA1303	400p	2SB835	75p	2SC1170	180p
TBA990	60p	TDA1870A	200p	TDA3710	300p	TDA7057Q	225p	TEA1062	250p	UPC1362C	250p	2SA957	185p	2SA1304	110p	2SB857	80p	2SC1172	150p
TC5020	200p	TDA1872A	275p	TDA3720	175p	TDA7072	100p	TEA1064	250p	UPC1363	190p	2SA958	60p	2SA1306	110p	2SB861	110p	2SC1173	33p
TC5081AP	80p	TDA1904	80p	TDA3724	300p	TDA7077	175p	TEA1067	150p	UPC1363C	300p	2SA963	120p	2SA1307	100p	2SB863	220p	2SC1195	210p
TC5082P	170p	TDA1905	80p	TDA3725	300p	TDA7211	100p	TEA1068	350p	UPC1364C	350p	2SA965	30p	2SA1309	50p	2SB865	25p	2SC1212	35p
TC5090A	230p	TDA1908A	90p	TDA3730	400p	TDA7220	65p	TEA1080P	170p	UPC1365	250p	2SA966	25p	2SA1315	100p	2SB882	180p	2SC1213	10p
TC9125BP	410p	TDA1910	160p	TDA3740	400p	TDA7222	100p	TEA1087	40p	UPC1366C	130p	2SA968	55p	2SA1317	30p	2SB885	45p	2SC1214	15p
TC9130P	150p	TDA1940	180p	TDA3750	400p	TDA7230A	150p	TEA1101	425p	UPC1370C	300p	2SA970	25p	2SA1318	20p	2SB891	35p	2SC1215	25p
TC9134	750p	TDA1941	300p	TDA3755	425p	TDA7231A	80p	TEA1330	65p	UPC1373	85p	2SA979	35p	2SA1319	25p	2SB892	25p	2SC1216	200p
TC9135P	125p	TDA1950	175p	TDA3760	350p	TDA7233	60p	TEA1511	150p	UPC1377C	200p	2SA984	25p	2SA1320	45p	2SB895	60p	2SC1222	15p
TC9137P	500p	TDA2002	50p	TDA3765V	225p	TDA7240	175p	TEA2000	500p	UPC1378	1000p	2SA985	60p	2SA1321	80p	2SB908	70p	2SC1226	75p
TC9138AP	150p	TDA2003	65p	TDA3771	460p	TDA7241	250p	TEA2014A	80p	UPC1379C	170p	2SA988	25p	2SA1327	130p	2SB926	30p	2SC1237	250p
TC9142	320p	TDA2004	150p	TDA3780	400p	TDA7245	225p	TEA2018A	80p	UPC1382	110p	2SA991	30p	2SA1329	200p	2SB941	60p	2SC1247A	35p
TC9143	300p	TDA2005	150p	TDA3791	200p	TDA7250	400p	TEA2019	600p	UPC1384	425p	2SA992	30p	2SA1346	20p	2SB950	180p	2SC1252	850p
TC9145	150p	TDA2006	70p	TDA3800	250p	TDA7255	400p	TEA2025B	75p	UPC1387C	250p	2SA993	50p	2SA1348	45p	2SB951	190p	2SC1278	110p
TC9148	200p	TDA2007	120p	TDA3803A	500p	TDA7256	400p	TEA2028	325p	UPC1394	120p	2SA995	60p	2SA1352	100p	2SB953	90p	2SC1279	30p
TC9149	225p	TDA2008	100p	TDA3810	200p	TDA7262	325p	TEA2028B	375p	UPC1397	350p	2SA999	30p	2SA1353	100p	2SB975	100p	2SC1308K	350p
TC9150	425p	TDA2009	160p	TDA3825	150p	TDA7272	170p	TEA2029A	650p	UPC1403CA	650p	2SA1005	25p	2SA1356	100p	2SB985	30p	2SC1312	40p
TC9151P	425p	TDA2010	150p	TDA3827	110p	TDA7273	80p	TEA2029C	270p	UPC1406HA	70p	2SA1006	90p	2SA1357	65p	2SB986	40p	2SC1318	10p
TC9152	425p	TDA2020	120p	TDA3840	200p	TDA7274	45p	TEA2031A	125p	UPC1420CA	450p	2SA1008	125p	2SA1358	130p	2SB1009	110p	2SC1325	400p
TC9153	300p	TDA2030	80p	TDA3842	200p	TDA7275	75p	TEA2037	200p	UPC1421CA	650p	2SA1009	200p	2SA1359	45p	2SB1010	25p	2SC1327	20p
TC9154AP	225p	TDA2030H	100p	TDA3843	200p	TDA7282	50p	TEA2114	200p	UPC1423CA	550p	2SA1010	225p	2SA1360	45p	2SB1012	55p	2SC1328	15p
TC9156	300p	TDA2040	140p	TDA3845	225p	TDA7284	100p	TEA2117	450p	UPC1470	200p	2SA1011	80p	2SA1362	25p	2SB1015	60p	2SC1342	15p
TC9158P	450p	TDA2048	600p	TDA3856	300p	TDA7302	450p	TEA2130	350p	UPC1474HA	75p	2SA1012	85p	2SA1370	50p	2SB1016	130p	2SC1343	200p
TC9162	275p	TDA2051V	450p	TDA3857	200p	TDA7310	800p	TEA2164	160p	UPC1484CA	300p	2SA1013	100p	2SA1371	100p	2SB1017	40p	2SC1345	15p
TC9163	375p	TDA2052V	525p	TDA3950	225p	TDA7313	650p	TEA2260	225p	UPC1488H	115p	2SA1015	10p	2SA1376	30p	2SB1018	130p	2SC1346	100p
TC9164	400p	TDA2054M	110p	TDA4001	250p	TDA7318	550p	TEA2261	185p	UPC1498H	500p	2SA1016	30p	2SA1380	75p	2SB1020	120p	2SC1358	270p
TC9167P	100p	TDA2107	250p	TDA4050	150p	TDA7330A	700p	TEA2262	275p	UPC1505C	400p	2SA1018	100p	2SA1381	100p	2SB1039	65p	2SC1359	15p
TC9172P	300p	TDA2148	325p	TDA4052	500p	TDA7350	300p	TEA3717DP	160p	UPC1513HA	70p	2SA1020	30p	2SA1382	120p	2SB1066	40p	2SC1360	70p
TC9174P	325p	TDA2151	375p	TDA4060	500p	TDA7359	300p	TEA3718S	175p	UPC1514CA	200p	2SA1021	35p	2SA1385	180p	2SB1068	160p	2SC1364	25p
TC9176P	500p	TDA2170	1300p	TDA4092	250p	TDA7360	700p	TEA5030	135p	UPC1515CA	250p	2SA1023	60p	2SA1386	400p	2SB1077	180p	2SC1368	75p
TC9177P	225p	TDA2220	200p	TDA4100	150p	TDA7361	175p	TEA5040	650p	UPC1520CA	250p	2SA1026	90p	2SA1387	75p	2SB1098	80p	2SC1382	40p
TCA9940	100p	TDA2270	250p	TDA4173AF	325p	TDA7370V	325p	TEA5101A	175p	UPC1521HA	120p	2SA1029	60p	2SA1396	120p	2SB1099	75p	2SC1383	25p
TCEP100	100p	TDA2320	80p	TDA4180	145p	TDA7374V	350p	TEA5110	175p	UPC1536C	550p	2SA1036	60p	2SA1399	25p	2SB1109	40p	2SC1384	20p
TD62308AP	200p	TDA2501	300p	TDA4190	180p	TDA7770	140p	TEA5114A	200p	2SA329	75p	2SA1037	50p	2SA1400	150p	2SB1123	50p	2SC1393	20p
TD62382	200p	TDA2502	175p	TDA4200	300p	TDA8114	225p	TEA5115	220p	2SA467	40p	2SA1038	40p	2SA1423	30p	2SB1133	50p	2SC1394	15p
TD62506	200p	TDA2503	200p	TDA4210	160p	TDA8115	200p	TEA5116	220p	2SA473	29p	2SA1048	25p	2SA1428	35p	2SB1134	65p	2SC1398	55p
TD62705	250p	TDA2504	200p	TDA4260	250p	TDA8116	350p	TEA5170	200p	2SA483	90p	2SA1051	300p	2SA1441	110p	2SB1135	60p	2SC1399	100p
TD6304AP	300p	TDA2505	220p	TDA4280	320p	TDA8120B	400p	TEA5500	325p	2SA484	80p	2SA1052	15p	2SA1442	110p	2SB1140	45p	2SC1400	50p
TD6306P	350p	TDA2506	400p	TDA4282	360p	TDA8124	250p	TEA5501	225p	2SA489	50p	2SA1060	120p	2SA1443	130p	2SB1143	40p	2SC1403	500p
TD6350P	200p	TDA2507	450p	TDA4283T	450p	TDA8134	225p	TEA5550	150p	2SA490	45p	2SA1061	300p	2SA1450	30p	2SB1151	75p	2SC1407	50p
TD6359P	300p	TDA2507T	450p	TDA4290	125p	TDA8135	225p	TEA5560	130p	2SA493	25p	2SA1069	150p	2SA1459	40p	2SB1162	400p	2SC1413	150p
TDA1001	200p	TDA2510	450p	TDA4400	175p	TDA8136	225p	TEA5570	85p	2SA495	40p	2SA1073	375p	2SA1462	25p	2SB1163	370p	2SC1419	50p
TDA1002	200p	TDA2514A	500p	TDA4420	120p	TDA8137	200p	TEA5580	165p	2SA496	30p	2SA1076	230p	2SA1469	100p	2SB1168	50p	2SC1426	700p
TDA1003	150p	TDA2515	450p	TDA4421	300p	TDA8138	200p	TEA5581	200p	2SA505	120p	2SA1077	300p	2SA1475	95p	2SB1182	40p	2SC1429	50p
TDA1005A	175p	TDA2530	300p	TDA4426	170p	TDA8138A	130p	TEA5591	200p	2SA509	35p	2SA1080	125p	2SA1488	150p	2SB1185	50p	2SC1431	400p
TDA1010A	80p	TDA2532	100p	TDA4427	200p	TDA8138B	200p	TEA5620	300p	2SA537	170p	2SA1081	80p	2SA1489	300p	2SB1202	45p	2SC1444	275p
TDA1011	75p	TDA2540	150p	TDA4431	150p	TDA8139	200p	TEA5630	225p	2SA539	20p	2SA1082	80p	2SA1490	225p	2SB1203	45p	2SC1445	350p
TDA1012	120p	TDA2541	70p	TDA4433	100p	TDA8140	200p	TEA5640E	750p	2SA544	650p	2SA1083	20p	2SA1491	300p	2SB1204	45p	2SC1446	55p
TDA1013A	110p	TDA2542	110p	TDA4437	125p	TDA8143	160p	TEA5701	650p	2SA550	150p	2SA1084	100p	2SA1492	260p	2SB1205	40p	2SC1447	70p
TDA1015	85p	TDA2543	210p	TDA4439	220p	TDA8145	120p	TEA6000	400p	2SA562	30p	2SA1085	75p	2SA1493	500p	2SB1223	60p	2SC1449	120p
TDA1016	140p	TDA2544	200p	TDA4440	180p	TDA8146	200p	TEA6100	350p	2SA564	15p	2SA1091	100p	2SA1494	450p	2SB1243	40p	2SC1450	200p
TDA1020	110p	TDA2545	120p	TDA4442	240p	TDA8160	125p	TEA6200	225p	2SA571	650p	2SA1093	180p	2SA1516	280p	2SB1274	40p	2SC1454	250p
TDA1022	330p	TDA2546A	200p	TDA4443	250p	TDA8170	170p	TEA6300	500p	2SA603	100p	2SA1094	190p	2SA1519	20p	2SB1282	300p	2SC1470	120p
TDA1023	130p	TDA2548	200p	TDA4445	220p	TDA8172	200p	TEA6310T	425p	2SA606	200p	2SA1095	300p	2SA1523	45p	2SB1318	40p	2SC1472	40p
TDA1024	150p	TDA2549	300p	TDA4450	225p	TDA8173	175p	TEA6414A	425p	2SA608	15p	2SA1096	80p	2SA1535	175p	2SB1375	45p	2SC1473	15p
TDA1025	320p	TDA2555	175p	TDA4452	250p	TDA8174	200p	TEA6415B	525p	2SA614	150p	2SA1102	130p	2SA1538	55p	2SB1382	350p	2SC1474	45p
TDA1028	175p	TDA2556	230p	TDA4453	275p	TDA8175	300p	TEA6420	360p	2SA628	20p	2SA1103	130p	2SA1540	50p	2SB1468	100p	2SC1501	70p
TDA1029	200p	TDA2557	225p	TDA4480	280p	TDA8178	650p	TEA8172	125p	2SA634	50p	2SA1104	140p	2SA1598	220p	2SC182	75p	2SC1505	55p
TDA1035	160p	TDA2558	400p	TDA4481	215p	TDA8179S	750p	TL431	45p	2SA636	50p	2SA1105	250p	2SA1599	220p	2SC372	25p	2SC1507	45p
TDA1038	500p	TDA2574V	350p	TDA4482	200p	TDA8185	180p	TL494	100p	2SA639	60p	2SA1106	160p	2SA1600	250p	2SC380	10p	2SC1509	35p
TDA1041E	250p	TDA2575A	100p	TDA4500	300p	TDA8190	200p	TLO61	40p	2SA640	60p	2SA1111	90p	2SA1601	200p	2SC388A	25p	2SC1514	35p
TDA1041P	180p	TDA2577A	200p	TDA4501	280p	TDA8191	425p	TLO64	80p	2SA642	50p	2SA1112	150p	2SA1625	40p	2SC394	60p	2SC1515	60p
TDA1044	110p	TDA2578A	200p	TDA4502	400p	TDA8192	200p	TLO71	38p	2SA643	25p	2SA1115	30p	2SA1626	90p	2SC403	25p	2SC1520	45p
TDA1047	200p	TDA2579A	210p	TDA4503	325p	TDA8196	120p	TLO74	80p	2SA673	15p	2SA1120	40p	2SA1640	100p	2SC454	15p	2SC1541	110p
TDA1048	200p	TDA2582	130p	TDA4505A	300p	TDA8205	1250p	TLO83	55p	2SA677	35p	2SA1123	40p	2SA1652	70p	2SC458	10p	2SC1545	120p
TDA1053	300p	TDA2590	170p	TDA4505E	275p	TDA8213	175p	TLO84	70p	2SA678	26p	2SA1124	60p	2SA1667	175p	2SC460	10p	2SC1567	40p
TDA1054	180p	TDA2591	110p	TDA4505K	450p	TDA8214B	225p	TMP47C-434N	1250p	2SA683	25p	2SA1127	50p	2SA1668	180p	2SC461	15p	2SC1568	35p
TDA1057	60p	TDA2591Q	150p	TDA4505M	1000p	TDA8215H	300p	TPU2732	800p	2SA684	25p	2SA1133	120p	2SA1671	310p	2SC495	45p	2SC1569	55p
TDA1059B	40p	TDA2593	80p	TDA4510	200p	TDA8217	225p	TPU2735	500p	2SA699	100p	2SA1135	130p	2SA1673	425p	2SC496	25p	2SC1570	40p
TDA1060	140p	TDA2594	300p	TDA4532	200p	TDA8303	250p	UC3524	100p	2SA705	70p	2SA1141	200p	2SA1680	40p	2SC497	85p	2SC1571	50p
TDA1062	140p	TDA2595	200p	TDA4555	275p	TDA8304	400p	UC3842N	60p	2SA706	140p	2SA1142	100p	2SA1706	25p	2SC515	100p	2SC1573	25p
TDA1068	75p	TDA2600	400p	TDA4556	370p	TDA8305	500p	UC3843	125p	2SA708	50p	2SA1143	15p	2SB175	45p	2SC535	30p	2SC1576	550p
TDA1072	150p	TDA2611A	100p	TDA4557	200p	TDA8340	150p	UC3844	70p	2SA711	280p	2SA1145	40p	2SB324	40p	2SC536	20p	2SC1580	600p
TDA1074	280p	TDA2616	250p	TDA4560	270p	TDA8341	250p	UPC20C	220p	2SA715	50p	2SA1146	200p	2SB337	150p	2SC605	100p	2SC1583	25p
TDA1077	250p	TDA2630	300p	TDA4565	150p	TDA8349A	350p	UPC554	130p	2SA719	50p	2SA1151	30p	2SB474	250p	2SC619	100p	2SC1586	540p
TDA1082	275p	TDA2640	350p	TDA4566	250p	TDA7350Q	275p	UPC555	60p	2SA720	20p	2SA1152	150p	2SB492	80p	2SC641	80p	2SC1617	340p
TDA1083	95p	TDA2653A	350p	TDA4568	225p	TDA8351	200p	UPC556H	80p	2SA725	80p	2SA1153	30p	2SB511	55p	2SC644	10p	2SC1619	170p
TDA1085	170p	TDA2654	200p	TDA4570	200p	TDA8360N3	800p	UPC571	220p	2SA726	20p	2SA1154	22p	2SB525	65p	2SC647	300p	2SC1623	50p
TDA1087	60p	TDA2658	300p	TDA4580	400p	TDA8361N3	900p	UPC574	60p	2SA733	15p	2SA1156	90p	2SB527	130p	2SC681	250p	2SC1624	60p
TDA1092	100p	TDA2670	150p	TDA4600	200p	TDA8362AN	1200p	UPC575C2	90p	2SA740	90p	2SA1162	30p	2SB531	400p	2SC683	35p	2SC1626	55p
TDA1097	475p	TDA2690	100p	TDA4600II	160p	TDA8362N3	1200p	UPC577	64p	2SA742	450p	2SA1163	15p	2SB536	80p	2SC708	100p	2SC1627	15p
TDA1151	40p	TDA2710 1	400p	TDA4601	120p	TDA8366N2	1500p	UPC592	95p	2SA747A	425p	2SA1169	500p	2SB537	90p	2SC710	15p	2SC1628	75p
TDA1154	50p	TDA2721	200p	TDA4605	190p	TDA8372A	1650p	UPC595	190p	2SA748	60p	2SA1170	500p	2SB544	22p	2SC711	15p	2SC1634	50p
TDA1170	85p	TDA2730	200p	TDA4610	370p	TDA8380	200p	UPC596	190p	2SA764	200p	2SA1173	60p	2SB546	45p	2SC730	350p	2SC1667	450p
TDA1170N	85p	TDA2740	300p	TDA4650	300p	TDA8385	275p	UPC1001	220p	2SA769	80p	2SA1174	25p	2SB549	50p	2SC732	40p	2SC1669	100p
TDA1175	175p	TDA2750	200p	TDA4660	200p	TDA8390A	650p	UPC1004C	130p	2SA770	200p	2SA1175	30p	2SB560	25p	2SC735	40p	2SC1674	15p

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Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
2SC1675	90p	2SC2261	700p	2SC2719	25p	2SC3263	280p	2SC3798	220p	2SD257	195p	2SD880	40p	2SD1327	150p	2SD1763A	60p	2SK312	750p
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	35p	2SD1348	65p	2SD1773	100p	2SK332	175p
2SC1729	900p	2SC2275	50p	2SC2750	300p	2SC3277	280p	2SC3832	135p	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
2SC1735	70p	2SC2283	700p	2SC2752	75p	2SC3280	200p	2SC3851	100p	2SD348	300p	2SD898B	225p	2SD1378	60p	2SD1785	160p	2SK364	40p
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
2SC1781	20p	2SC2316	150p	2SC2791	500p	2SC3306	130p	2SC3870	200p	2SD380	650p	2SD947	100p	2SD1395	80p	2SD1827	120p	2SK405	450p
2SC1789	100p	2SC2320	10p	2SC2792	220p	2SC3307	600p	2SC388A	25p	2SD381	50p	2SD950	300p	2SD1396	120p	2SD1843	70p	2SK414	550p
2SC1809	40p	2SC2324	120p	2SC2793	700p	2SC3309	150p	2SC3883	210p	2SD382	75p	2SD951	200p	2SD1397	100p	2SD1846	350p	2SK415	500p
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	50p
2SC1819	70p	2SC2315	175p	2SC2812	40p	2SC3317	350p	2SC3885A	290p	2SD389	60p	2SD965	35p	2SD1400	280p	2SD1850	325p	2SK430	200p
2SC1826	60p	2SC2329	480p	2SC2814	40p	2SC3326	50p	2SC3886A	275p	2SD400	14p	2SD970	170p	2SD1402	120p	2SD1853	40p	2SK511	450p
2SC1827	60p	2SC2230	300p	2SC2824	75p	2SC3327	60p	2SC3890	150p	2SD401	50p	2SD972	40p	2SD1403	225p	2SD1856	40p	2SK513	325p
2SC1829	500p	2SC2331	50p	2SC2825	900p	2SC3328	50p	2SC3892A	250p	2SD402	120p	2SD973	60p	2SD1405	80p	2SD1857	75p	2SK526	160p
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	180p	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	360p	2SK552	250p
2SC1855	85p	2SC2360	120p	2SC2873	60p	2SC3355	50p	2SC3943	75p	2SD468	15p	2SD1020	40p	2SD1415	190p	2SD1881	350p	2SK553	225p
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	50p	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	2SK769	500p
2SC1941	27p	2SC2482	20p	2SC2944	300p	2SC3420	80p	2SC4059	400p	2SD612	50p	2SD1094	375p	2SD1455	250p	2SD1994	200p	2SK786	200p
2SC1942	350p	2SC2483	120p	2SC2958	50p	2SC3421	45p	2SC4064	140p	2SD613	70p	2SD1110	225p	2SD1457	165p	2SD1996	45p	2SK787	800p
2SC1944	350p	2SC2484	185p	2SC2962	800p	2SC3422	75p	2SC4106	150p	2SD617	300p	2SD1111	20p	2SD1458	50p	2SD2006	75p	2SK791	225p
2SC1945	350p	2SC2485	400p	2SC2979	160p	2SC3423	60p	2SC4107	175p	2SD633	70p	2SD1113	225p	2SD1459	60p	2SD2010	250p	2SK792	300p
2SC1946	1500p	2SC2491	200p	2SC2987	250p	2SC3425	65p	2SC4123	230p	2SD636	10p	2SD1128	200p	2SD1468	40p	2SD2011	60p	2SK793	300p
2SC1947	450p	2SC2498	50p	2SC2988	150p	2SC3446	150p	2SC4124	200p	2SD637	15p	2SD1133	65p	2SD1487	225p	2SD2012	50p	2SK794	315p
2SC1953	45p	2SC2500	25p	2SC2995	60p	2SC3447	130p	2SC4125	275p	2SD638	15p	2SD1135	75p	2SD1494	150p	2SD2018	65p	2SK796	600p
2SC1957	70p	2SC2502	140p	2SC2999	50p	2SC3456	200p	2SC4137	40p	2SD639	20p	2SD1138	40p	2SD1496	300p	2SD2033	80p	2SK809	850p
2SC1959	10p	2SC2503	600p	2SC3001	1400p	2SC3457	125p	2SC4138	200p	2SD640	350p	2SD1140	40p	2SD1497	230p	2SD2061	100p	2SK812	150p
2SC1962	175p	2SC2512	20p	2SC3019	320p	2SC3459	180p	2SC4157	400p	2SD655	18p	2SD1142	350p	2SD1497-02	350p	2SD2066	250p	2SK817	325p
2SC1967	1300p	2SC2517	120p	2SC3020	1450p	2SC3460	130p	2SC4159	100p	2SD661	60p	2SD1145	25p	2SD1505	90p	2SD2125	180p	2SK851	550p
2SC1969	160p	2SC2519	60p	2SC3022	1850p	2SC3461	275p	2SC4161	125p	2SD666	25p	2SD1148	175p	2SD1506	50p	2SD2136	85p	2SK872	650p
2SC1970	100p	2SC2527	300p	2SC3025	500p	2SC3466	225p	2SC4169	60p	2SD667	20p	2SD1153	30p	2SD1508	60p	2SD2144	35p	2SK875	475p
2SC1971	400p	2SC2534	150p	2SC3026	450p	2SC3468	70p	2SC4199	400p	2SD669	35p	2SD1159	65p	2SD1509	100p	2SD2151	175p	2SK903	500p
2SC1972	600p	2SC2535	300p	2SC3030	300p	2SC3481	300p	2SC4204	60p	2SD673	350p	2SD1160	150p	2SD1511	75p	2SD2255	175p	2SK904	500p
2SC1973	150p	2SC2538	100p	2SC3037	125p	2SC3482	275p	2SC4231	250p	2SD676	250p	2SD1163A	220p	2SD1519	250p	2SD2331	250p	2SK951	275p
2SC1975	120p	2SC2540	1900p	2SC3038	125p	2SC3486	275p	2SC4235	300p	2SD717	180p	2SD1164	75p	2SD1521	70p	2SD2333	150p	2SK952	275p
2SC1980	30p	2SC2542	300p	2SC3039	80p	2SC3502	50p	2SC4236	450p	2SD718	85p	2SD1168	270p	2SD1525	450p	2SD2340	225p	2SK955	450p
2SC1983	75p	2SC2545	55p	2SC3040	260p	2SC3503	50p	2SC4237	500p	2SD722	240p	2SD1169	280p	2SD1526	100p	2SJ48	425p	2SK956	400p
2SC1984	150p	2SC2546	25p	2SC3042	300p	2SC3504	120p	2SC4242	120p	2SD725	200p	2SD1173	350p	2SD1541	350p	2SJ56	700p	2SK962	700p
2SC1985	100p	2SC2547	65p	2SC3052	30p	2SC3505	240p	2SC4278	175p	2SD726	275p	2SD1185	280p	2SD1545	275p	2SJ74	60p	2SK1023	550p
2SC1986	100p	2SC2550	50p	2SC3057	150p	2SC3506	250p	2SC4288A	650p	2SD731	250p	2SD1186	400p	2SD1546	350p	2SJ76	220p	2SK1036	450p
2SC2001	15p	2SC2551	70p	2SC3068	60p	2SC3507	650p	2SC4300	200p	2SD732	250p	2SD1189	55p	2SD1548	400p	2SJ77	350p	2SK1057	600p
2SC2002	15p	2SC2552	60p	2SC3070	35p	2SC3509	750p	2SC4301	300p	2SD734	15p	2SD1191	120p	2SD1554	170p	2SJ79	225p	2SK1058	800p
2SC2003	20p	2SC2553	200p	2SC3071	25p	2SC3514	170p	2SC4304	225p	2SD741	120p	2SD1192	90p	2SD1555	150p	2SJ103	75p	2SK1081	700p
2SC2004	20p	2SC2555	120p	2SC3073	100p	2SC3518	120p	2SC4313	600p	2SD743	130p	2SD1196	150p	2SD1556	225p	2SJ109	200p	2SK1082	450p
2SC2022	110p	2SC2562	90p	2SC3074	200p	2SC3519	250p	2SC4381	150p	2SD757	120p	2SD1197	150p	2SD1565	75p	2SJ113	1050p	2SK1102	375p
2SC2023	180p	2SC2563	200p	2SC3075	150p	2SC3526	45p	2SC4382	200p	2SD760	70p	2SD1198	60p	2SD1571	170p	2SJ114	1150p	2SK1117	250p
2SC2026	30p	2SC2568	120p	2SC3077	120p	2SC3528	750p	2SC4386	275p	2SD762	100p	2SD1207	40p	2SD1572	100p	2SJ116	1200p	2SK1118	225p
2SC2027	200p	2SC2570	30p	2SC3086	150p	2SC3531	225p	2SC4387	425p	2SD763	140p	2SD1210	280p	2SD1575	200p	2SJ117	550p	2SK1120	550p
2SC2036	50p	2SC2571	350p	2SC3089	130p	2SC3549	200p	2SC4408	50p	2SD768	180p	2SD1211	120p	2SD1576	150p	2SJ119	700p	2SK1190	350p
2SC2037	50p	2SC2577	110p	2SC3101	750p	2SC3552	270p	2SC4429	275p	2SD772	200p	2SD1213	220p	2SD1577	250p	2SJ162	680p	2SK1191	800p
2SC2053	120p	2SC2578	170p	2SC3112	35p	2SC3568	200p	2SC4431	90p	2SD773	20p	2SD1218	75p	2SD1579	80p	2SJ175	200p	2SK1197	800p
2SC2055	150p	2SC2579	110p	2SC3114	40p	2SC3577	275p	2SC4466	325p	2SD774	30p	2SD1223	75p	2SD1589	60p	2SJ182	150p	2SK1217	700p
2SC2058	20p	2SC2580	175p	2SC3116	75p	2SC3584	200p	2SC4467	175p	2SD777	400p	2SD1225	70p	2SD1590	100p	2SJ200	625p	2SK1220	200p
2SC2060	40p	2SC2581	225p	2SC3117	120p	2SC3591	200p	2SC4468	250p	2SD784	650p	2SD1227	40p	2SD1591	310p	2SJ307	175p	2SK1221	200p
2SC2061	75p	2SC2588	600p	2SC3122	50p	2SC3595	220p	2SC4517	200p	2SD786	100p	2SD1229	250p	2SD1593	125p	2SK19	45p	2SK1275	275p
2SC2068	60p	2SC2590	40p	2SC3148	145p	2SC3597	75p	2SC4517A	225p	2SD787	20p	2SD1237	300p	2SD1595	70p	2SK33	40p	2SK1296	350p
2SC2071	140p	2SC2591	50p	2SC3149	180p	2SC3599	140p	2SC4531	450p	2SD788	30p	2SD1238	300p	2SD1608	210p	2SK40	50p	2SK1299	450p
2SC2073	40p	2SC2592	200p	2SC3150	100p	2SC3600	175p	2SC4532	1000p	2SD789	20p	2SD1244	25p	2SD1609	45p	2SK55	100p	2SK1317	900p
2SC2075	60p	2SC2603	10p	2SC3151	175p	2SC3606	100p	2SC4542	400p	2SD792	400p	2SD1246	20p	2SD1632	320p	2SK68	100p	2SK1338	250p
2SC2078	95p	2SC2610	60p	2SC3152	130p	2SC3607	150p	2SC4742	275p	2SD794	33p	2SD1247	40p	2SD1637	50p	2SK73	75p	2SK1341	500p
2SC2085	100p	2SC2611	30p	2SC3153	175p	2SC3608	65p	2SC4744	350p	2SD795A	140p	2SD1251	180p	2SD1647	40p	2SK97	200p	2SK1342	500p
2SC2086	60p	2SC2621	70p	2SC3156	350p	2SC3616	45p	2SC4745	550p	2SD798	175p	2SD1254	55p	2SD1649	260p	2SK106	40p	2SK1350	200p
2SC2092	100p	2SC2625	190p	2SC3157	200p	2SC3636	280p	2SC4747	375p	2SD799	150p	2SD1263	90p	2SD1650	150p	2SK107	40p	2SK1356	225p
2SC2094	1200p	2SC2626	600p	2SC3158	260p	2SC3642	225p	2SC4757	200p	2SD809	45p	2SD1264	55p	2SD1651	150p	2SK109	150p	2SK1357	350p
2SC2097	2300p	2SC2630	1800p	2SC3159	200p	2SC3657	400p	2SC4762	300p	2SD811	450p	2SD1265	75p	2SD1656	250p	2SK117	50p	2SK1360	225p
2SC2099	2500p	2SC2631	20p	2SC3164	270p	2SC3659	600p	2SC4769	220p	2SD819	300p	2SD1266	180p	2SD1663	350p	2SK118	50p	2SK1362	425p
2SC2118	1100p	2SC2632	35p	2SC3169	150p	2SC3668	120p	2SC4770	250p	2SD820	250p	2SD1267	55p	2SD1666	50p	2SK125	100p	2SK1367	350p
2SC2120	10p	2SC2634	10p	2SC3170	300p	2SC3675	100p	2SC4820	225p	2SD821	550p	2SD1271	55p	2SD1667	120p	2SK133	650p	2SK1383	500p
2SC2122A	300p	2SC2636	40p	2SC3173	180p	2SC3678	280p	2SC4826	70p	2SD822	290p	2SD1271A	225p	2SD1668	90p	2SK147	160p	2SK1384	500p
2SC2131	550p	2SC2637	120p	2SC3175	150p	2SC3679	140p	2SC4891	800p	2SD826	30p	2SD1272	200p	2SD1669	85p	2SK152	40p	2SK1385	200p
2SC2141	60p	2SC2640	1800p	2SC3178	125p	2SC3680	380p	2SC4923	400p	2SD829	375p	2SD1273	50p	2SD1677	200p	2SK161	30p	2SK1386	600p
2SC2153	40p	2SC2653	100p	2SC3179	70p	2SC3685	450p	2SC4924	250p	2SD836	50p	2SD1274	80p	2SD1680	225p	2SK163	40p	2SK1389	115p
2SC2166	80p	2SC2654	180p	2SC3180	175p	2SC3687	300p	2SC4927	500p	2SD836A	50p	2SD1275	50p	2SD1683	45p	2SK168	40p	2SK1400	700p
2SC2168	120p	2SC2655	50p	2SC3181	200p	2SC3688	550p	2SC5002	300p	2SD837	55p	2SD1276	60p	2SD1684	70p	2SK170	50p	2SK1405	450p
2SC2188	70p	2SC2656	550p	2SC3182	120p	2SC3692	150p	2SC5003	350p	2SD838	500p	2SD1277	190p	2SD1706	325p	2SK184	35p	2SK1414	550p
2SC2200	250p	2SC2660	100p	2SC3198	30p	2SC3715	480p	2SC5027	100p	2SD841	110p	2SD1279	600p	2SD1707	400p	2SK192	45p	2SK1415	500p
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	60p	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	2SK1627	400p
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	60p	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	850p
VP7100, VS9300, VS9500	650p
VP7200, VS9700, VS9800	900p
VS1	900p
VS2	900p
VS3	900p
VS10	1350p
VSP1	900p
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	1600p
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	1000p
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	2300p
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, 45S, 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	1300p
VSG415, VSG415EA, VSG425	2800p
VS75, VSA77	2700p
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	1950p
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	1300p
GHV1295, 1296, 1891, 8210, 8215, 1221, 1240, 1241, 1247, 1248, 2145	2350p
VCP400, VCP4130, 4300, 4301, 4305, 4306, 4310, 4311, 4315, 4316, VCP4320, 4321, 4325, 4326	900p
C211, GHV1392P, 1393P, 19OOP, 1290, 1291PQ, 12931Q, 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, RQ20, RQ204HP, RQ241, VCP100P, GSEG10	1300p
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	
CSI, 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	850p
VT7, VT17, VT18, VT19	1600p
VT35, VT350, VT38, VT39	1800p
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	1100p
VT3000	550p
VT4000, VT4200, VT5000, VT5500, VT5600	1100p
VT77, 680, 6500, 6700, 6800, 7000, 8000, 8030, 8040, 8100, 8300, 8500 VT8700, 9000, 9300, 9500, 9700, 9900	850p
VT8, 9, 56, 57, 570, 575, 576, 580, 585, 588	2500p
VT65	1800p
VT130, 135, 138, 145, 250, 255, 258, 420, 425, 426, 428, 430, 431, 435 VT438, 535, 536, VTL30, 301, VTM630, 635, 636	1400p
VT52, VT60, VT61E, VT62E, VT63, VT64, VT640	850p
VT168, VT150, VT260, VT450, VT498 (4 HEAD)	1900p
VT530	1400p
VT522, VTM212, 620, 622, 720, 722, 822, 922, 925	1300p
VT660E	2600p
VT570, VT575, VT580, VT585, VT588, VTF70	2500p
VT540, 545, 546, 548, VTD660, 665, VTM598, 640, 645, 646, VTM730, 731, 735, 736, 740, 745, 746, 748, 753, 754, 830, 831, 835, 838, 840, VTM841, 845, 930, 931, 935	1800p
VTF770, 774, 775, 860, 861, 865	4100p
VT85, VT86, VT88	2000p
VTF780, VTF785	4800p
VTF180, VTF185, VTF280	8500p
VTF350, VTF351	5150p
VTM220, VTM220E, VTM220UK	3000p
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	550p
HR3660, 7600, 7610, 7650, 7700, HRD110, 111, 120, 121, 220, 225, HRS100, 8904, 8923, 8924, 8925, 8929, 8935, 8941, 8943, 8944, 3V16, 3V23V24, 3V31, 3V35, 3V36, 3V38, 3V39, 3V49	550p
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	900p
HR0154, 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, FVII, FV20, FV21, FV26	900p
HRD565, HRD566, 3V48	1800p
HRD725, HRD755, 3V43, 3V53	1800p
8930, 8931, 8933, 8940, 3V29, 3V30	550p
8945	2400p
3V00, 8902, 8903, 8909, 8912, 8922	1000p
FV31, FV41R	1150p
FV37, FV43H, HRD860	2000p
BR7000E, BR7000S, BR7030, BR7030/40H, BR7040	2100p
HR7200, 7300, 7350, 2650, BR6200	600p
HRD455	1600p
HRD520	1400p
HRD300, 400, 580, 600, 620, 640, 650	1500p
HR4100	1000p
HRD750, HRD830, HRD860	1900p
HRD250, HRD257	1800p
3V32, 8942, HR7655	1800p
HRD180, 190, 230, 610, 3V59, FV12L, FV20B, 26, 30, 32, 33, VC141L	1600p
HRD370, HRD430, HRD470, 3V58, FV13H	1800p
HRD530, HRD700, HRD840, HRD870, HRD910, FV14T, FV57H	2300p
GRC1, GRC2, 3 V41	2800p
BR9060, HRD330, 337, 440, 441, 637, 641, 660, 670, 720, 730, 740, 820	
HRFC100, SR3300MS, FV44L	1600p
HRD950, HRD960, HRD980, FV46	4500p
HRS5000, HRS5500, 5800, 9000, FV395.BRS600, SRS368E	5550p
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,HRJ318E	3750p
HRJ615, HRJ715, HRJ815	9200p
HRJ400, HRJ405, HRJ407MS, HRJ41 OEK, HRJ415, HRJ416	4500p
MATSUI	
VX500E, 800A, 810A, 820, 80A, 770B, 773B	1200p
VCRL3, VX730, VX750	1450p
VX735, VX755, VX990	1500p
VX735A, VX765, VX850	1750p
VX600	1100p
VX900	2650p
MITSUBISHI	
HS303, HS304, HS320, HS700	1100p
HS306, HS318, HS710	1100p
HS307	1900p
HS319	1900p
HS330	2000p
HS400	2800p
HS349, HSE27, 31, 32, HSB27, 31, 32, HSM33, 34, 35, 37G	1650p
HS411	2400p
HSE30, HSB30	1600p
HS338	1600p
HSE10, HSE11, HSE20, HSE21, HSE41, HSB10, HSB20	1500p
HS300, HS301, HS302, HS310, HS273, HS550Q	1000p
HS200	550p
HS337, HS347	1000p
HSB12, HSE12, HSE22, HSM16G, 18, 23, 25, 30, MX1	1700p
HS411EZ, HS411GZ	2100p
HSB11, HSB21	1600p
HSB52, HSE50, 52G, HSM36, 50, 54, 55, 57, 58, 60	3100p
HSE51	2600p
HS410	3000p
HS412, HS421GZ	3100p
HS5300, HS5424, HS5600	2500p
HSM20, HSM55	1900p
HSM40	2350p
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	2500p
NATIONAL PANASONIC	
AG1000, 1050, NV250, 260, 280, 450, 460, 465, 470, 480, 650	1100p
AG6010, AG6015	2000p
AG6840	2000p
NV100, NV200, NV370, NV380, NV630	675p
NVD80, NVH65	2600p
AG5150, AG5250, NVF65, NVH75, NVH77	2600p
NVF51	4200p
NVGI9	2300p
NVJ30, NVHJ33, NVL10, 20, NVL21, NVG30, 31, 40, 130, NVJ37, 40, 42, NVSD30, 10EE, 11, 2, 30, 35	1000p
NVJ35, NVG46	1400p
NVM1, NVM3, NVM5	4200p
AG2100, AG2200	700p
NV430, NV431, NV433, NVSD2, NVSD22, NVSD25, NVSD3	800p
NV730, NV730F, NV770 4 HEAD	1150p
NV366	1700p
NV21 HQ, NV 180, NVD48	1700p
NV7881	1700p
NV810, NV8301	1800p
NV850, NV950	2000p
NV870, NV890, NV970	2400p
AG6024, NVG33, 46, NVL23, 25, 28, NVJ47, 49, 700PX, NVSD20EE, 400, 44, 45	1200p
NVG10, 11, 12, 14, 16, 120, NV250, 280, 450, 465	1100p
NVG18	1400p
NVG20, 21, 22, 25, 28, 200, NVD48	1200p
NVG50, NVG300	1600p
NVG45	1100p
NVH70	2400p
NV688	1650p
NV600	1050p
AG6800, AH6810, AG6820	2100p
AG6100, AG6200, AG6300	2100p
NVG7, NVG9, NV230	700p
NV780	2000p
NVG 15, NVG400	2600p
NVM7, NVMC20	3800p
NVF70	5200p
NVJ45, NVJ47	1200p
NVD540	1050p
NVF75, NVF77	4300p
NVF55	2800p
NVFS200, NVFS88, NVSF90, NW8000	3600p
NVHD90, NVHD 100, NV HD 101, NVHF 100	2300p
NVSD1	1000p
AG7330, AG7350, AG7355, AG7450	5000p
NVFS 100	4500p
NVFS1	4200p
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	850p
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	550p
82611AH1 (FOR MODEL DX3000), DX4000, N9610, NS7000	2400p
N895	1800p
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	2650p
VRS5000X, VX6000A, 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
SV88110, 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	1700p
VHR1110, VHR1150, VHR1300, VHR1700, VHR2300, VHR2370	800p
VHR3200, 3270, 3100, 3110, 3150, 3300, 3400, 3310, VHRD500	1100p
VHR1500, VHR2500, VHR3330	1500p
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	1800p
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,	
VHRD4610, 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	850p
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	850p
VC6000, 6200, 6300, 7300, 7700, 7750, 8000, 8300	1800p
VC793	3000p
VC473, VC785, VC786	1600p
VC699, VCA501, VCA602	2400p
VC585, VC685	1700p
VC90ET	3900p
VFH815	2800p
VC800, VCH851, VCH852, VCH882	2700p
VCH80, VCH81, VFH815	2800p
VCA33, VCA36, VCA43, VCA44, VCA46, VCA49	1500p
VCA55, VCA63	1800p
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, SLT20ME, 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	1500p
SLK95, SLT50ME	2900p
SLV275, SLV373VB, SLV410, SLV412, SLV427, SLV474	1900p
DSR49R, SLHF100P, SLHF100UB	3000p
SLV656, SLV715, 725, 727, 757, SLV777, SLV815, SLV825	4100p
SLV353UB	2100p
CCDF340E, CCDF500E, CCDV90E, CCDV95E, CCDSP5E	4800p
SLV801, SLV802	2500p
SLV310, SLV315, SLV325, SLV335	1200p
SLV210, SLV212, SLV270, SLV273, SLV285, SLV300	950p
SLV125, 213, 225, 252, 255, 262, 280, SLVX1, 20, 3	1150p
SLV363, SLV416, SLVX50, SLVX55	2000p
SLVX75, SLVX90, SLVX95	3000p
SLV282, SLVX30, SLVX35	2025p
SLHF100P, SLHF100UB	3400p
SLVE7, SLVE8, SLVE9	3600p
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	1100p
V55, V57	550p
V71, V73, V74, V75, V77, V80, V81, V82, V83, V841V85, V86, V87, V88	1050p
DV90, 96, 97, NM3, V108, 109, 199, 200, 202, 205, 207, 209, 80, 93, 94	1150p
V5470, V5480	1300p
V600	2350p
V880MS	2600p
V700G	3700p
V500G, V509G	2500p
V9680	2900p
V300G, V301, V305, V306, V309G	2550p
V61, V63	1200p
V110, V120, V130, V140, V210, V211, V212,	
V220, V221, V222	1100p
V711, V880	2700p
VCPB1E, VCP2C2	1000p
V65, V66, V6	950p
V312, V322, V412	2600p
V91G	4600p
V609, V610V610B, V610UK, V611, V659F, V660, V660F	2200p
V312, V403T, V413G	9200p
V703W, V813G	4000p
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, RTV336, 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	60p
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

Model	Price
TX3650, VCR3000, VCR3002, VCR9500	75p
FISHER	
VBS7000	245p
VBS9000	120p
FVHP520, FVHP530, FVHP420	60p
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	55p
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, 416, 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, i70, 175, 220, 225, 250, 255, 258, 260, VTL30	60p
VM500 VM600	90p
J.V.C.	
HR3300, HR3330, HR3360, HR3660, HR4100	130p
HR7200, HR7300	50p
HR7350, HR7600, HR7610, HR7650, HR7655	50p
HR7700	50p
HRD110, 111, 120, 121, 220, 225, BP5000	60p
HRD140, 141, 143, 150, 152, 157, 158, 160, 190, 250, 257, 310, HRD455, 565, 566, 725, 755, HRP50	45p
HRD170, 171, 180, 210, 21 1, 217, 230, 300, 320, 321, 330, 337, HRD350, 370, 400, 430, 440, 44 1, 500, 530, 700, 750,950,	125p
HRS5000, 5500, 8000, 9000, BR9060, BRS600, 605, 920, 925	45p
HRD227, 520, 52 1, 522, 527, 600, 610, 620, 637, 641, 650, 830,	125p
HRD840, HRDX20, 22, HRJ200, 205, 300, 305, SR330, HRS10	125p
HRD840, 550, 560, 580, 590, 640, 660, 670, 720, 730, 740, 770, HRD820, 860, 870, 880, 910, 960, 980, HRDX20, 25, HRJ2 10,	80p
HRJ215, 315, 316, 318, 400, 405, 407, 410, 411, 415, 416, 507, HRJ6 10, 615, 715, 97,	150p
HRS4700, 5800, SR3200, SRS368E	125p
HRJ600	40p
LOGIK	
VR955	180p
MATSUI	
VX600, 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, 480, 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, 68	55p

Model	Price
N.E.C.	
N830, N831, N832, N833	100p
N895	80p
PVC2300, PVC2400	180p
DX1000, 1600, 1800, 2000, 3000, N9012, 9013, 9014, 9016, 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, 25BO1, 25BO2, 11, 12, 302, 303, 305, 31DVI, 31DV2, 31D, V3, 3SB11, 3SB12, 3SB13, 72SB8, VR3DV2, 36BO2, 36B03, 835B7, 715B4, 715B5, 715B8, VR865B2, 915B2, 925B3, VR6180, 6182, 6185, 6285, 6290VR6291, VR6293, 6362, 6367, VR6390, 6391, 6393, 6467, 6468, 6470, 6561, 6570, 6581, 6670, VR6676, 6710, 6760, 6761, 6762, 6870, 6970, 6975, VR68SB4, 86SBI, 92SB3	75p
VR445B9, VR445B920, VR445B922, VR6443, 6843, 6843, VR6943	100p
VR3260, 6349, 6448, 6449, 6548, 6648, 49SB620, 644869S, 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, 2469, 247, 2479, 251, 252, 256, 257, 258, 33, 19, 332, 3329, 333, 337, 339, 3419, 342, 343, 3469, 347, 3479, 35, 1, 352, 357, 358, 422, 4229, 432, 437, 442, 4229, 432, 437, 442, 44, 5, 4469, 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	
SV716, 717, V1616, V-621, V1626, VX616, VX617, VX619, X626, VX627, VX629, VX714	75p
VB520, 510, 610, 616, 617, 619, 620, 626, 627, 629, V1510, 520, V1611, 616, 621, 626, VX510, 511, 520, VT320, 5600	80p
VB900, VB910, V1900, V1910	110p
PX980, 981, 982, SE9001, SV9001, SVX307, 319, 322, VB750, 770, 8220, 8225, V1770, 790, 8220, 8225, VK8220, VPX31, VX750, VX770, 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	65p
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, 7630, VHR7540, 7700, 774, 7800, 7810, 8000, 8100, 8200, 8250, 8500,VHR8800, 8801, VHRD4400, 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	65p
VC700, 750, 783, VC6F3, VC6V3	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, 109, 110, 120, 130, 140, i99, 209, 210, 211, 220, 221, 411,V421, 609, 610, 611, 659, 660, 711, 880	120p
V91 G, V95G	115p
V212, 213, 22-2, 3i2, 322, 403, 412, 413, 610, 703, 813	50p
VCP81E	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 6861481
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
Goldstar	VXP0521	IT17		PU55373	IT09		VXP0521	IT17
Hitachi	6861471	IT03		PU55374	IT10		VXP0581	IT18
	6861482	IT04	**National**	VXP0329	IT11	**Sanyo**	1430662T15620	IT19
	6886971	IT05	**Panasonic**	VXP0343	IT12	**Sharp**	NIDL0005GEZZ	IT20
JVC	PU48697B	IT06		VXP0344	IT13		NIDL0006GEZZ	IT21
				VXP0401	IT14		NPLY0107GEZZ	IT22

Price:
20p each
16p each pack of 5
13p each pack of 10

Packs are for each model

PINCH ROLLERS

AKAI
VS10, VS9300, VS9500, VS9700, VS9800, VP7100, VP77 **140p**
VS1, VS2, VS3, VS4, VS5, VS6, VS8, VS9, VS12, VS15 **140p**
VS105, 112, 115, 116, 120, 125, 126, 155, 165, 205, 220, 240, 244, 245, VS247, 248, 250, 512, VS515, 516, VSX9 **140p**
VS201, 301, 303, 304, 603, 606, 607, VSP8, VSP82, VP58, VP82 **140p**
VS125, VS155, VS165, VS220, VS240, VS250, VS512 **140p**
VS22, 23, 25, 35, 37, 38, 53, 66, 75, 422, 425, 426, 427, 462, 465, 467, VS485, 765, 766, 767, 768, 865, 867, 965, 967, VSA77, VSA650, VSF10, 11, 12, 15, 180, 190, 200, 210, 220, 221, 222, 230, 240, 30, 33 **140p**
VSF330, 4, 500, 550, VSP88, VSR100, VSX400, 450, 470 **140p**
VSF260, 261, 262, 265, 270, 274, 275, 280, 290, 340, 350, 410, 420, 43C 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**
PINCH ROLLER ASSEMBLY
VS422, 425, 426, 427, 462, 465, 467, 485, 498, 765, 766, 767, 768, 865, 867, 965, 967, VSA650, VSF10, 11, 12, 14, 15, 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**
PINCH ROLLER ASSEMBLY
VSS99 **140p**

ALBA
VCR3000X, VCR4000 **140p**
VCR5000, VCR6000 **140p**
VCR161, VCR222 **140p**
VCR7000, VCR7800, VCR8000, VCR8800 **140p**
VTV10 **140p**

AMSTRAD
VCR1000, 2000, 4500, 4600, 4700, 5200, 6000, 6100, 6200, 8600, VCR8602, 8603, 8604, 8700, 8704, 8714, 8800, 8804, 9000, 9005, VCR9244, 9340, DD8900, 8904, TVR1, 2, 3, 4 **140p**
VCR7000 **140p**
DD8900, DD8904, VCR6000, 6100, 6200, 8600, 8602, 8603, 8604, VCR8700, 8800, 900>9, 9140, 9244, 9340 **700p**
PINCH ROLLER ASSEMBLY PART NO: 153148
TX3650, UF20, VCR3000, VCR3002, VCR4000, VCR9500 **300p**
PINCH ROLLER ASSEMBLY PART NO: 2554966
DD9900, 9904, TX3650, UF20, 22, 24, VCR3000, 3002, 9500 **140p**
VS1004 VS1104 **140p**

FERGUSON
3V00, 3V01, 3V16, 3V22, 3V23, 3V24, 3292, 8900, 8901, 8902, 8903, 8904, 8906, 8909, 8912, 8922, 8923, 8924, 8925, 8929 **140p**
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, FV10B, 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**
PINCH ROLLER ASSEMBLY
3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V56, 3V57, 8945, 8947, 8948 **1350p**
PINCH ROLLER ASSEMBLY
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
FVHP420, 520, 530 **140p**
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**
FVHD230, 250, 270, 370, 2000D, FVHP3, 210, 250, 300, 310, 1100, FVHP1200, 1250, 130, 132, 1340, 1340, 1400, 1410, 1440, 1500, 200, FVHP320410, 420, 430, 440, 445, 470, 475, FVSP290S, 495, 2905 **140p**
FVHD140, FVHD40, FVHD55, FVHP1, FVHP10, FVHP20 **140p**
FVHD140, 40, 55, FVHP1, 10, 25, 30, 40, 4000, FVHS10, 30 **1350p**
PINCH ROLLER ASSEMBLY

GOLDSTAR
GHV51, 1221, 1232, 1233, 1240, 1241, 1242, 1243, 1244, 1245, 1246,140p GHV1247, 1248, 1250, 1266, 1290, 1291, 1295, 1296, 1392, 1393, GHV1891, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430 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**

HITACHI
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 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 VT640, 830, VTF660, 665, 70, 770, 774, 775, 780, 785, 860, 861, 865, VTL30, 1000, 2000, VTLC50, VTM598, 620, 622, 625, 626, 630, 635 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**
PINCH ROLLER ASSEMBLY
VTF150, 155, 180, 185, 250, 255, 260, 265, 280, 285, 350, 351, 355, VTF360, 365, VTM140, 141, 145, 145, 210, 211, 212, 215, 220, 221, VTM230, 231, 235, 284, VTS390 **140p**

HINARI
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**
PINCH ROLLER ASSEMBLY
V20H, VXL5, VXL6 MOD KIT **275p**

J.V.C.
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 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**
PINCH ROLLER ASSEMBLY
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**
PINCH ROLLER ASSEMBLY PART NO: 948D020010
HSE11, 12, 16, 17, 21, 22, 27, 31, 32, 41, 51, 52, 5300, 5424, 5600, HSB11, 12, 16, 21, 27, 31, 32, 41, 51, 52, 82, HSM1000, 110, 120, 150, HSM16, 170, 18, 190, 210, 23, 25, 250, 27, 30, 33, 34, 35, 36, 37, 370, 38, HSM380, 40, 45, 450, 50, 54, 55, 555, 57, 58, 59, 60, 68, HSMS2, 9, HSMX1, 18, 19, 2, HSS11, 12, 14, 15, 17, 19, 21, 25, 5600, HVF125, HVF150, 303, 85, SV8900, 8930 **140p**
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 NV630, 650, 730, 770, 780, 810, 830, 850, 870, 890, 2000, 2010, 3000, NV7000, 7200, 7800, 8050, 8150, 8170, 8200, 8300, 8400, 8500, 8600 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**
NVD48, NVD80, NVG21 NVG45 **140p**
NVJ700PX **140p**
NVHD100, NVHD101, NCHD90, NVSD30, NVSD40 **1125p**
PINCH ROLLER ASSEMBLY
AG5150, 5250, 5700, 6024, NVD38, 48, 80, NVF55, 65, 70, 75, 77, NVFS1, 100, 200, 88, 90, NVG 19, 20, 21, 22, 25, 28, 300, 33, 40, 45, 46, NVG50, NVH65, 75, 77, NVJ30, 33, 35, 37, 40, 42, 45, 47, NVL20, 23, 25, 28, NVW 1 **300p**
PINCH ROLLER ASSEMBLY

N.E.C.
N830, 831, 832, 833, 895 **140p**
PVC2300, 2400, 740, 744, 746, 760, 764, 766 **140p**
DX1000, 1600, 1800, 2000, 3000, N9012, 9013, 9014, 9016, 9033 N9034, 9053, 9054, 9055, 9056, 9066, 9096, 9110, 9120, 9510, 9520, N9530, 9610, PX 1200 **140p**
DS6000G, DX4000, N9077 NS7000 **140p**

ORION
VH1, VH2 **140p**
VC150, 180, VH3, 33, 200, 201, 205, 212, 250, 254, 288, 300, 303, 312, VH404, 555, 700, 704, 712, 770, 780, 844, 900, 1000, 2948, 3030, 3312
VHF2A, VP2948 **140p**
COMB 15000, 16000, HV03, LVH50, NEVH, NEVHM, NEVHML, TVP230RC, VCP, VH04, 30, 103, 300, 358, 360, 362, 400, 416, 512, VH530, 532, 535, 536, 600, 630, 635, 640, 666, 730, 735, 744, 774, 790 VH800, 820, 850, 888, 893, 900, 930, 940, 942, 974, 1012, 1040, 1050, VH1060, 1070, VH1100, 1120, 1204, 1440, 1500, 1660, 1800, 2004, VH2151, 2308, 22042400, 2500, 2600, 2700, VH2960, 2970, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4300, 5020, VP 10, 200, 220, 225, 245, VR821, 925, 1032, 2949, 2959, 2957, 2966, 2979, 2980, VTV300, VXL20, 25, 30 **140p**

PHILIPS
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, 6863 **140p**
N-1700, VR2870 **140p**
VR2025, VR6580, VR6581 **140p**
49SB6, VR3260, 6349, 6448, 6449, 6548, 6648 **140p**
PRESSURE ROLLER ASSEMBLY PS403-40205
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, 86BI, 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 0VHR23, 235, 240, 244, 250, 251, 274, 27, 297, 310, 330, 335, 350, 390, VHR4100, 4105, 4150, 4200, 430, 4300, 4350, 4400, 474, 4770, 5080, VHR5100, 5200, 5300, 5350, 5600, 5700, 6850, 7100, 7200, 7250,VHR7260, 7300, 7400, 7440, 7500, 7520, 7530, 7540, 7700, 774, 780, 0VHR7810, 8000, 8070, 8100, 8200, 8250, 8500, 8800, VHRD4400, 4410, 4500, 4600, 4610, 4710, 4890, 6700, VHRS700 **140p**
VCR100 **140p**
VHR120, 135, 150, 190, 4150, 4160, 4350, 5200, 5240, 5350, 7200, 7250, 7260, 7700, VHRD4410, 4610, 4710, 4890, 5450, VHRS700 **975p**
PINCH ROLLER ASSEMBLY
VHR3100, 3200, 3300, 3310, 3400, 3700, 3800, VHRD500, 7000 **1350p**
PINCH ROLLER ASSEMBLY

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, VCTI314, VCTS313 **525p**
PINCH ROLLER ASSEMBLY

SAISHO
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, 626, 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, V1710, 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**
PX31 R, 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, 1261, 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, SLVX65BR, SVQ140, 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/VTL30
Contents
BELT SET. PINCH ROLLER. FF/REW ARM. CLUTCH PLATE. TENSION BAND
Order Code: SK51 **£14.00**

PANASONIC
NV2000/NV2010NV7000/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/NV688

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/VC699/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!

SERVICE KIT & UPGRADE FOR ONWA TV CHASSIS

FAILURE OF ZD401 (ZD401 ON THE 20/21 CHASSIS) IS NOT UNCOMMON.

THIS KIT HAS BEEN ASSEMBLED AS A REPAIR KIT FOR COMPONENT FAILURES AND AS AN UPGRADE FOR THE POWER SUPPLY.

THE KIT CONSISTS OF ALL THE REQUIRED COMPONENTS AND COMES COMPLETE WITH FULL INSTRUCTIONS AND CIRCUIT DIAGRAM.

THE KIT IS DESIGNED TO FIT THE FOLLOWING MAKES AND MODELS.

* ALBA / BUSH
* AKAI
* GOODMANS
* HINARI
* JVC
* MATSUI

ORDER CODE : ONWAKIT **PRICE: 1200p**
* SOME MANUFACTURERS HAVE ALREADY TAKEN STEPS TO UPGRADE THE POWER SUPPLY

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, 73401, 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.	3V38, 3V39, 8943, 8944, 8951, 3V35, 3V36, 3V49, HRD 110, 111, 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, HRD230, 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, 6760, 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, 605, 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: 70p
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

SATELLITE PSU REPAIR KITS

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	1100p

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: 100p

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: 130p

USED ON:
KV1400, KV1440, KV2040, KV2060
(POWER SWITCH 26mm)
Order Code: SW12 Price: 110p

SONY

USED ON:
KV2020
(POWER SWITCH 21mm +Remote)
Order Code: SW6 Price: 130p

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

32 mm CERAMIC SLOW BLOW

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

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

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

38mm CERAMIC TIME LAG

CURRENT RATING	ORDER CODE	PRICE
10A	FUSE48	825p

**** 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.

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

TELEVISION Edition 7
This new A5 size guide lists more than 9600 faults and in approx. 480 pages in size.
Price: 1650p only – no VAT. Order Code: BOOK02

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

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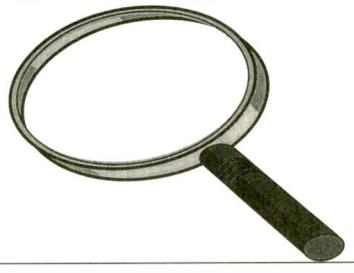

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PDM400, PDM410, PDM500, PDM510, PDM600, PDM610, PDM700, PDM710, PDM730, PDT303, PDT403, PDT503, PDX940M, PDX950M, PDZ560T, PDZ72T, PDZ73T, PDZ81M, PDZ82M, PDZ83M, PDZ960M, XDZ53T, XDZ54T, XDZ55T, XDZ62, XDZ62M, XDZ630, XRZ82	PWY1009	4800p
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DCFS5, MCD450K, 660K, MCDZ30L, 60F. PART No. 6142205006	614220	5600p
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QT-50CD, QT-60CD, QT80CD. PART No. RCTRH8124AFZZ	RH8124AF	2900p
DXR-840B. PART No. RCTTRH8130AFZZ	RH8130AF	2900p
CDS360E, 360H, 370, 450H/E, CMS150CDH, CMSR400CDH, CP150, CPR400, CPS360, 370. PART No. RCTRH8136AFZZ	RH8136AF	4500p
SONY		
KSS240A	KSS240A	2000p
KSS121A	KSS121A	3500p
KSS151A	KSS151A	1900p
KSS210A	KSS210A	1300p
KSS210B	KSS210B	2000p
KSS220A	KSS220A	2500p
KSS331A	KSS331A	3400p
KSS360A	KSS360A	2600p
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Description	Code	Price
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RCV 37 B	RC891	650p
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DECCA		
RC70	RC894	650p
FISHER		
RC905B	RC879	650p
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MK4 TEXT, 70155G, 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
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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
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OC11	RC146	650p
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010270601	RC889	650p
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ORION		
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EUR51200	RC200	650p
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69117032	RC178	650p
69117194	RC180	650p
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RC38	RC301	650p
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3V31-32	RC344	650p
3V57-58	RC628	650p
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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		
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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
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06 D-3-095-002	LOT87	1000p
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FETX 90 WHITE	LOT06	1650p
FETX 100 100 DEG	LOT34	1500p
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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	1500p
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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	1600p
2433012	LOT171	1600p
2433014	LOT171	1600p
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	950p
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	1500p
4515 03 08	LOT22	1250p
4515 03 09	LOT178	1500p
4515 03 10	LOT168	1500p
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	1550p
4515 03 28	LOT27	1450p
4515 03 29	LOT193	1550p
4515 03 30	LOT179	1350p
4515 03 31	LOT207	1550p
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	LOT196	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
D 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	1700p
TLF 14586 F	LOT42	1700p
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
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4822 140 101145	LOT134	1450p
4822 140 10146	LOT112	1700p
4822 140 10151	LOT102	1700p
4822 140 10161	LOT103	1250p
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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	1550p
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4822 140 10271	LOT208	1650p
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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	1400p
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	1600p
RTRNF 1783 CEZZ	LOT202	1600p
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
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3753100	LOT275	1500p
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1-439-243-11	LOT91	1600p
1-439-243-12	LOT91	1600p
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1-439-243-32	LOT229	1700p
1-439-243-41	LOT229	1700p
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1-439-244-11	LOT48	1600p
1-439-244-21	LOT48	1600p
1-439-244-31	LOT48	1600p
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1-439-289-31	LOT47	1400p
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1-439-294-21	LOT269	1550p
1-439-303-00	LOT94	1300p
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1-439-303-31	LOT94	1300p
1-439-303-32	LOT94	1300p
1-439-311-00	LOT95	1550p
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1-439-311-31	LOT95	1550p
1-439-311-32	LOT95	1550p
1-439-331-22	LOT96	1550p
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1-439-416-23	LOT255	1600p
1-439-416-41	LOT255	1600p
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154125A	LOT275	1550p
TOSHIBA		
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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
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- AUTO POWER OFF (APPROX 15 min)
- DIODE TEST FUNCTION
- ALL RANGES OVERLOAD PROTECTED
- SUPPLIED WITH TEST PROBES
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- AC VOLTAGE: 200mV/2V/20V/200V/700V
- DC CURRRENT A: 2mA/20mA/200mA/20A
- AC CURRENT A: 200mA/20A
- RESISTANCE Ω: 200Ω/2kΩ/200kΩ/2MΩ/20MΩ/200MΩ
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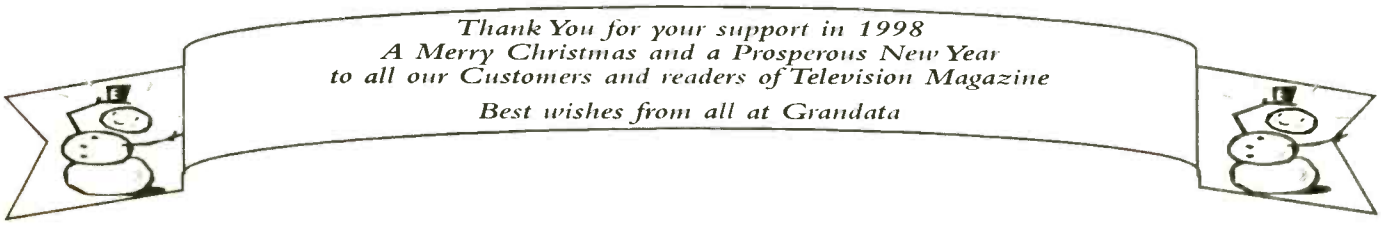

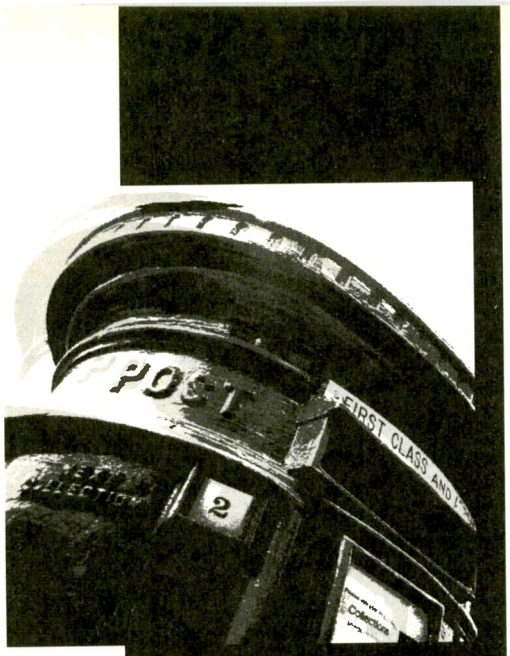

Letters

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, Room L302, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

The Cost of Digital TV

Much has been said about the advantages of digital television. Little has been said against it. This letter may redress the balance a bit.

For many years now I have encouraged my customers to use their lounge or living room as the base for their TV entertainment. I have recommended the use of a good aerial of the correct group, pointing in the right direction, and the use of best-quality coaxial cable with no joints, feeding straight into a satellite receiver which in turn feeds a VCR and from there to a distribution amplifier. Thus all five terrestrial TV channels, the satellite channel selected in the lounge, and the video inserted in the player reach as many rooms as required in the house, giving everyone the choice of seven channels at a time. This makes it almost worth paying nearly £100 a year for the TV licence.

With the new ONdigital system you have to buy a set-top box, at £200, which allows you to choose any *one* of fifteen channels. In addition you have to pay about £160 a year for the card to activate the channels. You can then point a remote-control unit at the box to select the channel you want to watch. If your wife or one of your children wants to watch a different channel elsewhere another £200 box will be required plus another £160 per year for a card. So for a three-child, two parent family to get what they already have will cost £1,000 for set-top boxes, £800 per year for cards and £100 for the licence.

I checked with the ONdigital helpline to confirm these figures, and can't really see many people paying that much money for so little. I give ONdigital full marks for cheek, but in the real world with Sky and cable both offering better value I don't rate ONdigital's chances too highly.

If ONdigital doesn't survive, will the existing system be retained? What will happen to all the digital decoders? Will it be another BSB debacle? Will early digital sets be dual-standard, and thus not complete right-offs?

Digital satellite systems have started to appear in the shops for £199, on condition that you pay a £30 charge to BT for connection to an existing line you already pay for. This seems daft to me, as Sky is offering the same product for £159. Why pay £40 extra for something that's useless without the Sky channels?

How long will it be before Sky starts to give receivers to subscribers in order to compete with cable? Sky appears to be offering unwatchable rubbish simply to increase its number of channels. The general consensus seems to be in favour of a system in which you pick the channels you want and pay for these only. The channels that no one chooses are not worth transmitting and could be dropped. This would reduce costs. Apart from the £30 BT charge, SkyDigital doesn't seem to cost more than the analogue Sky package.

It is difficult to guess what the cost of digital cable TV will be. My feeling is that it will cost about the same as satellite TV, but with a much lower installation charge. Should ONdigital go, it will be the only alternative to satellite.

I'm wondering: could we all end up going out to the cinema or renting videos again to save money?

John Hopkins,
Felixstowe, Suffolk.

A Clanger

Intermittent tuning drift was the problem with a Hitachi Model C2118. A voltage check across the 33V stabilising zener diode ZD002 produced a reading of 1·4V. So I replaced ZD002, but the voltage across it remained the same. Suspecting the zener diode's feed resistors, I replaced R044 (12kΩ) and R144 (10kΩ). There was still no difference. Strange!

When I took a look at the circuit diagram, see Fig. 1(a), I realised what the problem was. The tuning voltage integrating transistor Q003 is connected

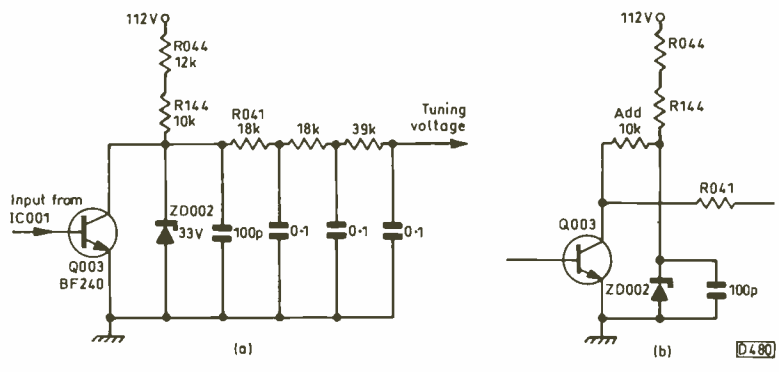

Fig. 1: The tuning voltage generator circuit used in the C2118 and some other Hitachi models (a). Modification to ensure that the stabilisation works (b).

directly across ZD002. As a result, the voltage across the zener diode can never reach 33V – unless Q003 is cut off. So the tuning voltage is unstabilised, the AFC action being relied upon to keep the set on tune.

This is obviously a design error – someone dropped a clanger! There's an easy solution however, see Fig. 1(b). Add a 10kΩ, 0·5W resistor between the collector of Q003 and the junction of R114 and ZD002. Cut the print between Q003 and ZD002 and fit the extra resistor on the print side. Disconnect (lift) the zener diode end of R041 and use a short length of insulated wire to connect it to Q003's collector. There's a small hole in the PCB, near Q003, through which the wire can be passed.

The error explains why these sets go off tune when the HT voltage rises because R909 (39kΩ) has gone high in value. You also get the problem with the 14in. version of the chassis.

Michael Dranfield,
Buxton, Derbyshire.

Akura CX25/26

Stephen Leatherbarrow's tip in TV Fault Finding, March 1997 led me to conclude that the cause of the sound fault I had with an Akura Model CX26 (the Nicam one) must be the EEPROM chip. But Akura had handed its spares business to CPC. I ordered the chip specified by Stephen (not listed in the service manual, and 20 digits long). Some time later it arrived, marked only with the first ten digits – as was the one it was to replace. It cured the fault and, going into the service mode, the settings of the faulty one were programmed in. Fine, except that the on-screen captions were half off the picture and refused to move on to the screen.

I then noticed from the invoice that I had received the CX25 version. CPC told me that this is the only one available. A very helpful CPC engineer investigated and told me that he could program a replacement EEPROM for CX26 operation. It arrived next day, and worked perfectly. I'm very impressed with this excellent service. But I wonder whether this is a foretaste of the sort of problems that will come our way with digital TV?

Laurie Watkinson,
Holsworthy, Devon.

The Widescreen Con

It's about time someone exposed what must be the biggest con since the start of TV. I have been in the TV repair trade since 1958. Up to a few years ago, one of the most common complaints with a faulty TV set was "the picture's gone small" or something similar. Yet here we are with these infernal widescreen sets.

I bought my 26in. set to get a 26in. picture. If I'd wanted a smaller one I would have bought a smaller set. I have yet to see a widescreen set that shows any more picture than a standard set. So why spend probably twice as much for a widescreen set that shows exactly the same picture as a standard one, the only difference being that with the latter you have twenty per cent of the screen doing very little. Perhaps we could all

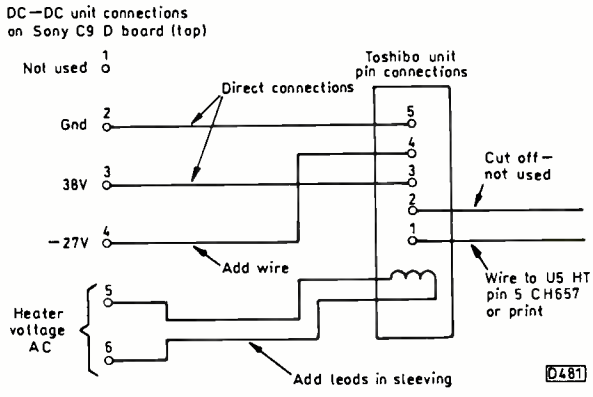

Fig. 2: Connections to the Toshiba V209 DC-DC converter unit when used in the Sony Model SLC9.

complain, and try to get a twenty per cent reduction in our licences, subscriptions etc.

Personally I've had enough of the irritating gaps at the top and bottom of the screen and have fitted a switch at the side of the set with a resistor to the height potentiometer. I can now fill the screen whenever I want to. Perhaps someone could come up with a way of doing it via the remote-control unit. They'd make a fortune!
Chris Plaice,
Winch Wen, Swansea.

Sony SLC9 DC-DC Unit

The Sony SLC9 VCR was way ahead of its time. I look after a number of them and have found that it's common for the DC-DC converter which powers the display to fail. Drastic action was required when my own failed with short-circuited windings, since the converter is no longer available.

The original unit in the SLC9 is on board D in the regulator section. It's powered by the U12 supply and provides 38·5V and –27V outputs plus 3·8V AC for the filament. These voltages sounded familiar to me and, while scratching around in the workshop, I came across a Toshiba V209 DC-DC unit that requires a 6V supply and provides 37V and 30V outputs but no filament supply.

I stripped the screening can from the Toshiba unit – it had to be cut off as the board is glued into the can. Once it was open I saw that the transformer is an open-bobbin affair to which it's very easy to add windings. To get a filament supply I used eight turns of enamelled-copper wire from an old RF choke. I took the 5V required from the U5 supply in the SLC9 – it's readily available. The Toshiba unit then produced 35V and –27V outputs, restoring the display.

The loading on the SLC9's U5 supply increased by about 200mA but, since the U5 and U12 lines come from the same regulator, the overall loading remains the same. The additional filament current is well within the ratings of the Toshiba transistors, which run very cool. I've used the unit for several months now with no problems. When I first fitted the unit I added various decoupling capacitors, as in the original Sony unit, but subsequently discovered that leaving them out had no detrimental effect.

The unit is very easy to fit, as two of the Toshiba unit's pins go into the Sony board directly. This is sufficient to anchor the unit. The other connections have to be made with wire links, see Fig. 2. To complete the screening arrangements, fit the original Sony screening can over the Toshiba unit, which is available from CPC under order code TS23107550 at about £5 plus VAT.
D. Plummer, FIIE(elec),
Bexhill.

Mitsubishi HSB82

The fault that Pete Gurney mentioned in the November 1998 VCR Clinic (page 53) has become quite common with the Mitsubishi HSB82. I would just like to add that the PCB should always be cleaned – it is not always obvious that the capacitor (C232) has leaked over the PCB, and the print in this area is very fine and concentrated. Leakage here will soon open-circuit the print, producing the same symptoms as before, but the next repair will be very difficult indeed.
Mike Orr,
Congresbury, Bristol.

The First RSL – TV 12

The first Restricted Service Licence local TV station, TV 12, recently started transmissions from Rowridge, Isle of Wight. I have managed to receive a weak signal, but the situation is fraught with problems.

TV 12 is like the local channel of small town cable networks in the USA. Outside prime time these run rolling page adverts and notice boards. But, unlike a cable channel, TV 12 isn't part of a package. It stands alone, and viewers have to spend up front to receive it. Unfortunately the channel used, 54, is outside the local group (A). So you need a group C/D aerial. In addition TV 12 is transmitted at 1kW, the other local transmissions being at 500kW each.

So to receive TV 12 at a realistic range a group C/D aerial is required. An amplifier may also be needed. Add to this the price of a diplexer and installation costs and it's easy to exceed £100. Will viewers pay this to receive just one channel whose prime time runs typically from 1700-2200 hours, the rest of the day being filled with small ads? TV 12 cannot compete with the major channels, terrestrial or satellite. Instead, it's a channel viewers will dip in and out of as their local interest dictates.

Potential viewers have to consider the cost in terms of what they will receive. According to my hairdresser, the word on the streets is that the only way you'll see a TV 12 broadcast properly is by going to the studio! My own reception seems to suggest that there can be polarisation problems.

I feel that in other parts of the country RSL stations could provide an important service in addressing the needs of ethnic minorities: in Vancouver two cable channels are dedicated to the Chinese community and are commercially viable. It remains to be seen how successful TV 12 will be.
Keith Cummins,
Chale Green, Isle of Wight.

Corrections

Low-Ω add-on unit, pages 740-1 August 1998 issue: IC1 should have been listed as type TL082, not type TL802.

VCR clinic, page 52 November 1998 issue: The part no. given for the reel-drive gear assembly in the Daewoo Models 5172 and 7372 was incorrect. The correct part no. is 97SB361400.

UK DTT channel allocations chart, December 1998 issue: Some sort of computer glitch affected the listing for the Pontop Pike transmitter. The first letter, W, should have appeared at the end of the line above – it's the aerial group for Plympton. As a result of this, every other figure in the line is in the wrong column, i.e. the BBC channel is 48 (10kW), the ITV/C4 channel is 55 (10kW), while multiplexes A, B, C and D are on channels 59, 62, 65 and 53 respectively. The aerial group is C/D.

Our apologies for these errors.

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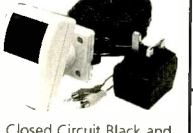

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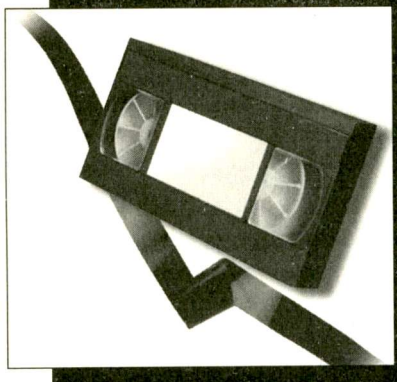


VCR Clinic

Reports from
Philip Blundell, AMIIEelec
Eugene Trundle
Graham Richards
Russ Phillips
Gerald Smith
Colin J. Guy
Alan J. Roberts and
Ronnie Boag

Philips VR657

There was sound from the modulator in the E-E and play modes but no picture. Checks showed that the video signal was missing at pin 1 of the modulator. I traced the signal path back and came to a transistor that had a signal at its base but nothing at its emitter. Tr7406 (BC858B) was open-circuit. **P.B.**

Daewoo DVR7372P

When a tape was inserted in this machine it would be played back in the LP mode, regardless of the speed at which it had been recorded. This didn't do much for the reproduction of rented movies! The cause of the trouble was a noisy operational amplifier within the CTL pulse amplifier chip IC502. A new chip restored normal operation. **E.T.**

Ferguson FV67/77

There was no sound in any mode, just noise. The sound modulator coil LS54 read open-circuit – in fact it was the wrong way round. Someone must have refitted it incorrectly when looking for the cause of the original fault, which was playback sound OK but no E-E sound because the MSP2400-C48 (flatpack) Nicam decoder chip was defective. It turned out to be a very expensive repair. **G.R.**

Thorn VR172L

We've had a number of cases of a dead machine with no 6V or 5V supplies because IC101, a 7806 type regulator, has failed. It seems to fail because the plate that secures all three regulators doesn't ensure good contact with the heatsink.

Another problem is that the 7806 regulator is difficult to obtain. You can fit a 7805 with two 1N4148 diodes in place of W109 and reconnect the negative lead of the regulator's decoupling capacitor to a suitable chassis point.

This machine is of GoldStar origin. **G.R.**

Goodmans VN6000/6001 (Daewoo DVRG892)

The complaint with this machine was that it sometimes tried to work while at others it didn't do anything at all. I tricked it into accepting a cassette shell and noticed that the loading mechanism was pulsing intermittently. In addition if you pressed a function button, e.g. play, the clock went out!

Various checks were carried out in the power supply. I found that the 5·8V supply was slightly low and seemed to have excessive ripple on it. Once C822 (330µF, 25V) had been replaced everything was OK. C823 (1,000µF, 10V) is another suspect but was OK in this machine. **G.R.**

Ferguson FV62LV

This machine was dead, with TP91 (2SA1020) short-circuit collector-to-emitter. When it had been replaced the motors worked and the machine loaded a tape. But there was no display and no response to operation of the front keys. Once RP86 (27Ω fusible) had been replaced the display came up, asking for a code to be entered. **R.P.**

Tatung TVR744

There was no E-E sound and when channels were changed the AFC would take a couple of seconds to pull the picture in. Tests showed that the tuner was OK and that the sound was being muted by the microprocessor chip. Once this had been replaced and the EEPROM (IC1002) had been reprogrammed the machine worked normally. **G.S.**

Toshiba V110

This machine was dead with no clock display and no functions. I found that TP03 (BD202) had gone short-circuit, blowing the overvoltage zener diode DP011 and fuse FP02. Normal operation was restored when these items had been replaced. **G.S.**

Tatung TVR933

This machine had a tape stuck inside and wouldn't stay out of standby. When I finally persuaded it to eject the tape the capstan did not turn and the tape was damaged. The drum and loading motors both worked: the capstan seemed to have correct drive but didn't turn. A new capstan cured the fault. **G.S.**

Aiwa HVFX2500

Intermittent failure to rewind was the complaint with this machine. When it did rewind it would sometimes switch off to standby. A new mode switch cured the problem. **G.S.**

Tatung TVR933X

Intermittent eject during or after rewind was the complaint with this machine. While it was running on test I noticed that it would switch on or off by itself. The final clue was that the lift would sometimes shuffle backwards and forwards. LED D1001 had low emission, a replacement curing the symptoms. **G.S.**

Ferguson FV32L/Baird VC141

There was no display though the machine worked otherwise. DP50

was found to be short-circuit. It's located near the front, right corner of the main PCB. **C.J.G.**

Hitachi VTM822

Tape looping on eject is usually caused by the gear-clutch assembly. On this occasion however the bottom of the cassette holder was bent down, obstructing the reel gear. **C.J.G.**

Panasonic NV7000

This venerable machine had had one owner from new, and the service history was known. During its 18-year life one new drum had been fitted, several electrolytic capacitors in the power supply had been replaced and umpteen belt kits had been fitted. This time the complaint was that it stopped after thirty-five minutes in the play or record mode. So I went off armed with a belt kit, idler and pinch roller and fitted them. Next day I received a call to say that the machine was "still the same". Back to the workshop it came, where I found that, sure enough, after exactly thirty-five minutes the sound became very wowy, the tape shuddered to a halt and the machine shut down.

Examination revealed that the capstan motor would slow then stop, though there was nothing wrong with it – it didn't seize up at all. Next time the fault occurred I pressed the pause button before shutdown took place. To my surprise, the tape then ran at the correct speed, displaying an immaculate picture, but the sound was muted. When pause was released the shuddering and slowing effect returned.

Quite by chance I noticed that an IC on the complex servo panel was getting hot. It was a 4049 CMOS chip, IC6403. CMOS ICs shouldn't get hot, so I replaced it. This cured the fault, and the machine is now set for another 18-years' service. IC6403 is in a bit of circuitry, called the "still pause" circuit, which looks as if it was tacked on to the original design as an afterthought. **C.J.G.**

Philips VR412

This machine was dead with no activity from the power supply. I found that start-up resistor R103 was open-circuit. **C.J.G.**

GoldStar P500I

There was no activity around this player's microcontroller chip. On investigation I found that a capacitor soldered across the leads of the crystal, on the component side of the PCB, was touching the underside of the deck chassis. Normal operation was restored when it had been repositioned. **C.J.G.**

Mitsubishi HSM37

This machine was in the fully laced-up position, with a tape in, and the motor tried to continue in the same direction. Once I'd unlaced the tape manually the machine worked normally for a while. It then locked up again after trying to stop from play. A new mode switch cured the fault. **C.J.G.**

GoldStar GHV1296I

This machine's mechanism appeared to be jammed. I removed the loading block from underneath the mechanism that holds the loading motor and master cam and found that the grease in the cam had dried out – it resembled lumps of candle wax! So I cleaned it all out and used some Molikote instead.

After reassembling the machine I found that, on test, it sort-of worked but the back tension was stuck. More solidified grease. Once this had been cleaned off and the lever had been lubricated everything was OK. **A.J.R.**

Sony SLV715

The customer said that a tape had got caught in the machine. When he had eventually managed to extract it "something fell out"! This "something" was taped to the top of the machine, and turned out to be the inclined base for the left-hand (supply) side. The pin that should be attached to it was still in the loading arm. To get to this I had to remove the large sensor PCB underneath.

A new inclined base was ordered from Sony and fitted in no time. The adjustable guide was removed from the old base and fitted to the new one. Then the sensor board was replaced. Nice and simple – except that when I tried the machine there was no head rotation. As I didn't have the manual I had to play this by ear. After checking the plugs and sockets I found that there was very little by way of voltage around the head driver chip on the sensor board. When I removed the board again I found an open-circuit N20 circuit protector. Once this had been replaced and the board had been refitted, the machine came to life. All that remained was to adjust the entry guide carefully and lock it in place. A really excellent picture was obtained. **A.J.R.**

Philips 14TVCR240

This combi unit came from another dealer who said it was impossible to repair. Well any combi unit is a bit awkward to work on, but this one is better than some I could mention! The first problem was that it wouldn't accept a tape. Simply putting the machine into the service mode revealed the cause: a faulty end sensor. You replace the sensor system as a complete assembly (Turbo deck).

The machine would now accept a tape, but would record and play back only in black-and-white. Scope checks were not very conclusive. The reference oscillator was running, and the DC voltages were all very close to their stated values. So, with some doubts, I replaced the LA7191 video/chroma processor chip IC7051. As I expected, there was no difference. Very occasionally however there were flashes of unlocked colour. In view of this I replaced the crystal, which cured the fault. The original one must have been slightly off frequency. **A.J.R.**

Sanyo VHR775

This machine damaged tapes when it played them: the tape was riding up past the audio/control head. A new audio/control head cured the problem. **R.B.**

Samsung VI395

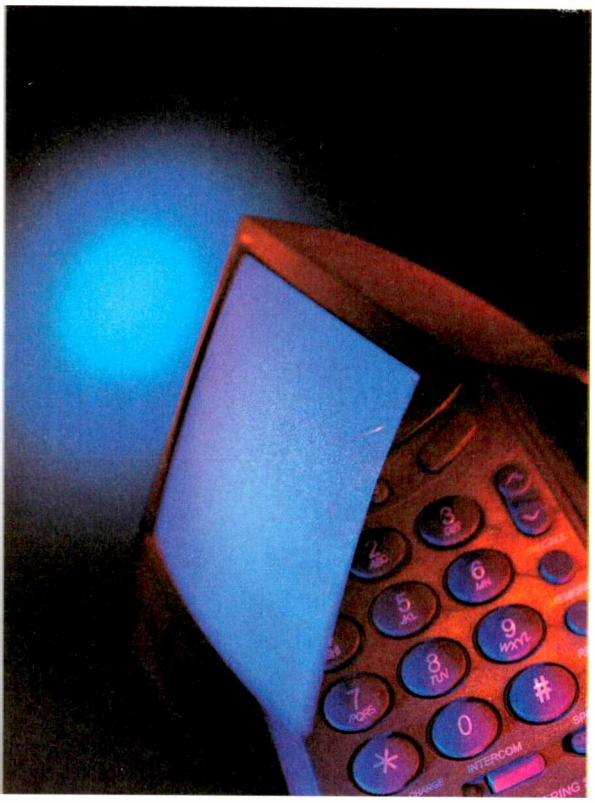
This machine was brought in because it was dead. When the power supply was checked out of circuit I found that there was only 14V across pins 1 and 3 of CN101 (a power supply kit had been fitted two years previously). The reading at pin 3 should be 16·5V DC. So I checked the reservoir capacitor C116 which read 330µF instead of 1,000µF. A replacement restored normal operation. **R.B.**

Panasonic NVL20

This machine would intermittently unload and stop in the record mode. The cure was to replace the record inhibit switch. **R.B.**

JVC HRD720

This machine would partially accept a tape then shut down to standby. The cure was to replace the mode-state switch, the control cam and the end sensors. **R.B.**



DTV

The Modem Interface

For interactive TV a communication path is required between the receiver and the broadcaster. Telephone lines are used for the purpose, with modems to provide an interface at each end. K.F. Ibrahim describes the basic technology

Interactive TV involves the use of a return line between the viewer's receiver-decoder and the broadcaster. The telephone system is used for this purpose. Since a telephone channel is designed to carry analogue audio (i.e. speech) signals, the digital data sent by the viewer to the broadcaster or from the broadcaster to the viewer must first be converted to a similar signal. This is done by using the digital data bits to modulate an AF carrier at one end and demodulating the carrier to retrieve the bits at the other end. Hence the use of a modulator/demodulator (modem) at either end of the telephone-line link, see Fig. 1.

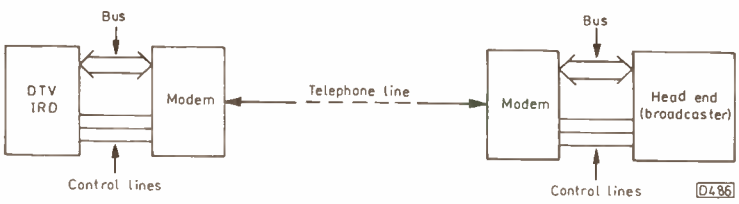


Fig. 1: Block diagram of a telephone line link for interactive TV.

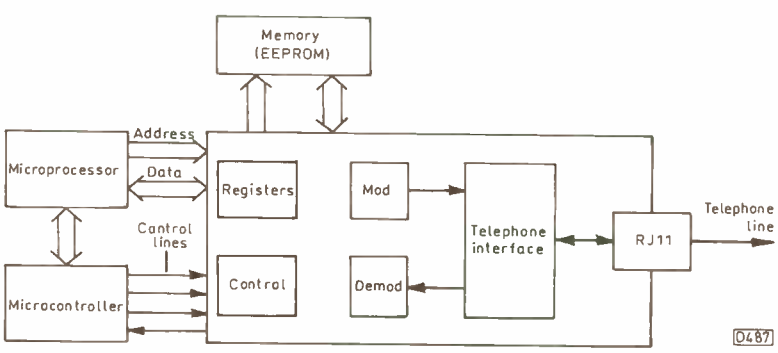


Fig. 2: Block diagram of a DTV modem interface.

Digital data created within the viewer's IRD (integrated receiver-decoder) modulates an AF carrier so that the signal can be sent along the telephone line in the same way as an ordinary speech signal. Conversely, modulated carriers from the broadcaster are received by the modem which converts them back to their original data form.

Modem Operation

Fig. 2 shows the basic elements of a modem interface unit. A non-volatile memory chip such as an EEPROM is used to store modem settings and some software routines. The modem is controlled by the IRD's microcontroller chip: data transfer to and from the modem is carried out by the IRD's microprocessor chip.

When the broadcaster sends a signal, the telephone interface detects the incoming ring and connects the line – as if it had been answered by lifting a telephone receiver. A signal is then sent to the microcontroller chip to get it to start negotiating a connection. A process known as modem handshaking then takes place to establish an agreed communication and data exchange protocol between the send and the receive modem. The protocol includes an agreed transmission speed, the size of the data packets, the number of signalling bits, and parity or other error correction/detection techniques.

Once a protocol has been agreed, the modem is set up by the microcontroller chip and data exchange can commence. Dialling may be initiated at the IRD or by the broadcaster. In the latter case an off-air signal may be used to prompt the viewer's IRD to dial the head-end (broadcaster). The procedures followed ensure that

dialling does not interfer unduly with normal use of the telephone.

Modulation

Modulation is the process of using an information signal, analogue or digital, to change one of the characteristics of a carrier waveform. With a modem system the carrier is then sent via a communication cable to a receiver which demodulates the carrier to retrieve the original signal information.

The carrier is a sinusoidal waveform of constant amplitude, frequency and phase. The modulating signal, e.g. speech or digital data, may be used to alter the carrier's amplitude (amplitude modulation – AM), frequency (frequency modulation – FM – or frequency-shift keying – FSK) or its phase (phase-shift keying – PSK).

A digital signal has only two states, 1 and 0. When it's used to modulate a carrier, the result is either of two different carrier amplitude, frequency or phase conditions.

With amplitude modulation the carrier's amplitude is varied by the modulating signal. Amplitude high represents logic one, amplitude low logic zero. Each change of carrier state (transition) represents a change from 1 to 0 or vice versa. At a transmission speed of say 300 bits/sec (bits per second) there will be up to 300 carrier transitions per second, which is known as the transmission's baud rate.

With frequency modulation the carrier's frequency is shifted by typically +150Hz for logic 1 and –150Hz for logic 0, hence the name frequency-shift keying. As with AM, each carrier transition represents a bit change and the baud rate is identical to the bits/sec rate.

The most economical form of modulation, in terms of bits per baud, is phase-shift keying (PSK). This is the type used for modem operation. With PSK the carrier's amplitude and frequency remain constant but its phase angle (e.g. 0°, 180°) varies in accordance with the modulation (data bits).

Binary PSK is a two-phase (0°, 180°) modulation technique. When the carrier is transmitted in the 0° phase condition it represents logic one; when it's phase condition is 180° this represents logic zero. There is thus one bit per baud.

The number of bits per baud can be increased by using smaller phase shifts, such as 90° for a 4-phase or 45° for an 8-phase PSK system.

There are four phase conditions with 4-phase QPSK, 45°, 135°, 225° and 315°. Each of these is used to represent the instantaneous states of a pair of bits, i.e. 00, 01, 10 and 11. Table 1 lists these states. The advantage of this type of modulation is its ability to transmit twice as much information as binary PSK, i.e. two bits per baud.

A further increase in the bit per baud rate can be obtained by using quadrature amplitude modulation (QAM), in which the phase and the amplitude of the carrier are both varied to enable more than two bits per baud to be transmitted. Trellis coded quadrature amplitude modulation (TCQAM), which is also known as Trellis coded modulation (TCM), enables six bits per baud to be transmitted, giving a data transfer rate of 14,400 bits/sec or over.

Bandwidth and Speed

The bandwidth allocated to a telephone channel is 3kHz (actually 300Hz-3,300Hz). The data communication channel must therefore fit within this bandwidth.

It is usually necessary for data signals to flow in both directions. This is called duplex operation. With full-duplex operation there is simultaneous communication in both directions; with half-duplex operation data can flow in only one direction at a time.

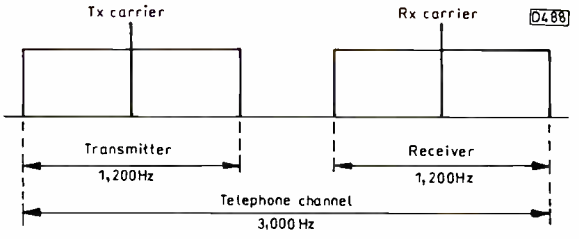


Fig. 3: Use of a frequency-division mulitplex to provide full-duplex operation.

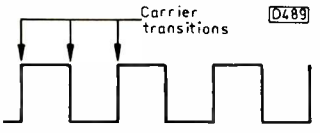


Fig. 4: Carrier transition points.

With full-duplex operation the bandwidth of the telephone channel has to be shared between the two-way signals. This involves what's called a frequency-division multiplex (FDM), see Fig. 3. Two different carriers are used, one for the transmitter (Tx) channel and one for the receiver (Rx) channel. These frequencies are generated as required by the modems involved: the transmitter modem generates the Tx carrier while the receiver modem generates the Rx carrier. Each carrier is modulated by the digital data as necessary and sent along the telephone line.

To ensure the reliability of this two-way communication, a gap is inserted between the two modulated signals (Fig. 3). This reduces the total bandwidth available to 2,400Hz – 1,200Hz each for the Tx and Rx signals. Thus the maximum frequency that can be accommodated with full-duplex operation is 1,200Hz.

At maximum frequency the carrier transitions alternate between 1 and 0 as shown in Fig. 4. One cycle of the waveform then represents two transitions (or bits). It follows that the rate of carrier transitions, i.e. the baud rate, is twice the bandwidth. Thus with full-duplex operation the maximum baud rate is 2 x 1,200 = 2,400. As we have seen, the actual bit rate is determined by the number of bits each carrier transition represents. With one bit per baud operation the maximum bit rate is 2,400 bits/sec. By using QPSK the bit rate can be doubled to 4,800 bits/sec and so on. This is the reason why modem speeds are a multiple of 2,400 bits/sec.

Modem Standards

Before communication between two modems can take place, they have to establish a common communication protocol. There are several standard modem protocols. They fall into two categories: the Microcom Networking Protocol (MNP), such as MNP class 2 and MNP class 3; and the International Telegraph and Telephone Consultative Committee (CCIT) types such as V.32 and V.42.

Table 1: 4-phase QPSK signalling.

Bit 1	*Bit 0*	*Carrier phase angle*
0	0	45°
0	1	135°
1	0	225°
1	1	315°

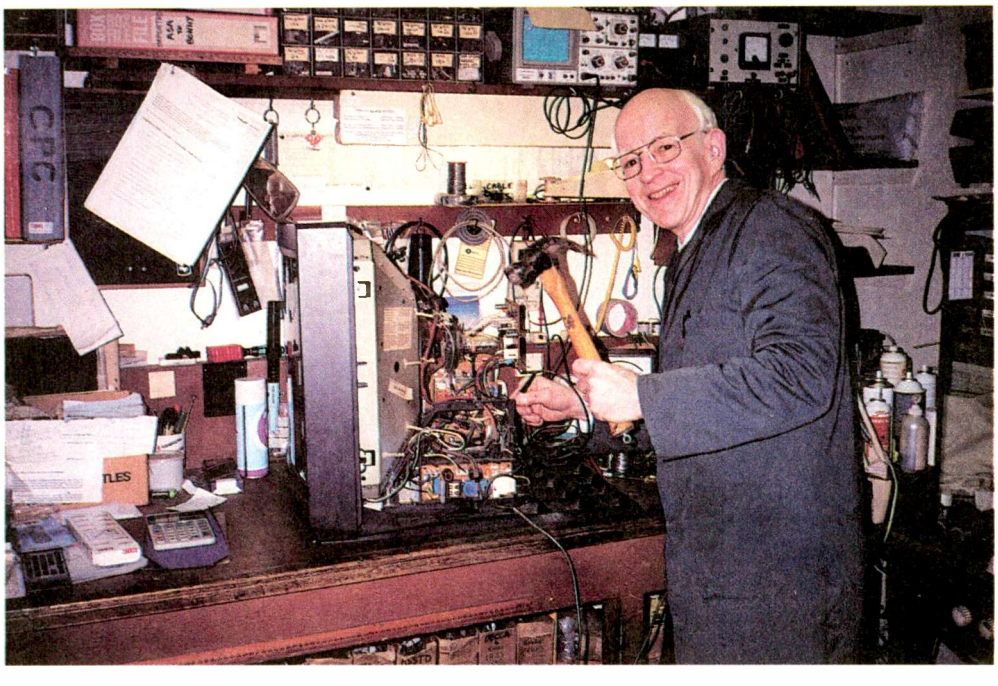
K.F. Ibrahim is a Senior Lecturer at the College of North West London.
For course information on digital television servicing, see advertisement on page 226 of this issue.

That's Our Business

Chris Avis and his wife Anne have run a successful TV/VCR business in Exeter for many years. How do they manage it, and how do they see the future? Chris explains

What do you call a collection of TV/VCR service folk? A Technotribe? The Short of the Earth? The Riled Bunch? The Dead(end) Set? Having for many years heard and read about other people's approaches and attitudes to running their own businesses in our trade, I've discovered a common factor: there isn't one! There are successful, independent brown goods retailer/service operators whose technical and entrepreneurial skills fill me with awe, admiration and, sometimes, a degree of intimidation. There are individuals who depend solely on their service skills and experience to earn a crust, with jam sometimes. And there are those who see a gloomy picture that no A1 diode can rectify, as their businesses go down the tube.

One-man bands, partnerships, family businesses: we're a mixed bunch, each with our own working methods – as has often been made clear in *Television*. In the February 1986 issue my wife Anne wrote an article, called "partnership", that chronicled our early days together running our RadioVision business. The intervening years have passed quickly, but we and the business are still here, with increased workshop space and now two engineers. We make a living, if not a fortune, from our corner shop in Exeter. Along the way we've acquired some useful business know-how that's supported and strengthened our ability to trade. Some of our strategies may be useful to you in your own business.



Chris demonstrates expert SMD removal.

Tools of the Trade

Apart from the obvious gear necessary for reasonable service efficiency, such as a scope, pattern generator, variac, isolation transformer, digital/analogue multimeters etc., there's a growing number of other equally important aids that make servicing less stressful. Information is as vital as the humble screwdriver, and is just as able to screw you up when a repair remains incomplete for the want of a circuit diagram or the value of a burnt component.

The U-View servicing volumes that are advertised in these pages are an excellent though large investment: ours are in use every day. Alternatively or, as in our case, additionally an annual subscription to the Harvey Electronics Manuals Library (01291 623 086) enables you to borrow up to six manuals at a time for a fortnight, the only additional cost being the return postage. Many sources of fault guides are listed in the rear pages of *Television*, but the magazine has itself described thousands of faults over the years. We have found that the ECS fault indexes provide affordable, easy access to this information goldmine. We've also been using the Euras CR-ROM system for a while, but have yet to decide on its cost-effectiveness. As well as fault lists, the regularly-updated CD includes power supply circuits, makers' modifications and a useful IC cross-reference which lists all makes/models that use the same device, often enabling a chip

in unfamiliar surroundings to be checked using a circuit diagram for a different model and/or brand. At £18 a month it's not cheap: the jury is still out.

Mention of CD-ROMs leads inevitably to the PC, another essential tool for the modern workshop. Add a modem and you have speedy access to the likes of SEME, CHS and Willow Vale, each with their CD catalogues plus on-line ordering for, usually, next-day delivery. As manufacturers prepare to release bewildering digital monsters to terrify us workshop inhabitants, the routine use of downloaded software to identify/correct problems will make the PC as important as the multimeter.

The cost of SMD desoldering equipment is falling. Recently we invested in a JBC JT6040 station from Willow Vale. This well-designed, cost-effective unit still represents big bucks, but is necessary when the future of soldering amounts to a lot of hot air. The HR LOPT tester and the Capacitor Wizard, previously reviewed in these pages, are other great time savers for a modest outlay.

Customers

Many words of wisdom have been written about how to treat customers. The rules are familiar, if not always followed. To us, the most important customer is the one who complains: we do everything we can to ensure that he or she leaves the shop more than satisfied.

The occasional bouncing repair is unavoidable in this trade, so we guarantee all our work for twelve months. In the worst type of case the same symptom arises because of a quite different cause, leading to the claim "it's gone exactly like it did last time!" Even if a guarantee means replacing further unrelated parts, we usually make no charge. It can be quite amusing to see the effect of this on an irate customer, who may display a mixture of surprise, bewilderment and very limp sails! On rare occasions this approach can be costly, but it's our belief that one or two angry ex-customers can cost our business far more than a few uncharged components and time, whereas happy customers are the most cost-effective form of advertising, often bringing us much new business through recommendations.

How Much?

The question you most often get asked is of course "how much?", which assumes that we have supernatural powers to be able to provide an instant diagnosis. To deal with the contentious problem of estimating, we have evolved a system that's proved to be mutually satisfactory while minimising unproductive bench time.

When a repair is brought in, we state the maximum that the job would cost without having to check with the customer. The present limit for TV sets, satellite and audio (excluding CD) equipment is £45; for VCRs, CD players and monitors it's £65. "If it would cost more, we'll let you know, if it costs less we'll do it" we tell the customer. Should an estimate be demanded, we ask for £17.50 in advance, deductible from the repair cost when the estimate is accepted.

In practice we rarely make this charge, as it's usually possible to judge the viability of a repair at the shop counter stage and advise the customer accordingly. Most customers are reassured to know that there's a limit to repair costs without their acceptance, and appreciate our openness. Those who are shopping around for free estimates are invited to check elsewhere.

A problem can arise where, for example, a viable TV repair requires a LOPT that would lead to our basic maximum being exceeded. If a modest replacement transformer is available and the repair is worth carrying out we normally proceed, but phone the customer with an 'estimate' rather than saying that the repair is complete. This is more likely to result in confirmation of the repair charge, as the customer doesn't feel that he has been trapped into acceptance.

If an actual or contrived estimate is refused, the customer can choose to either leave the item with us free of charge for scrap, spares or resale, or collect it in its unrepaired condition for £17.50 complete with a written estimate.

You may have different ideas about this, but in our opinion the system outlined above works.

Anne, daughter Ruth 14 and Chris in the shop.

Strength in Numbers

It's best, we feel, not to be entirely on your own. With today's service technology, going it alone is likely to lead to frustration and an impatient bank manager. There is strength in numbers – we consider that shared knowledge and togetherness has never been more important in our trade.

We make a living, if not a fortune. Along the way we've acquired some useful business know-how that's supported and strengthened our ability to trade

We've never regretted joining the Radio, Electrical and Television Retailers' Association, and gain much from its facilities and meetings. The savings we made on insurance costs alone more than covered our first year's subscription, and making contact with others in the trade can, for a small business, be invaluable. Local meetings are held regularly, and the Service Conference at Solihull each July is becoming an essential event.

Discounts are available via RETRA for some services, including the Manuals Library mentioned earlier and a Barclay Merchant Services PDQ terminal for electronic processing of card payments – another business boost.

A Quick Fix

Simple repairs are usually carried out immediately at the shop counter, where mains, aerial and monitor sockets are available for connection. A VCR head clean and check or a remote-control unit dry-joint problem can, for example, be quickly remedied for a standard inclusive charge of £10. Video customers are usually given a copy of our information sheet on the use of reputable tapes and the recommendation not to use head cleaners.

Our while-you-wait services are much appreciated. Aspiring DIY experts can purchase spares – on the clear understanding that no guarantee applies unless the components are fitted by us. Specially ordered parts have to be paid for in advance.

Shock Tactics

Uncollected repairs tie up space and money. We display the usual notice about collecting repairs promptly and their sale after three months if left uncollected, but some customers have persistent amnesia. The law requires three months' written notice before an uncollected item can be sold. We post a card after a month, threatening to sell the item after a further seven days, and find that this usually results in speedy materialisation of the owner.

Second Time Around

Our business has always strongly featured the sale of reconditioned TV and VCR equipment. Although the tumbling cost of new equipment has had an effect on the second-hand market, there is still a demand for reliable used sets.

We find that ex-Granada Panasonic 21/24in. TX2/3 sets (Alpha 1 chassis) with Fastext are dependable and sell well. Even the old Rediffusion Mk 4/4A sets are still popular – and a lasting tribute to long-extinct British design and build quality.

Our small shop cannot display impressive arrays of TV/VCR stock, even if our bank was sufficiently impressed to finance it. We've held a Samsung agency for many years however and sell small but steady quantities of their VCRs and TV sets. Samsung has treated us well. The company can make mistakes, like everyone else, but is quick to act on problems and is more flexible than many of its competitors.

We deliver, install and give tuition with any TV sets or VCRs we sell, and our reconditioned goods have a six-months guarantee. By the time you read this, new laws will be enforcing a two-year guarantee with new goods and a one-year guarantee with second-hand goods. This won't worry us unduly. The Samsung TV sets we sell rarely return to the workshop in less than five years, and I would be very concerned if any of our reconditioned sets failed within a year. The effect on those who sell the mass of unreliable dross that proliferates today remains to be seen.

Outside Jobs

Apart from installations and occasional calls to the old folk in our area we do no field servicing or aerial installation work. Instead, money is invested in good facilities for our three workbenches, and reduced overheads mean lower charges for our customers.

Requests for house calls usually result in the item being brought in. If this is not possible we give the telephone number of a reliable, well-established fellow engineer who is equipped for outside service calls. Similarly, an excellent local aerial man receives referrals as necessary.

Work Sharing

I spend as much time as possible at the bench. But this time is limited by the need to attend to customers, answer the phone, order spares (and return wrong items received), see reps, open the mail, file 80 per cent of it in the bin and attend to other delightful administrative duties.

Fortunately I'm spared the bafflement of bookkeeping, VAT and the Inland Revenue. These are efficiently managed by Anne.

Contrary to some opinions, there are still plenty of bread-and-butter stock-fault jobs around. But the proportion of nasties is increasing. Thus every workshop needs its Sage, to reduce the number of sets on the EFITT (Elusive Fault Impossible To Trace) rack. We are very fortunate to have two Sages, Tony and Mike, who between them have invaluable knowledge and accumulated experience, providing repair expertise on a wide range of brown-goods products. We cannot pay them their worth: they remain loyal for our excellent coffee!

Fast Forward

The development rate of future technology makes Marty Fly's Back to the Future car look like a Model T. The shortage of skilled personnel and lack of new entrants bodes ill for future digital problem shooting. The trade is not, generally, helped by the politicians – particularly those who get involved in ridiculous price-fixing claims, and the decision of the MMC (Must Manufacture Conclusions) enquiry that's likely to result in price-plummeting mayhem and the disappearance of even more service skills.

There are however those of us who can still view our future as a potentially rewarding challenge, especially as independents with a personal, caring attitude towards our customers. With the advent of ever more new technology, increasing numbers of them are seeking this rather than knock-down bargains, and are deserting the impersonal, unhelpful multiples.

As to the future of our shop in a corner of Exeter – that's our business!

Camcorner

Reports from
David C. Woodnott

Toshiba A1-420P

The note that accompanied this elderly VHS-C machine simply said "dead". Our experience with these machines has generally been confined to mechanical or connector faults, sometimes when a unit has been dropped. This one had no such problems, but refused to power up.

The cause was simply failure of the primary fuse link, which is housed inside the grip case. It was a surprise to find that it's rated at 4A. No cause for the failure could be found: the unit worked well once a replacement had been fitted. Age-related fatigue was probably the cause – I know the feeling all too well!

Sony CCDTR705E

This Hi-8 model is generally reliable. We had one recently that wouldn't power up in either mode however. It's not a common occurrence, though the power switch on the Switch Block Control assembly sometimes fails. It was OK on this occasion.

A check around the DC-DC converter circuits revealed that PS901 and PS902 (both 1·6A ceramic) had failed. As no short-circuits and no unusual loading of the supply lines could be found, replacements were fitted. The camcorder then started to operate, though not as it should do. White spots on the monitor's screen suggested possible failure of the converter drive chip IC101. I've reported this symptom before with other, similar Sony models. A new IC and set-up restored normal operation.

A service was then carried out. With the FL mechanism used in this and other models it's good practice to check tape guide TG9 for looseness. The guide quite often falls out. The result is tape damage, if you are lucky, or more severe mechanical damage if you are unlucky. If it's loose, refit and secure with Loctite 221, which is available from Sony as part no. 7-432-090-41.

Philips VKR6840

This elderly model, which is based on the JVC GR45E, came in with a long list of fault symptoms from poor playback to no playback colour with its own recordings though the playback was OK(ish) with recordings known to be good. There were also several vertical striations on the E-E picture.

I try, usually successfully, to persuade customers not to proceed with repairs to this model because of the widespread capacitor failures that occur and the possible long-term consequences. But the owner decided that he liked his "old friend" and wanted it fixed, despite the fact that its replacement would have been to his long-term advantage. So off we went!

Our "best friend", the capacitor wizard, confirmed that all the electrolytic capacitors on the Y/C PCB were, as expected, faulty. They had not leaked but had dried out, most of them having little capacitance left. I removed all the surface-mounted capacitors from the PCB, then inspected and washed the board and left it to dry overnight. New components were then fitted.

Similar work was done on the camera head, SSG and video PCBs etc. The mechacon PCB was inspected, but no work was required as most of the capacitors here are of the wire-ended type and checked out OK. When all the replacements had been fitted the unit was reassembled for testing.

The monitor produced a good E-E picture, and the striations had gone. Playback of a test tape was also fine. So far so good.

But playback of its own recordings was not so good: a colour pattern danced around over the playback picture, which had distinct noise visible in the saturated parts.

Nothing had been adjusted during the course of the repair, so no setting up should have been needed. I had, after all, only replaced failed components with the correct value ones. A little thought was needed – replacing large numbers of surface-mounted electrolytics daily can sometimes muddle your thinking!

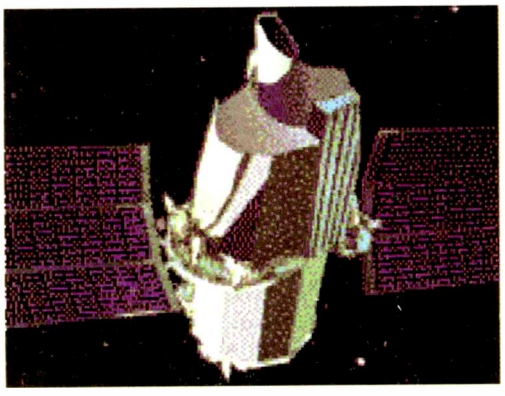
The cause of the trouble was obviously in the chroma record channel – but all the capacitors on the YC board were now new. The only remaining section of circuitry in this signal path is the head amplifier. The manufacturer regards this unit as non-serviceable – it's supposed to be replaced as a complete item. There's a circuit diagram in the manual however.

I opened the can and found several tightly-packed surface-mounted capacitors which were all faulty when checked. After the usual washing process I fitted replacements. This restored correct operation, and a service completed the repair. The customer was very happy to have his "old friend" successfully restored, and I was happy with the relatively large cheque.

The capacitors in the head amplifier can are extremely tightly packed and are best removed using dual heated tongs (OK Industries etc.). Fitting 3mm-type surface-mounted components as the replacements instead of the original 4mm types will give you more room.

Sony CCDTR750E

This newish model failed to produce an E-E camera picture: all other functions were OK. Internal checks revealed that there was no CCD imager output signal though the iris worked correctly and the SSG drives were present (PCB FP89). The 15V supply to the CCD FET etc. was missing because L691 was open-circuit. A replacement cured the fault – no reason for the failure of the original coil could be established.



DX and Satellite Reception

Terrestrial DX and satellite TV reception. News from abroad and from the satellite belt. The start of RSL-TV in the UK. DTT problems. New receivers. Roger Bunney reports

Terrestrial DX reception took an autumn holiday this year. I can report signals on only two days during October. On the 20th Cyril Willis logged RAI (Italy) ch. IA and TVR (Romania) ch. R2 from 1415 onwards. On the next day I too received RAI ch. IA, for about half an hour from 1300 hours local time.

Start of RSL-TV

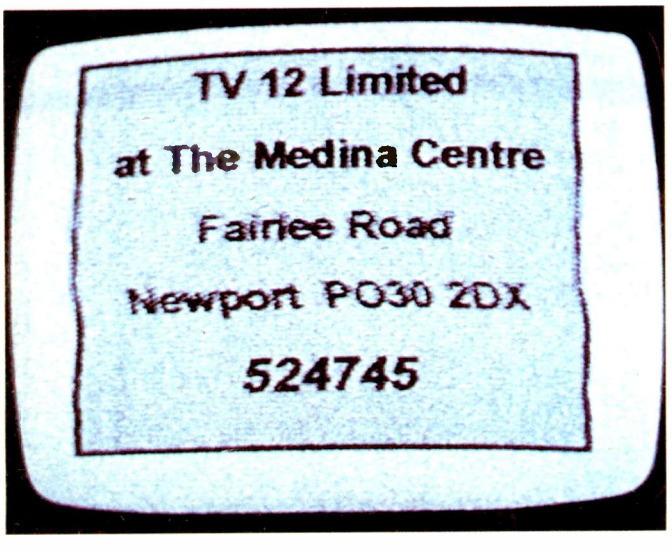
The main news this month is that the first RSL (Restricted Service Licence) TV station in the UK is now on air, being transmitted at 1kW ERP from Rowridge, Isle of Wight on ch. 54 with horizontal polarisation.

After five days of test transmissions the station, called TV 12, finally opened at 8 p.m. on October 31st. It's real local TV: the programming is immediate, personal and intimate. During the first week we had a re-run of the Ryde 1998 Carnival, College Cuisine (students cooking meals), Island Farming, Video Club, Village Gardens, Gig Night Out plus weather forecasts on the hour and local news reports.

The programmes are produced entirely on the island, the station being based at Newport. At present the programme hours are 1600-2230, with repeats scattered through the day at weekends. There's Bloomberg News at 0600-0800 weekdays, then birthdays, weather and what's on. At 2300 QVC is transmitted. Local advertisements are transmitted as 'graphics' during the day: rates are £1 private (£2.50 with picture) and £5 upwards commercial. Unlike network TV, the programme timing tends to be refreshingly unpunctual.

TV 12 is quite different from TV as we have known it to date. It's based on the style of US community TV. The main broadcasters are watching closely to see how it develops. There's an advice line for prospective local viewers – 01983 524 745.

The station represents a real challenge for DXers, since the transmitter powers are low (permission is being sought from the ITC to open relays). At my Romsey location, which is well outside the predicted coverage area of TV 12, reception is fair though there's co-channel interference from Mendip. I've even had watchable-quality reception using a Band I aerial! Anyway, check out TV 12 – you'll find it quite different from the TV you are used to. The accompanying photograph shows a station ident.



One of the first TV 12 transmissions from Rowridge, Isle of Wight, on ch. 54.

Satellite Sightings

October was a busy time for analogue satellite TV – see News later. During the month there were a couple of major computer corporate presentations. The Apple Program on the 12th came via PAS-3R (43°W) at 12·7GHz vertical. It started with an extended report on the company's performance during the past year then moved to the introduction of the new MAC OS 8·5. Dramatic demonstrations of how the new machine works brought applause from the captive Apple staff, especially when the internet search engine Sherlock went to work seeking out data then classifying its findings in terms of relevance and importance. The main message was that Apple has turned the corner and that the business is on the up and up.

Some days later, on the 23rd, the Loral Skynet test card appeared from Intelsat K at 1430 UK time on 11·537GHz horizontal. At the same spot but with ver-

tical polarisation Tivoli Corporate was present. This was another computer company presentation. The first caption read "Network Associates – who's watching your network". There followed a staff presentation that was similar to the Apple one but decidedly more relaxed.

At the same time, on 11·621GHz vertical, there was yet another corporate feed to Europe. But the attention-grabbing material that afternoon was the follow-up to the Loral Skynet card. It consisted of a feed from Stanford Hospital, California, showing a complicated operation being carried out on a 40-year old woman. There were question and answer sessions both within the hospital and from remote locations. Extreme close-up camerawork was not for the squeamish. The surgeon displayed skills and confidence and was happy to pause to explain and discuss the unfolding action.

It was a good month for satellite launches. The Arianspace 503 rocket was launched from Kourou during the afternoon (UK time) of the 21st. This was seen live via Intelsat K at 11·625GHz vertical, also via Telecom 2 (5°W) in C band at 3·769GHz. There were dramatic shots: later re-runs of the action featured a camera that looked back from the rocket as the ground became rapidly more distant, showing the South American coastline.

The launch of Afristar, which is to provide Band L radio transmissions for Africa and the Middle East, was a success on the 28th, seen via Intelsat K at 11·624GHz vertical during the early evening in the UK.

There were, following the launch of Eutelsat W2, several reports of test transmission reception as the satellite was moved to its slot at 16°E. John Locker (Wirral) logged strong signals at 2°E in mid-October, and Cyril Willis (King's Lynn) reports reception of more tests from this position. By the end of the month there were strong signals from 16°E, confirming that W2 had arrived.

My favourite satellite, Intelsat K at 21·5°W, provided history in the making during the month, with reports on the Middle East peace deal between Israel and the Palestinians and the Cuban president Fidel Castro's visit to Portugal. The latter was seen at 11·537GHz horizontal as an NTSC signal.

Arabsat at 30·5°E provides some interesting viewing – the 4·085GHz transponder is a favourite for news feeds. Devious methods are used to avoid news-feed piracy. Most locally-generated and distributed news items are carried in the clear, but with material from the Asian Broadcasting Union and Reuters the picture is usually upside down and reversed, though the extreme upper and lower video strips remain the correct way up – the audio is clear. Uplink powers vary considerably – Jordan is usually very strong but Qatar is weak.

The EBU may have gone to MPEG 4:2:2, but analogue signals are still present in more distant parts!

There were naturally lots of sports feeds during the month. On November 1st we had the New York Marathon '98 live in the early evening via Intelsat K at 11·534GHz horizontal, with audio at 6·6 and 7·4MHz. On October 11th from 1800 hours there was exciting car action with the Winston Cup from the Talcageda, Alabama race track, an ESPN feed to Europe via Intelsat K. There were interesting shots from the air, using a Coptorcam eye-in-the-sky camera.

Finally Hugh Cocks (Portugal) suggests checking Intelsat 801 at 31·5°W. There's a video splurge at around 11·14-11·172GHz which is breakthrough of C-band ORTN Niger TV (3·918GHz) to the Ku-band downlink. It goes to test card, which can just be identified, at 2200 hours GMT.

1999 Meteor Showers

Our thanks once again to Neil Bone of the Meteor Section, British Astronomical Association, for details of the main meteor showers during the coming year – see box over the page.

Meteor shower/scatter (MS) reception calls for an accurately-tuned system that can react quickly, in respect to picture sync, when brief signal pings arrive from cosmic particles that burn up at around E-layer height (100-140km) above Earth. These burn-ups produce intense ionisation. Signal reflection occurs mainly at 45MHz up to Band II, but if the ionisation is sufficiently intense it can occur at up to Band III. Reception lasts for only a few seconds, and depends on the receiver being accurately tuned to a specific channel and able to lock instantly.

Random MS propagation occurs throughout the year, providing brief VHF radio and TV signals with reflection distances typical of single-hop SpE. The reception technique is to use an

The Apple Program on October 12th via PAS-3R, with John Lennon and Yoko on the wall.

Shower	Overall period	Peak
Quadrantids	Jan 1-6th	Jan 3-4th
Lyrids	April 19-25th	April 23rd
May Aquarids	April 24th-May 20th	May 3-5th
Cetids	May 7th-June 7th	May 14-25th
Delta Aquarids	July 15th-Aug 20th	July 29th and Aug 6th
Perseids	July 23rd-Aug 20th	Aug 12th
Orionids	Oct 16-27th	Oct 20-22nd
Taurids	Oct 20th-Nov 30th	Nov 1-7th
Leonids	Nov 15-20th	Nov 18th at 0400 UT
Geminids	Dec 7-15th	Dec 13-14th
Ursids	Dec 17-25th	Dec 23rd

The Giacobinids, a minor shower that occurs in early October, is unlikely to be active in 1999.

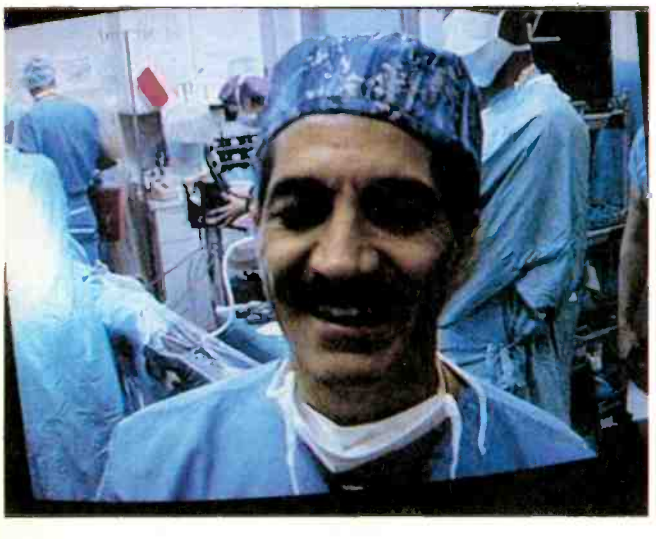
efficient aerial system, tune to a Band I TV channel – and wait! The chance of reception increases considerably at certain times of the year, when the number of meteor particles increases considerably – these are the meteor showers, such as the November Leonids. Reception can be of long duration and good strength at such times.

DTT

Digital terrestrial TV problems will probably be less in the UK than those in North America. Over a year ago Kerry Cozad, the engineering manager at Andrews Corporation, commented on problems with transmission masts and the aerials mounted on them. In North America masts usually carry numerous aerials used by broadcasters who operate at VHF and UHF. The aerials are often fed individually instead of, as with the UK channel-group transmission system, via a single feed from a diplexing network.

With the advent of DTT in the States, many aerials will be unable to accept additional digital inputs. So additional aerials will be required on masts that are often already fully loaded. The problem is how to cater for this increased loading – both aerials and cables. One answer from Andrews is the use of slim-profile slot arrays – a form of coaxial transmission line. These provide fully-adjustable radiation patterns with minimal problems from systems mounted nearby, e.g. TV panel transmission arrays, PMR etc., and offer low wind-load stress. Other ideas are to use thinner cable with higher-gain aerials, or higher-specification cable that can carry greater powers within a smaller diameter. With careful design, existing lattice masts should be able to manage the additional task of DTT transmission, avoiding the need to erect adjacent masts.

Fortunately only UHF transmission is used in the UK for TV, but whether the aerials will be able to handle the additional DTT signals remains to be seen – obviously not where the signals are not in the same group. This point leads to the question of whether viewers will, in some areas, be prepared to replace their existing aerials with wideband ones or have them replaced. Or will they accept poor quality or no signals with an existing single-group UHF aerial – or just not bother?



A sen ior surgeon at Stanford Hospital, California greets medical viewers in Europe and explains the operation to be performed. Reception via Intelsat K.

Terrestrial News

Germany: The government has come down in favour of closing analogue TV services down in 2010, though industry suggested 2006. The situation will be reviewed in 2003, to assess technological developments.

Canary Islands: There's a battle for the new single commercial station between media groups Televisa and Sogecable. The local authorities are not too happy with the situation and are seeking to delay the franchise process for further consultation. A Spanish broadcast privatisation bill to be passed shortly will allow many private local channels to open across the mainland.

Spain: In the October issue I mentioned reception of a mystery Spanish ch. E29 station, which transmits a test signal with the message "Emision Experimental Prueba DTT", by George Gaskin in Gibraltar. The situation has now been clarified. The proposed GBC-2 service was to have used this channel and transmitted test signals earlier on. For political reasons however Spain has decided to jam the channel – even though the plan for GBC-2 has now been dropped.

New Receivers

Last month I reviewed the Manhattan LT6300+ Mark 2, recommending it as a suitable analogue satellite TV receiver for DXing. Gareth Foster has since drawn my attention to another budget-price analogue receiver with good facilities. Satellite Solutions is selling to its trade account holders a Chinese manufactured, BT-badged receiver, Model SVS300, for just £49.95 plus VAT. It's a VideoCrypt IRD with a 200-channel memory, threshold extension, a tone switch and three scart sockets on the rear panel. Coverage at IF is 900-2,150MHz. The receiver is switchable for C- or Ku-band operation. Gareth has one and says it's really good value with excellent RF performance on weak signals.

Aerial Techniques has just introduced Model STV1020KIT, a 10in. PAL B/G/I VHF/UHF plus cable hyperband receiver that features auto-scan, a 99-channel memory and OSDs and incorporates a 950-2,050MHz satellite receiver with decoder input, a 35cm dish and an LNB with an 0·8dB noise figure. It runs on either 230V AC or 12/24V DC supplies and is intended for camper van, canal boat or lorry driver use. Further details can be obtained from Aerial Techniques – phone 01202 738 232.

Satellite News

True hand-held global communication is now available with the opening of the Motorola/Iridium LEO (Low Earth Orbiting) satellite system. Globalstar brought its 66 LEO craft on-line in early October,

so your Iridium phone switches from terrestrial to satellite should you be out-of-range of a cellular land-based station. The LEOs orbit at 400-700kms above the earth, and there is always at least one above the horizon. Iridium has tied up Orange, One-2-One and Cellnet in the UK, so GSM subscribers have "roaming" contact provided by access to terrestrial and satellite communication systems.

Teleport London International has been bought by Kingston Communications, making Kingston one of the top three satellite operators in the UK. Over two thirds of the globe is covered, in all modes, from the company's Bedford-based teleport. The London-based Molinaire facility is to provide transmission/presentation control with its new three-year contract for the Al Jazeera satellite channel.

The Chinese government has allowed Japanese broadcaster NHK to beam digital satellite services to mainland China. NHK is to form partnerships with Chinese companies to make receiving equipment. Programming from the NHK World service and NHK Premium channels will be converted to digital in April.

Indian group Sterling has leased three Ku-band transponders aboard the Singapore/Taiwan ST-1 satellite to beam digital educational services to India through an intermediary, SivaSat TV Communications. The plan is for an eventual 60-channel package tied in with schools' curricula.

The cause of recent problems with three faulty Hughes HS601 satellites seems to be corrosion on a tin-plated latching relay that shorts to earth, taking down the satellites' main control processor. New satellites are being modified to avoid this potential fault condition.

The Galavision analogue service at 11·515GHz horizontal via PAS-1 (45°W) has closed down. It seems that when the current French Telecom birds come to the end of their life no more will be launched: France Telecom will instead lease capacity from Eutelsat.

It's now official that the EBU has dropped its analogue news distribution feeds via Eutelsat II F4 (7°E), moving to MPEG digital transmission. Up to twenty video circuits can now be provided, with much higher sound quality and instant access encryption for commercially sensitive material.

There were several satellite launches during the month – Eutelsat W2 (16°E) on the 5th, Hot Bird 5 (13°E) on the 9th and Afristar on the 28th. There was also a test/proving flight for the new Ariane 5 rocket on the 19th (see previous note).

CNNI and Euronews are going digital, CNNI via Astra 2A on December 16th and Euronews via Hot Bird 3 in early January. Canal+ Belgique is to launch Belgium's first digital service in mid-January, with both French and Flemish language programming. There are about 700,000 subscribers to the present analogue services.

AB Sat (France) has signed an agreement to provide five TV channels for the CanalSatellite digital service.

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: Timebase panel for the Philips G8 chassis. G. Cox, 6 Cardinals Close, Bexhill, Sussex TN40 2QJ. 01424 214 579.

Wanted: Source of parts for the OK Industries Inc. DG24100-A desoldering gun. Reg Fullerton, 5 Shilgrove Place, Castledawson, Co. Londonderry BT45 8AL. 01648 468 477.

Wanted: Type ZC84328P processor chip for the Ferguson TX98 chassis. New IC or old board with chip. Roger Scales, 17 High Street, Bridlington, E. Yorks YO16 4PR. 01262 602 584.

Wanted: Circuit diagram/servicing information for the Gateway 2000 Vivitron 17in. monitor (photocopy OK). Model no. is CVP GF200T. C. Radford, 16 Greenhill Lane, Kikby-in-Ashfield, Notts NG17 9GA. 01623 758 548 or e-mail cmrg7vjq@aol.co.uk

Wanted: Scan coils for the Grundig P1423GB UHF/VHF 14in. TV set. J. Austin, 5 Cranwell Road, Greasby, Wirral. 0151 677 9048.

Wanted: Complete control door unit for the Panasonic NVG21B VCR and if possible a genuine remote-control unit. Also a 240V/10V standby transformer (part no. 4511 31 18) and remote-control unit for the Solavox 14R19/1. Used items would be acceptable. Also require a service manual or circuit diagram, either of which must have oscillograms, for the Triumph CTV8210. This set has a weird blanking fault when cold: the picture is present at either side of a wide black vertical bar which disappears after about 15 minutes to leave a normal picture. Paul Hardy, 43 Sheridan Avenue, Caversham, Reading RG4 7QB. 01189 475 869.

Wanted: Circuit diagram for the Boots 1417R colour portable and a LOPT for the Hinari Model CT15. Andie Wilkes, 34 Tideswell Road, Great Barr, Birmingham B42 2DT. 01926 404 935 (day), 0121 650 0720 (evenings).

Wanted: An owner's instruction book for the Ferguson Model 3V32 VCR. A. Squres, Fairview, High Bullen, Torrington, N. Devon EX38 7JA. 01805 623 349.

Wanted: Circuit diagram for the electronic Avometer type EA113, also a circuit diagram for the vintage Ekco radio Model SH25 (photocopies OK). Leon Schyvaerts, Werkendam 43, B. 2360 Oud-Turnhout, Belgium.

Wanted: Thorn 2000 and any other early colour chassis; a Philips N1500 VCR; and information on the Thorn Model 8759. Steven Nicholson, 77 Deerlands Avenue, Parson Cross, Sheffield 5S5 7WS. 0114 257 7163.

For disposal: Various 14in. CRTs including an A34EAC01X06, A370HFB22, A3702B22, A37592X etc. Also several non-working VCRs, all good makes, some recent. F. West, 8 Llainwen, Tynygongl, Anglesey LL74 8SD. 01248 852 950.

Wanted: Power supply panel and off/on/timer switch for the Ferguson 3V29 VCR or a scrap working machine. G. Chester, 6 St. Aidan's Close, Horninglow, Burton on Trent DE13 0LQ. 01283 563 948.

Wanted: CNC monitors. Cash paid for any circuit diagrams, spares or technical information on monitors used in CNC machine-tool control systems – Fanuc, Heidenhain, Sienumeric, Meldas, Yasnac and others. Please call John Holland on 0973 443 735 or fax 01203 715 055. ReVision, 165 Albany Road, Earlsdon, Coventry CV5 6NE.

Wanted: Lopt for the Protech Model Pro 10 colour portable, or any information on where to obtain spares. Ken Howe, 13 Howardian Close, Lambton, Washington NE38 0PX. Phone/fax 01914 178 101.

Wanted: KSS123A laser for the Toshiba XR30, and an LCD remote-control unit for the Sony SLV270. D.F. Rogers, 4 St. Cuthman's Road, Steyning, Sussex BN44 3RH. 01903 814 021.

Wanted: Can anyone help with the following problem with a Toshiba TV set. The channel numbers go on running. When the channel is locked the picture is normal – but not on all stations as the picture starts jumping and the sound disappears intermittently. Any ideas on what to look for, please write to B. Samson, 82-39, 134St., Apth IP, Jamaica – NY11435, USA.

Wanted: Power supply circuit diagram (photocopy OK) for the Panasonic NVJ30B VCR – it's completely different from the one shown in the April 1998 issue of *Television* (IC1102 is type STK5392). Also need a power supply (switching unit) for the Ferguson FV33H VCR. Arthur Tomkinson, 10 Lodge Court, Station Grove, Wembley, Middx HA0 4AP. 0181 903 574.

For disposal: Lots of electronic scrap, complete TVs to PCBs, video bits etc. Free to anyone who will take it away. Also some complete, repairable units at a small charge. G. Hadley, 283 Old Wakefield Road, Moldgreen, Huddersfield, W. Yorks. 01484 300 889.

Wanted: TDA5660P IC as used in the Black Star Orion test-card generator. Peter Antcliff, 63 Chester Road, Stevenage, Herts SG1 4JY. 01438 225 602.

Wanted: Old spares – valves, knobs, books, circuit diagrams, test gear – in fact anything to do with valve radio receivers. Particularly require a 6X5GT rectifier valve. Will travel anywhere to collect. Steve Taylor, 11 Charnborough Road, Coalville LE67 4SF. 01530 832 695.

Wanted: Service information/manuals for BT cordless phones, particularly the Freestyle range. Brian Barron, 55 Henderson Avenue, Cavehill Road, Belfast BT15 5FN. 01232 715 826.

Wanted/for sale: Require an AC adaptor, type EA-771v, for the Sharp PC-7700 laptop or a circuit diagram for the adaptor (photocopy OK). May consider dead PSU for parts – cheap please. Also require a circuit diagram (copy OK) and plastic keyboard surround for the Compaq Contura 400 laptop. We're breaking Amstrads PC2086/PCW8512: most parts available. John McClean, 66 Castle Park, Limavady, Co. Londonderry BT49 0SB. 01504 763 045.

Wanted: Text module or its ICs for the Hitachi Model C1709T, and a LOPT for the Matsui Model MB10 (part no. FCA017 422 105 1024. Gordon Howie, High Street, Harlech, Gwynedd. 01766 780 613.

Answer to Test Case 433

– see page 175 –

Two faults for the price of one this month! In fact two faults and three diagnoses, the first and last of which were correct.

Why didn't the VCR work when it was first connected to the mains supply? Simple this one: the start-up capacitor C6 (1µF, 250V) had dried up and fallen in value. The owner would not have encountered this problem unless there had been a power cut or the machine had been disconnected from the mains supply for some reason.

Once it was clear that the tape-drive fault was not caused by the capstan motor, Sage used an oscilloscope to monitor the supply voltages at motor plug PG01 – he should have done that earlier in the proceedings of course. The A5V supply was OK. But the 'V CAPST' line, which should have been at about 11V, was low and varying: the greater the mechanical load on the motor, the lower and rougher (in terms of ripple) the V CAPST voltage became.

This led Sage back to the power supply section, where he found that regulator transistor Q5 was working with a rough, rippled collector supply of little more than 11V. This is in fact the A14V line, which comes from the chopper transformer via rectifier diode D8, with smoothing by the two 470µF capacitors C12 and C13 along with choke L4. The value of these two capacitors had fallen. Once they'd been replaced, operation was back to normal.

NEXT MONTH IN TELEVISION

Servicing the Philips Turbo VCR deck

The Philips Turbo mechanism has been around for a number of years and has proved to be efficient and reliable. Most repairs are straightforward and don't require much explanation, but some points can cause confusion. Alan J. Roberts provides detailed notes to help when a VCR fitted with this deck comes in for service.

Low-power standby operation

Greenhouse gas emission from electricity generating stations could be considerably reduced by lowering the power consumption of TV sets – and other equipment – in the standby mode. Over the past year or two "green" chopper power supply controller chips have been developed to achieve a worthwhile reduction. Eric Carlton outlines the problem and the techniques devised to make more ecologically friendly operation possible.

A visit to Pioneer

Japanese consumer electronics manufacturer Pioneer undertakes considerable R&D work. George Cole reports on its DVD-Rewritable deck, work on the DVD-Audio format and a flat-screen display technology known as Organic Electroluminescence.

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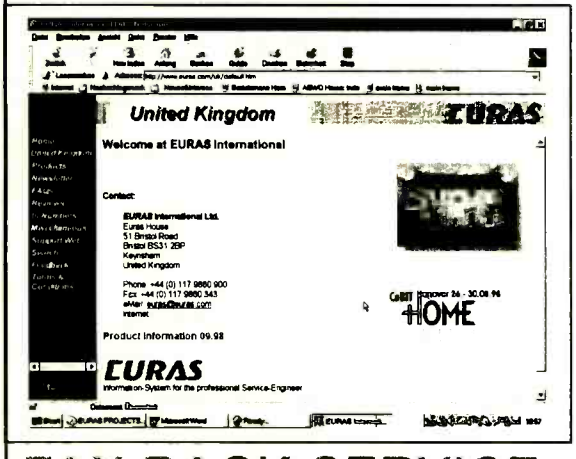

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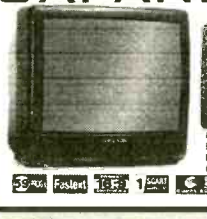

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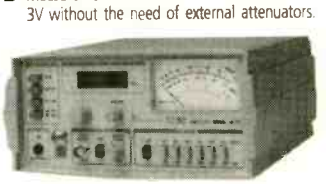

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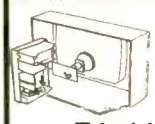

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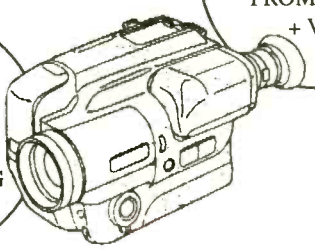

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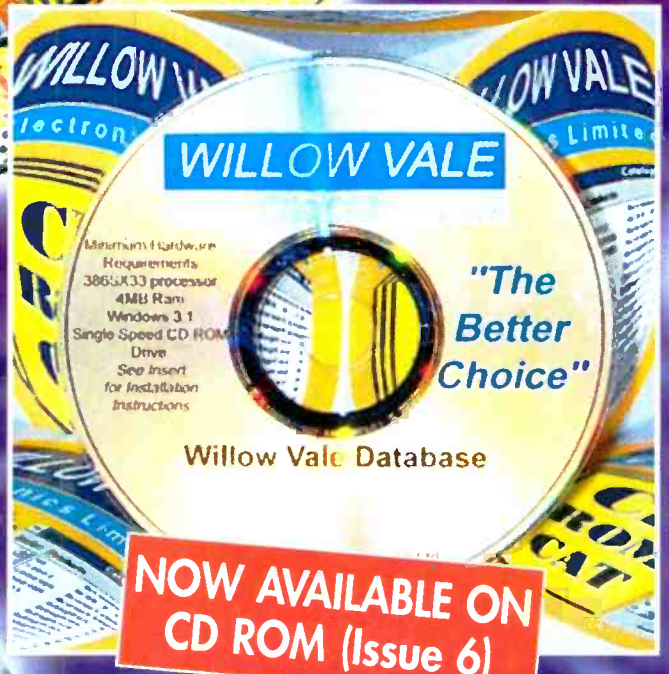

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