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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.

March issue on sale February 17th.

Next issue, dated April on sale March17th.

The R&D Problem

It would be interesting to know how much money and effort goes into research that fails to produce viable commercial products. A certain amount of wastage is inevitable, and is part of a healthy, competitive industrial scene. Yet waste is waste: one of the most difficult management tasks is trying to control R&D budgets, in particular to decide when a programme should be given the chop.

Consider for example display devices for TV pictures. Researchers long sought a flat display to replace the CRT and have, in recent years, been increasingly successful with liquid-crystal and gas-plasma panels. Even within these fields there have been several significantly different approaches. For a time it seemed that the LCD might eventually take over – Japanese manufacturers are reputed to have invested some $5bn in developing thin-film transistor LCD technology in the Eighties – but plasma panels have since turned out to be more successful for reasonably-sized TV screens. The trouble with plasma displays is their cost and limited life expectancy. They are also rather wasteful when it comes to power consumption. We are not likely to see the demise of the CRT for many a year.

As you would expect with a device that has been around for so long – the CRT actually predates the thermionic amplifying valve – there have been tremendous improvements, many of which have been the result of small but significant technological advances: things like pigment composition, ways of mounting the shadow-mask, improvements in electron lens design and so on. And research continues.

Philips has recently announced a development that could provide a smaller spot at a higher brightness level, and thus crisper pictures: it's called the avalanche cold cathode (ACC). Instead of the conventional heated cathode, the source of electrons is a buried (less than 1μm beneath the surface) zener diode junction. A bias of 5V produces an adequate electron flow, with enough electrons per square mm – more in fact than with thermionic emission – to provide a beam. And while the electrons emitted by a thermionic cathode are in effect 'boiled' off, producing a space charge, the electrons produced by an avalanche cold cathode emerge with a degree of acceleration. The bias is varied to control the electron flow, and a first-stage electrostatic lens can be formed on the surface of the cathode. As with a conventional tube, three cathodes are required to provide a colour display. It sounds very promising, but will it turn out to be another false trail? Philips is uncertain: lifetime and reliability have yet to be fully assessed. Even if the technique doesn't prove successful initially, some seemingly minor technological improvement could subsequently make all the difference.

Perhaps something similar could be done to provide a flat-panel display, which brings us to the photocathode display (PCD) being developed by a Californian company, New Logic International. It's similar to the field-emission display (FED), another technology that has been quietly evolving. Both, while being flat panels, have the same optical performance as a CRT. New Logic International first showed a laboratory prototype PCD in 1997. Development samples are now being produced: according to NLI, Korean, Japanese and US manufacturers are interested.

What about the FED? The French technology company PixTech, which demonstrated the first monochrome FED panel in 1991, has just announced the development of a 15in. full-colour FED panel. It believes that large screens using high-voltage FED technology will be ideal for monitors and TV sets. We shall see.

Work is being carried out on many other display prospects. In our February issue George Cole reported on Pioneer's development of organic electroluminescent displays. Various organisations have been working on light-emitting plastics.

There seems to be no end to all this effort on alternative technologies, and not only in the display field. Take discs as another example. DVD-Audio is being challenged by the Super Audio CD before either have appeared, and there are now three recordable DVD formats – DVD–RW, DVD+RW and DVD-RAM.

And so it goes on. A lot of effort, and one chance discovery at the right time can make all the difference – as with the transistor effect in 1947!

Correction

Our apologies for various errors in Martin Pickering's Pace PRD series receiver modifications article last month. In Fig. 1, page 239, Q2 and the added transistor were shown as npn instead of pnp devices. There is no need to select vertical polarisation for the LNB supply switch-off modification to work – the receiver does this automatically in standby (this was the original reason for carrying out the modification by replacing D17, so ignore the bit about connecting the added transistor in series with L3). Oh, and the cover should have said PRD not RRD. But the modifications do work!

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2SA1020Y	0.53	2SD1426	3.51	BAT85	0.96	BD132	0.26	BU807	0.60	HA13119	2.09	SAB3035	3.06	TDA1524A	5.25	TEA2164	3.40
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2SA966	0.69	2SD1650	2.48	BC212	0.12	BD435	0.38	BUT12AF	1.87	LA4705	6.41	STK5342	4.07	TDA2577A	3.45	TIP111	0.57
2SA970	0.19	2SD1651	2.38	BC212L	0.18	BD436	0.52	BUT18AF	1.37	LA6324	3.25	STK5372H	6.84	TDA2578A	3.20	TIP112H	0.77
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2SB1143	0.77	2SD1858	0.43	BC238	0.11	BD839	0.57	BUW12A	2.99	LA7832	2.40	STK730-060	11.65	TDA2593	1.12	TIP29E	0.77
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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
2SB688	1.61	2SD1884	3.35	BC307	0.06	BDW94C	0.60	BUZ80	3.52	LA7838	2.65	STR10006	3.94	TDA3301B	9.12	TIP42A	0.35
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2SB892	0.35	2SD2012	0.86	BC309B	0.10	BF245A	0.19	BY127	0.14	LN1203N	3.25	STR50103	4.48	TDA3561A	3.85	TIPL791A	2.48
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!

A wonderful start to the day. Then the difficulties start. But at least the technical problems get sorted out, if not the customer ones. Donald Bullock's servicing commentary

I was awakened early by the streaming sun. It was a lovely day. Blue skies, soft breeze, birds singing. I set off for work at peace with the world.

The car purred happily through the sunshafts on the soft-tar road. It had been a good buy. What a morning! Softly bright, quiet, not a cloud in the sky. It was good to be alive.

I reached the shop. Our bit of pavement was wet, and a parked cider flagon rested in front of the window. There was a TV set leaning against the front door. And a scrawled note had been wedged in the door handle.

I smoothed it out. "Still not right" it said, "you'll have to call back." No name, no address.

Letters

I opened the shop door and picked up twenty five letters. Threw twenty rubbish ones in the bin then opened the rest. Tax bill. Can't be right! Electricity bill. What? Never! Gas bill. Heavens! And what's this? Mr Manson's set still has patterning. Call after eight? Oh dear, I'll never get that one right.

And a letter from Mrs Garvil. "Will you come and put a new ECL80 in my TV set?" Field collapse, obviously. Silly old fool. Ever since she saw me fit a new ECL80 in her Ferguson TV back in 1963 she's considered herself to be a technical wizzard . . .

Ah, I know that writing. Mrs Botulos from Rosebud Avenue. Nice lady. Decent husband too. Friendly and reliable. I like that type. It'll be her cheque for that tube job, just as she promised. Oh, no cheque. A note to say her picture's gone and it must be the tube. Wasn't right after we delivered it. To give us the benefit of the doubt, they'd waited to see if it would settle down. Husband now hopping mad. Couldn't see the wrestling. Has a mind to come and sort us out. And report us. Her Maisey reckons Gumboils would have done it cheaper.

Nasty old fool Mrs Botulos. And that workshy slob of hers, and her sweaty daughter. Should all be birched. Always loathed 'em.

Oh God! The phone.

"Oh, good morning Mrs Whelp. Nice to hear fro . . . What do you mean, ruined your set? But we don't make the progr . . . Mrs Whelp! Mrs Whelp!! How dare you! Yes they were! St. Marks, if you must know."

It's going to be another filthy, miserable day, I can see that. Wish I was back on that newspaper. Who are these blundering oafs pushing at the door?

"Oh, er, good morning Reverend Goode. Morning curate Blande. Er, ha ha! Yes, lovely day gentlemen.

"Lovely day indeed Donald" said the Reverend, looking upwards. Restores your faith, doesn't it?

I nodded sagely.

He pointed to his ancient car. "My neighbour Miss Sawnie's set. In the car Donald. Head trouble I believe."

"Head trouble" echoed the curate.

An Aiwa Combi

I brought it in. An Aiwa combined TV/video, Model VXT141K, about four years old.

The symptoms did indeed look like head failure. But there was something wrong with the sound too. A wow that became better as the unit warmed up.

The reverend gentlemen departed, and Paul opened up the unit. He was still working on it an hour later. "TV sound is all right" he commented, "though some of its circuitry is common to the VCR section. Never had this one before."

He eventually discovered that the cause of the trouble was C523 (100µF, 16V), which had fallen in value to about 32µF. A replacement cleared the symptoms. It's in the centre of the chassis.

A Couple of TVs

Our next caller was Towser Watts, who runs a smallholding in the hills. He brought in a dead Bush 1418. There was no standby light. Paul soon discovered that there was voltage across the mains bridge rectifier's reservoir capacitor but none at the other side of the 330kΩ start-up resistor R913, which was open-circuit. A replacement brought the set back to life.

Meanwhile Steven had pulled up the set that had been outside the door. A 25in. Mitsubishi, Model CT25A5STX – Euro 14SF chassis. The fault was field collapse.

We'd had another one in only the other day with the same problem. The AN5521 field output chip IC451 had failed. Probably the same thing.

Sure enough the voltages around it were haywire. So Steven fitted a replacement then switched on again. Still field collapse, and the voltages were still haywire. He took the chip out and rechecked the voltages at the socket. Those that remained were OK. The cause of the trouble turned out to be the flyback boost capacitor C454 (100µF, 35V). It was low in value at about 30µF.

"All we need to know is whose set it is" said Steven.

Interlude

The Phone rang. "Are you there?" a strange voice rasped.

"Sure am" I replied.

"Can you repair tellys?" the voice continued.

"Certainly can. Name and address please."

"Herr Ellis, vith a dubblevoo after the K."

"Ellis with a w after the k?" I said, "look, never mind that, what's the address?"

"300 Crout Street" rasped the voice.

The penny dropped. It was Ribby Ellis the practical joker. So I said a rude word and slammed the phone down.

Mrs Ruff

At that point Mrs Ruff came in.

"Eh? Wassat?!" she bawled. "Look, Mr Billhook, me other set's gone again an' I wan' 'im put right. Really right this time. Can't pay much, and I don't wanna 'ang about for a week neither. If I did I'd go to Snoddy's. If I could stand that thin, tall fellow. Where's Pukey? 'E's supposed to have the set."

She yanked the door open and Pukey stumbled in with a 24in. Pye set. "I went to the wrong shop" he panted, "they don't mend tellys."

She gave him a sharp look. "If 'e gets wusser I'll 'ave to throw 'im out."

Mrs Ruff's Pye, Model 59KE2706/05R, contained a Philips 2A chassis and was dead. Steven checked the voltage at the collector of the BU508V line output transistor Tr7618. It was correct at 140V. A scope check at the transistor's base then showed that there was no line drive. Steven traced back to the TDA2579/N5 timebase generator chip IC7635, which was producing neither field nor line drive. As its supply was OK he fitted a replacement. We now had a picture, but there was excessive width with EW bowing. A check on the two transistors in the EW drive circuit showed that Tr7598 (BC547) had a base-emitter leak. Once it had been replaced there was an excellent picture.

Video Dept

Our next caller breezed in with a video recorder. "My name's Mudd" he announced.

"Been upsetting the missus?" I asked.

He just laughed.

Paul had a look at the machine, which was a Mitsubishi HSM55. There was a tape jammed in it.

"Bet it's the capstan pulley" he said. "It cracks apart and the drive belt comes off. I've had several of these machines with this problem recently."

He was right, and because of his previous encounter we had a couple of pulleys in stock.

Then a chap rushed in with a Canon E60E camcorder. "I'm Mr Thesp, Mr Thesp" he said, waving the camera in the air. "He's six years old but he's a good un. A good un."

"What's the trouble, what's trouble?" I asked.

"No sound, no sound" he replied.

Steven looked at this one. "Probably the miniature electrolytics on the AV board" he commented, "they give a lot of trouble in these camcorders. The board's under the deck, so we'll have to take all the case sections off to get at it."

There was quite a mess when he got to the board. Some of the electrolytics had leaked very badly, destroying several tracks and through-board links. He shook his head.

"It'll have to be a new board" he announced. "We got one recently from Canon UK for £51 plus postage and VAT." The camcorder worked excellently once the board had been obtained and fitted.

Return Visit

The Reverend was pleased when he returned with his curate. "Ah, this will make her happy again, Donald" he boomed, "she's worth her weight in gold, Miss Sawnie."

". . . weight in gold, Miss Sawnie" echoed the curate.

"Really decent old stick" the reverend continued.

". . . decent old stick" the curate smiled, timidly.

Then the telephone rang. Steven answered it, but we could all hear the caller.

"Why haven't you come back to put my set right?" it blared.

"What set?" asked Steven, "who is it?"

"Mr McCruddock" the voice continued, "but you know that perfectly well. I left a note on your door this morning."

"There was no name or address" said Steven, "and I don't know what the set is. You didn't say."

"You know what my set is and all about it. My God, you were here only last night."

"I'll call right away" Steven promised.

He was soon back.

"What was the trouble?" I asked.

"Aerial lead pulled out. His dog sleeps across it."

"The symptoms did indeed look like head failure."

TELETOPICS

CES Las Vegas

A number of interesting developments were revealed at this year's Consumer Electronics Show in Las Vegas, held in early January. In particular Sony launched a new camcorder format, Digital 8, which records digital video and sound on analogue Hi-8 tape. The system is backward compatible with Video 8 and Hi-8, and will play tapes recorded in these formats.

Digital 8's picture quality is claimed to be equivalent to that offered by the MiniDV format, with a horizontal resolution of about 500 lines. The specification includes video sampling at 13·5MHz with 8-bit quantisation, a digital component recording system, a chroma bandwidth of approximately 1·5MHz and a video transfer rate of 25Mbits/sec. There are two digital PCM audio recording modes: 16-bit/48kHz and 12-bit/32kHz.

Digital 8 uses a new recording pattern. Information for one frame is recorded on six tracks by using a dual-head technique to lay down two tracks vertically – the MiniDV format records information for one frame on twelve tracks. There's 33 per cent less recording time when Hi-8 tape is used to make a Digital 8 recording – for example a 60-minute Hi-8 tape will store 40 minutes of Digital 8 recording.

The first Digital 8 camcorders are expected to be available in the UK this spring, with entry-level models selling at about £750. All Digital 8 camcorders will incorporate an IEEE1394 FireWire output connector.

According to the US Consumer Electronics Manufacturers Association digital TV has had a good start in the USA, with over 13,000 sets sold just weeks after the launch of services on November 1st. Two types of sets are on sale, high- and standard-definition. Industry observers believe that HDTV will account for two-thirds of TV sales this year. A number of HDTV sets were on display at CES. Models from Samsung, Sony and Toshiba featured a 65in. rear-projection display.

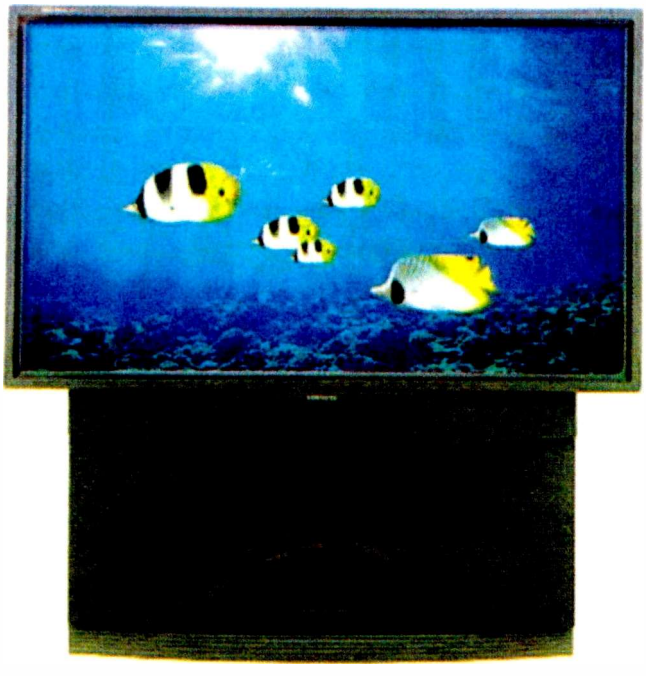
Canal+ announced plans to offer a number of interactive applications based on Sun Microsystem's Java programming language. Canal+ and Sun demonstrated several applications including an EPG and games. The advantage of Java is that it enables broadcasters to provide services that work with many different types of set-top box and operating systems.

DirectTV, the leading digital satellite TV company in the USA, outlined its plans for 1999. These include the launch of Wink-enhanced interactive broadcasts, which give viewers access to background information and statistics relating to the programme being viewed. The service will be free to subscribers – DirectTV has 4·46m at present, 1·5m of whom were added in 1998. Wink-enabled set-top boxes will be launched in the second half of the year, with the service becoming available in the third quarter. DirectTV is working with Philips and TiVo on a Personal TV system (see below). The company plans to launch a fourth high-powered satellite that will add up to twenty more channels.

Philips plans to launch DirectTV set-top boxes that incorporate TiVo's 'push' TV technology, which 'learns' viewers' watching habits then automatically finds and records programmes of interest. TiVo has been developed by a Californian company of the same name. It uses a hard-disc video recorder that's expected to sell for about £300. The recorder has a hard-disc drive, a real-time MPEG-2 encoder, a microprocessor and a telephone modem. An entry-level model would store up to twenty hours of TV programmes. The system uses on-line TV data services and software, memorises a viewer's preferences then seeks and records programmes. During the night, TiVo downloads programme data for the next fourteen days, enabling the viewer to make manual selections. A subscription to TiVo is expected to cost about £6 a month.

A similar service was demonstrated by another Californian company, Replay Networks. Called ReplayTV, the system uses a hard-disc video recorder that can store between 6-28 hours of MPEG-2 video. The service itself is free, the recorders costing about £600. Their specification includes an MPEG-2 encoder; PowerPC processor; cable-ready tuner; S and composite video inputs; RF, S and two composite video outputs; a telephone socket; and cable-box control. ReplayTV offers a range of compression rates, from 2-6Mbits/sec (the lower figure is the default setting). The 4Mbits/sec rate is said to approach DVD picture quality.

Satellite TV company Echostar is working with Microsoft to offer its subscribers the WebTV service.



Samsung's 65in. rear-projection HDTV receiver, introduced at CES '99.

The system will use a receiver with a built-in 8·6GB hard disc and will enable viewers to mix TV viewing with internet surfing. A new feature will be Video Pause, which enables the viewer to freeze a TV programme for up to thirty minutes for viewing later. Future features will include downloading of MP3 (layer 3) MPEG-1 digital audio at a rate of one full CD every two minutes, with a total capacity of up to 1,000 hours of music. A second upgrade will enable full-length films to be downloaded overnight for future viewing.

Sales of DVD players have passed 1·4m in the USA: a further two million are expected to be sold this year. Over 2,200 DVD titles are now available. Aiwa plans to launch a portable DVD player with a 5·8in. LCD screen. Prototype DVD players with a record capability were on display. Pioneer demonstrated its DVD-RW player (see page 247 last month) while Philips showed a DVD+RW player. Both companies hope to market machines next year, depending on whether the DVD Forum can resolve remaining copyright problems. The Philips system offers up to four hours of recording time per disc depending on quality level, which varies from VHS to DVD. The discs can be played back by a standard machine. Pioneer's machine records up to one and a half hours of high-resolution video (about 500 lines), but this is to be increased to two hours before launch. Pioneer also expects to overcome the non-compatibility problem with standard DVD players before launch. Both systems use a 4·7GB disc.

Divx, the DVD system that uses discs which can be played for 48 hours after which the contents become scrambled, is now backed by four hardware companies. Player sales are claimed to have reached some 87,000 units. DVD-Audio was also featured at CES, with Universal Music and Warner supporting the system. The Super Audio CD, an enhanced CD format developed by Sony and Philips, was also being demonstrated. Both systems are expected to be launched in Japan this year. Thomson announced that it is developing an audio system that uses flash memory for storage.

Philips has developed a wireless PC peripheral called Ambi: it enables PC pages to be transmitted to a TV set for display.

News from SEME

SEME is now able to supply customers who do not have a direct Mitsubishi account with original spares for over 500 TV/video/audio models. The company can also supply spares for Beko TV sets and other products. SEME is now stocking original white good spares and accessories for many well known brands including AEG, Electrolux, Tricity Bendix, Zanussi, Parkinson Cowan, Moffat, Hotpoint, Creda, Cannon, Beko, LG/GoldStar, Daewoo and Panasonic. An introductory leaflet, ref LEAF159, is available. Phone the number given in the next paragraph for a copy.

Most SEME staff have now moved to the company's new 17,000 sq. ft. high-tech head office building directly opposite the existing building at Melton Mowbray. There's a new sales hot line telephone number, 01664 484 000. General enquiries is now 01664 484 001. The fax no. is unaltered – 01664 563 976.

New Products from Philex

Philex has introduced a revolutionary flat, amplified indoor TV aerial that can be placed out of sight without affecting performance. It can be used with VHF, UHF and multi-channel digital systems and comes complete with fittings for fixing to a wall or other surface.

Philex has been appointed sole distributor in the UK and Ireland for the Italian Meliconi range of high-quality stands and brackets for use with TV sets, VCRs, audio systems, speakers, multimedia equipment and microwave ovens. The range also includes storage stands for CDs and CD-ROMs.

For further details of these and other Philex products phone 0181 202 1919, fax 0181 202 0014, send an e-mail to sales@philex.com or check the web site at http://www.philex.com

More Teletopics on page 364

New Test Equipment

Vann Draper has added to its range the high-performance Grundig 4.5 digit auto-ranging, microprocessor-controlled DM100 bench multimeter. Despite its comprehensive range of features, the meter is extremely user-friendly. Its main functions include AC and DC voltage over five ranges from 200mV to 1kV with a resolution of 10µV and an accuracy of 0·05 per cent; resistance selectable over six ranges from 220Ω-20MΩ with a resolution of 10mΩ and an accuracy of 0·05 per cent, also a continuity test and acoustic signal; six AC and DC ranges from 200µA to 10A with a 10nA resolution. The menu system enables a fast or slow measurement speed to be selected and provides selection of relative and mathematical modes including a decibel readout. There are just four panel controls plus an on/off switch. A standard RS232C interface enables the instrument to be controlled from a PC or, with optional software, the microcontroller can be used with other instruments to provide an automatic test system. Price is £349. For further information phone Vann Draper Electronics Ltd. on 0116 277 1400 or fax 0116 277 3945.

Kenwood Electronics has introduced the PAC/PAC-R range of series-regulated CV/CC power supplies to suit most uses, with models providing up to 60V and 6A. Further details can be obtained from the Kenwood Test and Measurement Instruments Data Book. For a free copy phone Kenwood on 01923 655 291 or fax 01923 655 297. Kenwood has also introduced a new range of three-channel analogue oscilloscopes with bandwidths of either 50 or 100MHz. All four models in the CS5300 range have six-trace capability, 1mV sensitivity and 2 per cent accuracy. For further details see phone details above.

The Kenwood PAC30-3R regulated power supply.

The Grundig DM100 bench multimeter.

REPAIRING CB RADIOS

Something else to keep the service department busy – CB radios. They can be worth repair if rapid fault diagnosis is possible. Chris Watton summarises his experiences in this field

I was asked to repair a number of CB radios recently. They are inexpensive to buy, so the viability of repair depends on whether a quick fault diagnosis is possible. If you have to spend hours on a CB radio, repair will not be worthwhile.

The following notes are based on experience and will, hopefully, help with rapid fault finding. To repair CB radios you will need a 13·8V supply at 3-4A, a scope, a frequency counter, a dummy load for the transmitter and a power meter. A suitable dummy load consists of two parallel-connected 100Ω, 2W resistors, which must not be of the wire-wound type. A signal generator is useful as well.

What's inside?

We'll start with a brief account of what you will find in a CB radio. The circuitry is very similar with most makes and models. Fig. 1 shows a basic block diagram.

The heart of the system is a phase-locked loop (PLL), which maintains the correct frequency and channel spacing. The transmission frequency must be maintained as it's illegal to operate a CB radio outside the allocated frequencies, which are 26·965-27·405MHz and 27·60125-27·99125MHz, with 10kHz channel spacing. Frequency modulation is used.

The PLL chip works in conjunction with two voltage-controlled oscillators (VCOs). Varicap diodes are used to adjust the frequency of the VCOs when the PLL's DC output varies as different channels are selected. There are two frequency dividers within the PLL chip. One is connected to the output of a 10·240MHz crystal oscillator, which provides the reference signal. The other frequency divider operates in conjunction with the programmable input from the channel switch. The VCOs provide feedback to the PLL: when the signals are in phase, the system is said to be locked.

The receiver section uses two-stage frequency conversion, with a first IF of 10·695MHz and a second of 455kHz. This is followed by an IF amplifier/limiter, demodulation and finally an audio amplifier.

The transmitter section is also quite simple. The microphone input is amplified, filtered then used to modulate the transmit VCO. The output from this is frequency-doubled then fed via tuned amplifiers to a power amplifier which provides 4W into the 50Ω aerial. This section can be easily checked with a scope: a 27MHz sinewave, increasing in amplitude stage-by-stage, should be seen. You won't see the modulation, as this is very small – only 1kHz in the 27MHz signal. The tuned amplifiers are usually adjusted for maximum output, but the receiver should be checked at both ends of the band – it may be high at one end and low at the other. The final stages are often not set for maximum gain – check with the service manual.

What goes wrong?

The circuitry is very reliable. An unfortunate problem is that most CB owners are, naturally, experts. They think nothing of taking the top off and adjusting those screw things as you can get a lot more power out, or so they believe. Most of the time they just detune the harmonic traps, which makes the signal meter go a little higher as it can't tell a 27MHz signal from one at 54MHz.

Other problems include add-ons, such as power-amplifying microphones and echo boxes. These are usually wired or set-up incorrectly.

A particular problem arises when a CB radio is used in a car. Power is often connected the wrong way round. If the fuse is present this is usually not disastrous as a protection diode is incorporated. But you often find that the fuse has been replaced with a piece of wire, the diode has melted, and silicon such as the audio amplifier chip has been destroyed. People just don't appreciate the power of a car battery. In this case the unit is usually not worth repair: the cost of the PLL and the audio chip and a bit for labour is more than the cost of an average CB radio. Nevertheless most CB operators don't mind paying a reasonable amount for a repair and will seek help before they go shopping.

Poor leads to the power supply unit can cause the radio to transmit with a buzz. The display lights usually dim as you speak into the microphone. A poor power supply can add AM to the output: at another receiver this sounds like distortion. The on/off switch contacts can be the cause of no transmission. A dirty microphone switch is often the cause of intermittent or broken audio when transmitting. A signal generator is useful for adjusting the IFs and detector, as with an FM radio. A 100μV signal fed to the aerial socket should give a reading of S9 or more on the signal meter with the squelch and RF gain controls at maximum. Adjust the preset squelch control so that the audio mutes when the level at the aerial input is 7μV.

Components and circuit diagrams are available from various sources, including S.J. Tonks, 34 Bradford Street, West Midlands (01922 646 710); Truck King, 320 St. Albans Road, Watford (01923 235 943); and Nevada Communications, 189 London Road, North End, Portsmouth (01705 698 113). Two particularly useful books are *Understanding and Repairing CB Radio* and *CB PLL Data*, both by Lou Franklin (USA). A couple of news letters by Martin Pickering, called *The Midnight Express 1 and 2*, are a must – some very good information here. These publications are available from S.J. Tonks and, possibly, other sources.

Illegal Radios

A number of the radios in use don't meet the legal requirements. They have other modes of operation, such as amplitude modulation and single sideband. These are illegal to operate, and the penalty imposed is confiscation with a heavy fine. But of course some people will use them, won't they? They are certainly better quality radios and are more expensive to buy.

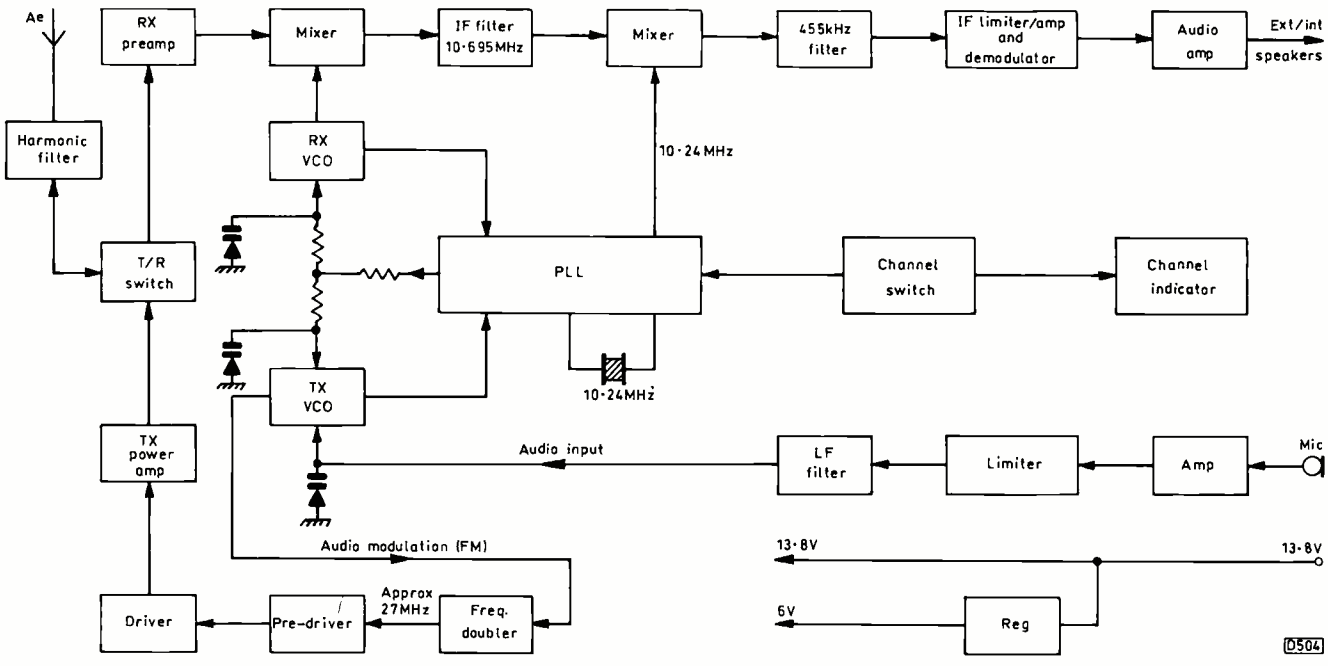


Fig 1: Basic CB radio block diagram.

Basic Faults

Faults fall into several categories i.e. dead, no audio, no transmit or no recieve. Remember that many radios require a microphone input to produce an audio output. Also that the radio's case is not connected to the negative side of the supply, as with a car radio – it's isolated from the supply rails. So don't try to read voltages from the case: I usually connect to the negative side of my power supply or the frame of the power input choke.

Dead unit: If the input fuse has blown, the protection diode should be the first item checked. It's usually a 1N4002 and is connected across the power supply terminals before the on/off switch. If the diode is OK, suspect the audio output chip or the transmit power output transistor.

Most legal CB radios incorporate a three-pin voltage regulator. The output varies with model but is usually in the 6-8V region. If the fuse is OK, check this item. You often find that it is open-circuit of cracked from the PCB. This is simple enough to deal with.

When screws are used to attach the PCB to the frame you will often find that the board is cracked. The radio is taken from car or tractor to the house and dropped on the way!

Radio appears to work but has no audio: If signals are received, this will show on the signal meter. Almost all CB radios have one – a LED, bar or a normal meter. A quick check on transmit operation can be carried out with either another radio, a scope or a simple RF output tester (see Fig. 2). If the output is working, a visual indication can be seen on the signal meter. Check the microphone wiring, the speaker and the extension socket: faults here are more common than in the audio section.

No transmit or, as they say, "I can't git out": If reception is possible, it's fair to assume that the main oscillator is working. So the cause of the problem could be anywhere between the transmit VCO and the aerial socket. Again the microphone, or the push-to-talk (PTT) switch, could be to blame. The most common cause however is failure of the transmit power amplifier transistor.

This transistor can fail for several reasons, e.g. a poor aerial or coaxial lead, loose connections etc. or incorrect aerial setting where the SWR (see later) is too high. The latter is more often in the user's imagination.

A scope check at the collector of the transmit power amplifier transistor should show a 4V peak-to-peak 27MHz sinewave. Set the scope to 0·2μsec, 0·1V/div. If this waveform is missing, work back through the driver, pre-driver etc. stages. Note that some radios will stop transmitting if the VCO's frequency is slightly off, even though reception is OK. This is because the PLL lock detector prevents an out-of-tolerance transmit frequency.

No transmit or receive, audio OK, microphone working, all stages have a supply voltage: This will probably mean a PLL or oscillator fault, in most cases the VCO which is encased in wax. The small-value capacitors here can fail. It's not worth testing them as they often read all right with a meter but don't work when in the circuit. If you have to dig the wax out, replace it. It's there to provide temperature stability and prevent microphony. If the components can vibrate, you may get spurious FM. Suitable wax can be obtained from a beekeeper – one sheet from a honey comb will fill fifty or more VCOs. Some people use candle wax, but it doesn't look as nice.

SWR

SWR means standing wave ratio, a term most CB operators think they understand well. The transmitter's output has an impedance of 50Ω. So the aerial and the coaxial cable should also have an impedance of 50Ω, otherwise there will be a mismatch. The result of a mismatch is signal reflection (a standing wave) and thus loss of power.

A small SWR meter can be bought for less than £10 and will provide a good indication. Usually people hope for a 1:1 match. In practice anything below 3:1 is acceptable – most CB radios won't 'blow up' even when the reading is 10:1 or higher.

Most home aerials are preset and require no adjustment. When a mobile aerial requires adjustment there are normally guides for setting, adjustment being by alteration of the physical length of the whip.

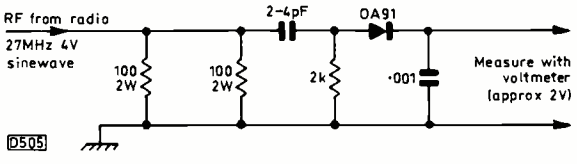
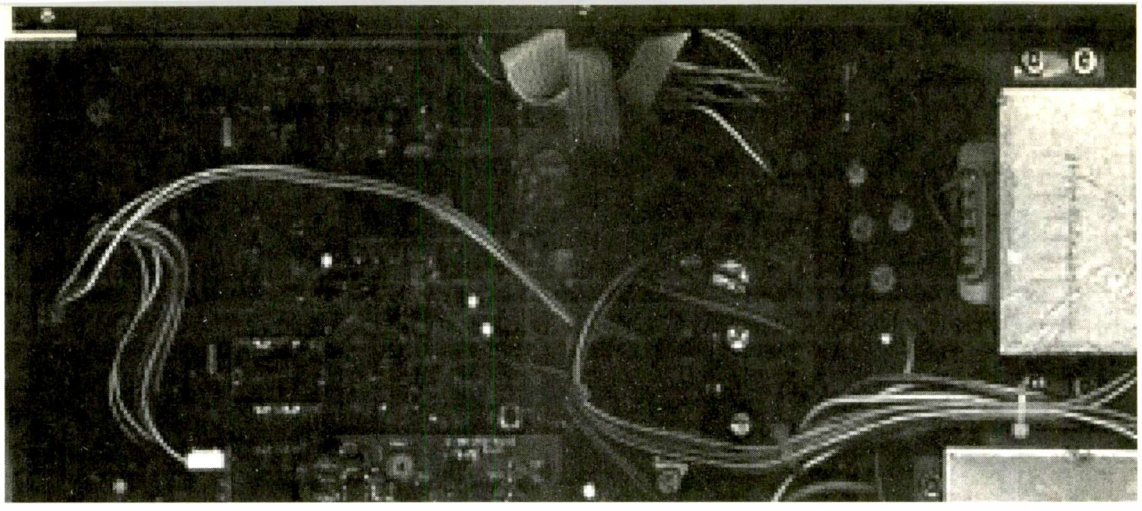


Fig. 2: Simple RF voltage tester. The two 100Ω, 2W resistors must not be of the wirewound type. Any small-signal germanium diode can be used, e.g. an OA91.



Satellite Notebook

Reports from Christopher Holland and Hugh Cocks

Old F Connectors

When carrying out any work on an old dish system, for example using the existing coaxial cable for a new Astra 2 digital installation, I always replace the F connector at the LNB end of the cable. Many early crimp-on types now give poor contact between the coaxial cable braid and the body of the plug. The result can be intermittent signals or reception of the vertically-polarised channels only – the horizontally-polarised channels require 17-18V from the receiver, and poor contact will drop the LNB's supply voltage to the level for vertical polarisation, about 13V.

The problem often starts when the old cable and plug have been disturbed. It may not show up until a few days after the work has been done. **C.H.**

Low Mains Voltage Problem

We supplied and installed a 1m dish for the owner of an early Cambridge receiver. He had only recently moved to this part of the world (Algarve, Portugal). Despite its age the receiver seemed to be in good condition, no doubt in part because of its solid mains transformer and 'traditional' type power supply circuitry – many models of similar age from rival manufacturers have long since overheated and been consigned to the scrap heap, despite offering far more features. The main drawback with this receiver is the limited tuning range for each of the 99 channels, making it impossible for example to tune in all the BBC radio stations on separate channel numbers.

Once the dish had been set up the receiver produced good pictures with unscrambled channels. But, despite displaying the "please insert card" message, when the card was inserted the only response from the decoder was a rapidly flashing "please wait" message. This exonerated the card (some defective early-series Sky cards could produce an effect similar to this).

I was about to take the receiver back to the workshop, with visions of selling the customer a new unit, when I noticed that the "please wait" graphics started to produce a distinct rolling hum-bar effect, indicating power supply problems. The mains transformer had 220V and 240V mains tappings. Since it had been brought from the UK, it was naturally enough set for 240V. The receiver was now being used at a remote rural location where the voltage would at best be about 220V, probably rather less at peak demand periods. There were perfect decoded pictures with the card inserted once the tapping had been changed to 220V. We won't be seeing many more power supplies like this! **H.C.**

Pace MSS100

Despite being connected to a known good LNB one of these receivers produced a blue "no signal" message. At the decoder scart socket there was a baseband video output signal that corresponded with the channel selected by the remote control unit, so at least the tuning circuitry was working correctly. This led me to look at U500, the 56-pin IC that handles virtually all the video processing.

Baseband video from the tuner was present at pin 20, but there was no clamped video output from the chip. The 4MHz reference signal was present at pin at pin 35, and the clock and data signals were present at pins 30 and 31 respectively. While the 5V supplies were present, the 12V supply at pin 45 was missing.

Heading back to the 12V regulator U3, I found that there was no input voltage from diode D18. There was voltage at this diode's cathode, but the print to which it is soldered had fractured. There was normal operation once the supply to the 12V regulator had been restored. **H.C.**

Digital Reception Problem

After a week or so of trouble-free operation, the on-screen information from this digibox displayed a helpful message to say that no signal was being received. When I connected my in-line satellite signal and LNB voltage/current detector to the back of the receiver it indicated that there was no power supply to the LNB. I disconnected the mains supply to the digibox and the LNB feed, then reapplied power to the digibox. A normal 13V reading was obtained (the digibox's digital default/start-up frequency is on a vertically-polarised channel).

When the cable from the dish was connected to the meter, a period of higher than normal current consumption was shown. Then the digibox shut off the LNB's supply. A replacement LNB was tried but made no difference. The cause of the problem turned out to be water: it had got into a very well hidden joint in the cable, which had previously been used for analogue reception only. It's a pity that the digibox doesn't give some sort of on-screen indication of this problem, like its analogue predecessors, bearing in mind the need to disconnect from the mains before the LNB supply is re-established! **C.H.**

An Unusual SkyDigital Installation

At a SkyDigital installation we carried out recently the owner told us he wanted to keep his existing analogue equipment. The installation was at a large farmhouse, where a cable conduit had been put in by a builder during renovation work some years back. This conduit had

room for only one coaxial feeder, which was already carrying terrestrial FM and UHF signals as well as the analogue satellite ones: combining outside and splitting inside was done by RF/IF diplexers. Installation of a new cable externally was not possible: it would have been visible, and the owner had a great dislike of cables in any shape or form!

Since the SkyDigital transmissions are in the 11·7-12·5GHz band, the digibox always produces a 22kHz tone output. Unfortunately it has no DiSEqC dish-switching facilities. In this case the analogue receiver was a Pace MSS1000, which also has no DiSEqC output.

The solution (see Fig. 1) was to install a tone switch at the dish end of the system, to switch between the existing analogue and a new digital dish. The switch also passes the tone from the digibox to the universal LNB at the digital dish, in the normal way.

Unfortunately the digibox produces the tone when it's in standby – Sky insists that the box is powered at all times. As a result, the tone switch would have made permanent connection to the digital dish. The problem was solved by adding an on/off switch adjacent to the digibox. When analogue reception is required, the owner switches the digibox to standby then removes the power. Fortunately the owner had opted for a non-telephone-line installation for his digibox (I leave to your imagination his views about telephone lines being connected to digiboxes along with visible external cables!), so his receiver wouldn't get any over-the-air commands to ring up the subscription centre and constant powering was not essential.

When the digibox was initially powered it took a little time to find all the channel listings. As shown in Fig. 1, the video scart is connected to the MSS1000's auxiliary input, forcing the receiver to route its video and audio output signals to the hi-fi, TV set and VCR.

In view of the possibility of an over-the-air digibox software upgrade at night, the owner understands that mains power to the digibox should normally be left on, being removed only when analogue viewing/listening is required. **C.H.**

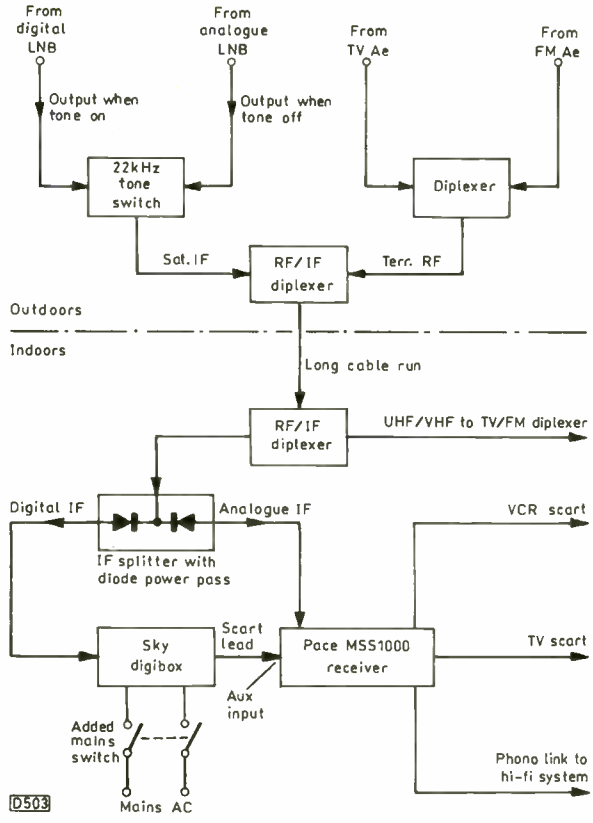
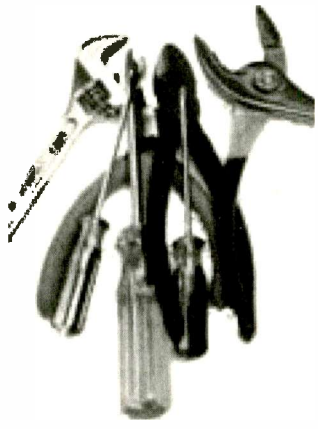


Fig. 1: Digital/analogue receiving system using a single cable between the aerials and the receivers.



John Edwards' Casebook

Sony KVM14TU (BE1 chassis)

There was a dark, negative picture with severe line tearing and a loud hiss on the sound. A gurgling-type noise seemed to come from the area of the line output transformer. The symptoms came and went when the PCB was prodded, but a thorough resoldering job made no difference.

A slow, careful prodding exercise then narrowed the source of the problem to the IF module VIF101, which is mounted vertically near the tuner module. To clear the fault I had to remove the IF module and its side screen plate and resolder every joint.

Goodmans 1405R

This portable lived on a swivel wall bracket in the bedroom of a customer's daughter. It had apparently been subjected to a violent push, hitting the wall, after which it had ceased to work. An estimate was required, as the daughter was to pay. The cabinet wasn't damaged in any way.

I removed the back, expecting the innards to fall out on to the bench, but this didn't happen. When the set was switched on it was indeed dead. I unplugged the set and withdrew the large power board that sits in moulded runners, vertically, along the left side of the cabinet. When the board was placed on the bench I saw that a crack ran the entire width of the board and across the chopper transformer's terminals. The two halves were held together by the components soldered to it. It's difficult to guesstimate such a job, and to make matters worse I could see that Q602 (2SC2120) had split in half. So I assumed that a power supply rebuild would be required and hoped that other stages hadn't been damaged.

Because of the convenience of being able to work on the power supply PCB out of the set, I felt that the best policy would be to check every component on it. The whole exercise took a little over a quarter of an hour and provided me with a list of known failed components on which to base my guestimate. R601 (4·7Ω) and R612 (0·56Ω) were open-circuit, Q602 had blown apart and R607 (47Ω) had broken in half. I assumed that the STR58041 chopper chip would be faulty and added it to the list. If I was lucky there wouldn't be any surprises in store. So I phoned with the price, and was given the go-ahead.

After repairing the PCB, using Superglue and joining the broken tracks with stiff wire, I started to fit the replacement parts. I hadn't a 2SC2120, so I checked its details. The readily available BC639 seemed to be a suitable replacement, so in one went. The only other item I didn't have was an 0·56Ω resistor: I used two 1Ω resistors in parallel instead. After fitting a new STR58041 the variac was brought into service and slowly wound up. To my delight the set burst into life. After a few minutes I switched off and checked the temperature of Q602 and the chopper chip. Both were cool and clearly working well within their limits.

Sony KV1612

This set drifted off tune about four minutes after being switched on. It would then start a channel search, of its own accord, without stopping at any of them. A few seconds later there would be a display of random channel numbers. As the push-switches (S401-413) on the front control panel all felt spongy I decided to replace them. This cured the problem.

Ferguson 3V39/JVC HRD110

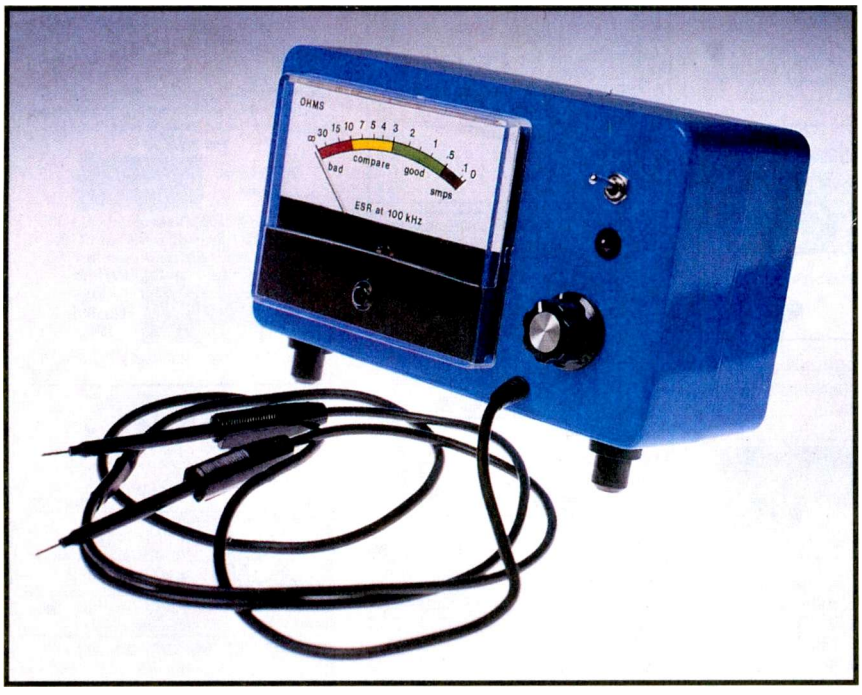
The clock and channel displays were normal, also the deck function LEDs when a function was selected. But the mechanism failed to stir from its sleep. CP1 on the bottom PCB was open-circuit. It's in the middle of the machine, towards the rear.

Philips 24CE3588 (CP110 chassis)

There was no E-W correction. Apparently the set had been like this for months, until the owner's son finally insisted on it being fixed and had promised to pay the bill. How anyone could have put up with it for even an hour I'll never know: the sides almost met at the centre of the screen!

While the EW diode modulator circuit is where you would expect it to be, on the main PCB, the drive circuitry is on the tube base panel. Unusual that. Anyway, investigation here showed that the BF819 driver transistor Tr7600 was running far too hot. In fact it had base-emitter leakage. Tr7600 is in turn driven by the pnp transistor Tr7601 (BC558), with direct coupling. This transistor was short-circuit collector-to-emitter. Its emitter is biased by R3588 (15kΩ) and R3587 (1·8kΩ), which were charred. R3599 (47Ω) was also charred. So was the circuit board beneath these resistors. Which of these items had deteriorated first would be hard to guess. At the input to the circuit, the EW parabola coupling capacitor C2589 (33μF) was very leaky.

Scraping the burnt area of the board clean and renewing the defective components cured the trouble. The owner and her son were pleased to see a full screen again.



The subject of an electrolytic capacitor's ESR has generated a lot of interest in recent issues. Alan Willcox has taken it a stage further in designing a practical ESR meter. This first part deals with the operation of the circuitry used in the meter

Design of an ESR Meter

A lot has appeared in recent issues on the subject of the ESR (equivalent series resistance) of an electrolytic capacitor. The Capacitor Wizard was reviewed by Martin Pickering in June 1998. It's designed to measure a capacitor's ESR in-circuit while ignoring any components that are connected to it. The unit described in this article performs the same task, and a lot of work has been put into achieving the end result. Even if you don't get around to building the meter, this article will give you insight into the design criteria and the way in which the instrument works. But build it if you can: it's effective, very useful and inexpensive.

ESR

In view of Martin's review and also the articles by Ray Porter on a capacitor's ESR (January and April 1993) I won't say a lot about ESR here: it would simply be repetition. To put it in a nutshell, a capacitor's measured ESR (in ohms) is an indication of its 'goodness'. The lower the ohms reading, the better the capacitor. An ESR check can give an early indication of capacitor failure, and is far more useful than a capacitance measurement. Indeed many faulty electrolytics show OK when checked with a conventional capacitance meter.

In recent months I've talked to many people who don't appreciate the importance of ESR and in what sense it differs from capacitance. So I feel it worthwhile including an extract from a technical bulletin on the Capacitor Wizard written by Doug Jones, the President of Independence Electronics Inc. It sums up the question of ESR well.

"ESR is the dynamic pure resistance of a capacitor to an AC signal. High ESR can cause time-constant problems, capacitor heating, circuit loading, total failure etc. A switch-mode power supply may not start reliably – or start at all. Slight hum bars appear in the video of a VCR or monitor. A TV display may be pulled in from the sides/top/bottom. Diode and transistor failure can occur over a period of time.

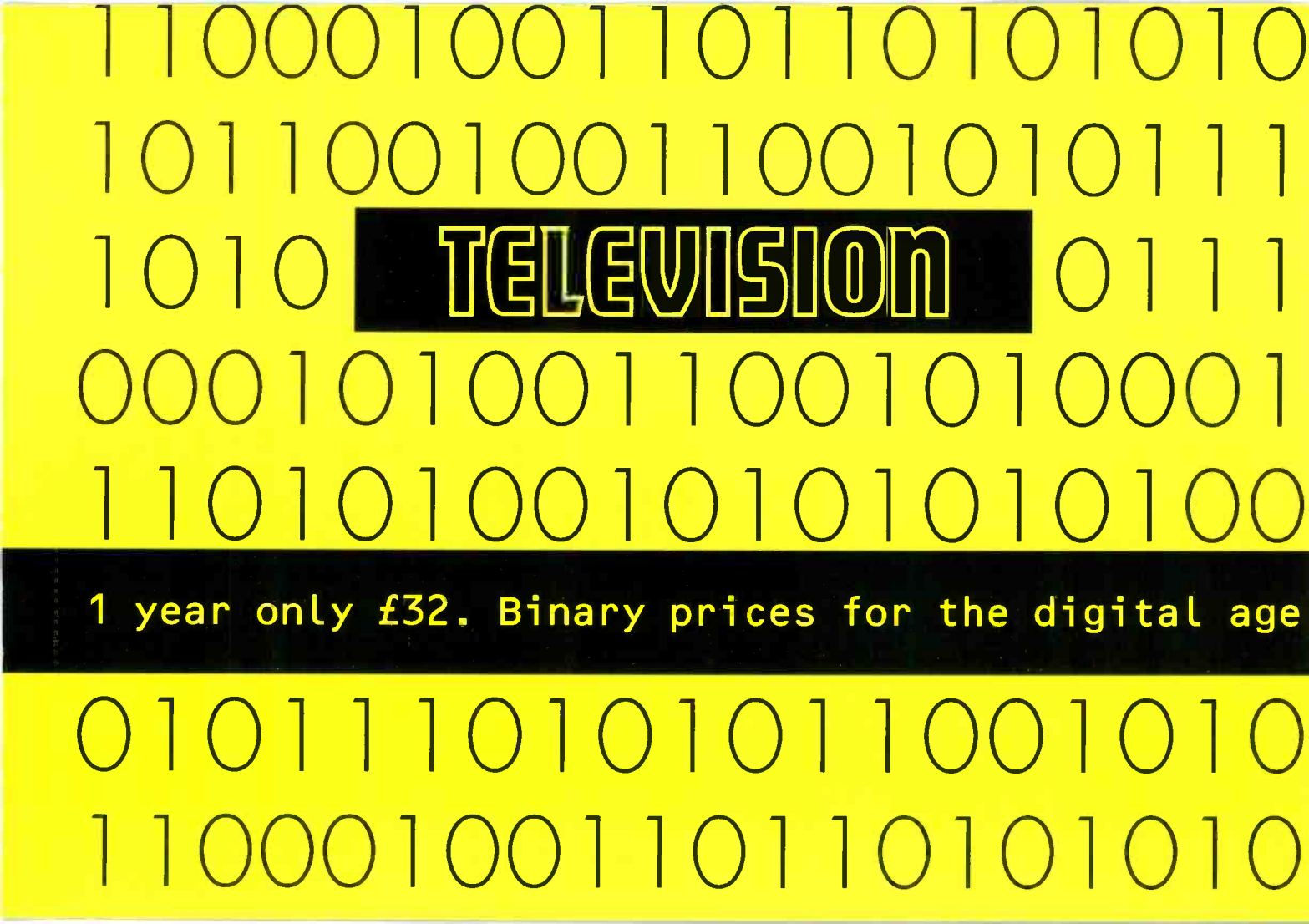
These and many other problems are often caused by capacitors with normal capacitance but high ESR, which does not exist as a static quantity and therefore cannot be measured using a conventional capacitance meter or a DC ohmmeter. ESR exists only when alternating current is applied to a capacitor or when a capacitor's dielectric charge is changing state. It can be considered as the total in-phase AC resistance of a capacitor, and includes the DC resistance of the leads, the DC resistance of the connection to the dielectric, the capacitor plate resistance and the in-phase AC resistance of the dielectric material at a *particular frequency* (my italics) and temperature.

The component combination that constitutes ESR can be thought of as a resistor in series with a capacitor: the resistor does not exist as a physical entity, so a direct measurement across the 'ESR resistor' is not possible. If, however, a method of correcting for the effects of capacitive reactance is provided, and considering that all resistances are in phase, the ESR can be calculated and measured using the basic electronics formula E = I x R! This is the basis of the design of the Capacitor Wizard."

Design Criteria

Capacitor manufacturers quote ESR values measured at 100kHz. So this is the test frequency I chose. The impedance of inductors in the microhenries region can be measured at this frequency, enabling the condition of video heads to be gauged – as they wear and the gap deteriorates, their inductance falls.

The Wizard has a buzzer that sounds when the ESR is below 1Ω or so. A capacitor with an ESR of less than about 1Ω is generally considered to be good, so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this is a very useful feature in situations where you want to check a number of suspect components – it means that you need refer to the meter only when there's no beep. I've incorporated this facility, but you must bear in mind that a lot of the capacitors in which we are interested have ESR values of less than 0·5Ω when good. More on this later.

I'd like to stress this basic point before going any further: as with the Capacitor Wizard, the meter described in this article doesn't measure a capacitor's microfarads. It simply lets you know if the capacitor is or isn't up to the job. After gaining some practical experience with the meter, you will soon get to know what reading to expect from a good capacitor – taking into account its capacitance and voltage rating. But in any case the reading obtained with a faulty capacitor usually leaves little doubt as to its condition.

The Op-Amp

The circuit uses the basic op-amp as an oscillator, amplifier, detector, voltage-follower and comparator. So it's appropriate to devote some space to a description of the op-amp and its associated circuitry. Incidentally the term 'operational amplifier' relates to its use in analogue computers and appeared in a paper by Ragazzini and others in 1947. The first general-purpose op-amp, with differential inputs and using the familiar triangular symbol for circuit representation, was introduced in 1952 (Model K2-W, by George A. Philbrook Researches Inc.). It's sobering to think that almost forty years ago an early op-amp, the P2, cost $227 – an eighth of the cost of a VW Beetle at that time: now a superior device can be bought for less than a pound.

The op-amp is a high-gain (x100,000 or so) amplifier that usually has two inputs, one non-inverting (labelled +) and the other inverting (labelled –). For practical purposes the gain can be considered as infinitely high, with no current flow at the inputs. The op-amp is designed primarily to operate stably with heavy negative feedback. In fact from the historical point of view the op-amp and the concept of negative feedback (the invention of H.S. Black, working for Bell Laboratories, in 1927) are synonymous. Black was working on telephones, his objective being to achieve stable gain independent of the characteristics of a valve (a thermionically-activated FET to youngsters!). When he tried to patent his negative-feedback amplifier in 1928 the idea was ridiculed. Over the years however this concept has become one of the most important in the field of electronics. Marconi had much the same problem. It seems that people often dismiss things they don't understand.

Anyway, I digress. To get back to the point, the op-amp usually requires a positive and a negative supply with respect to a common earth. These supplies are often not shown on circuit diagrams, being taken for granted. The common earth (0V line) serves as a reference point for the voltages that are present in the circuit and as a return path to the power supply for any currents generated by the device's operation.

The main point here is that if the voltage at the + input increases with respect to the voltage at the – input, the output voltage will be positive-going. Conversely if the voltage at the + input decreases with respect to the voltage at the – input the output voltage will be negative-going. Thus in normal practice the output corresponds to the *difference* between the inputs.

If the op-amp doesn't have any negative feedback and the + input is at only 0·1mV above the – input, the output voltage will be close to that of the positive supply rail. If the + input is lower than the – input by the same amount, the output voltage will be close to that of the negative supply rail. Thus the gain is equal to the average slope, which is typically 10V/0·1mV = 100,000. This very sensitive property is used in comparator circuits (it's used in the ESR meter's buzzer circuit). But the op-amp is far more useful when the output is restricted to narrower limits.

The Precision Inverting Amplifier

This is one of the most common op-amp applications and is used in the second and third stages of the meter. Circuit operation will hopefully be made clear by the rather unusual representation (due to Tom Hornack) shown in Fig. 1.

At (a) the op-amp is arranged to provide a voltage gain of two. The fact that in this case the output is inverted (the gain is minus two) is not important. The heavy negative feedback via resistor Rf forces the output to be such that the voltage at the – input is equal to that at the + input, which is 0V. Remember that the op-amp responds to the *difference* between its inputs. As point X is at earth potential, there is 1V across Rin (1kΩ) and the current flow via Rin, calculated by Ohm's Law, is 1mA. There is no current flow at the input of the op-amp, so this 1mA flows via Rf (2kΩ) which thus has 2V across it.

Notice how Rf and Rin behave like a seesaw as the input goes from a positive to a negative value, with the pivot at the null point X. This point is referred to as a virtual earth. There is no current path between point X and earth, and point X is always at zero voltage with respect to earth.

The concept of a virtual earth is used as a short-cut

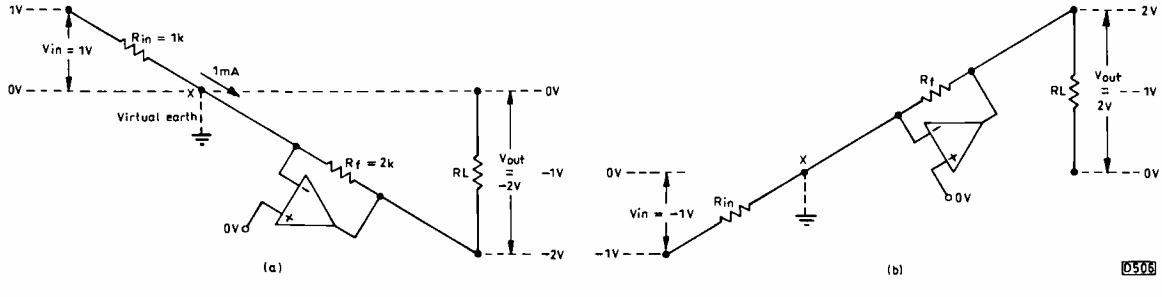


Fig. 1: Precision inverting op-amp circuit, (a) with a positive input, (b) with a negative input. Note how Rf and Rin behave like a seesaw as the input goes from positive to negative, with the pivot at the null (virtual earth) point X. The gain of the stage is Rf/Rin, so the output is Vin x Rf/Rin.

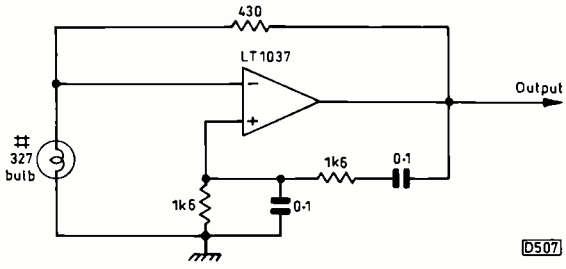


Fig. 2: Jim Williams' original circuit, the first attempt at combining an op-amp with a Wien bridge network to form an oscillator.

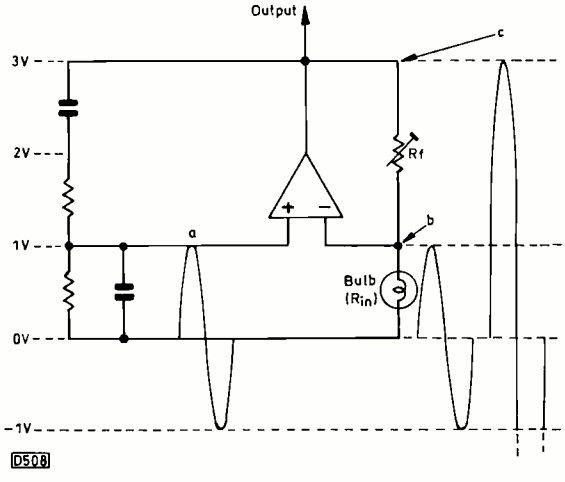


Fig. 3: An op-amp Wien bridge oscillator arrangement with the output set at 6V p-p (positive peak shown). At the resonant frequency points a, b and c are in phase and the waveforms at the op-amp's inputs are a third of that at its output. The ratio Rf/Rin = 2.

when the operation of a current-to-voltage converter is analysed. From Fig. 1 you can see that, because of the virtual earth, Rf appears to be in parallel with RL. So the voltage across Rf appears across the load as the output voltage. But although the null point is considered to be at earth potential, at a microvolt level it's very much active.

It can be seen from Fig. 1 that the stage gain, within the limitations of the supply, is determined by the ratio of Rf to Rin. Incidentally there's a frequency limit on the gain: with common types of op-amp we are limited to a gain of about x10 at 100kHz. If the resistors in Fig. 1 are transposed the stage gain will be 0·5 – the circuit acts as an attenuator.

Overview

Before we go further, it would be as well to provide a quick introduction to the meter circuit presented here (see Fig. 5). The first stage consists of a 100kHz oscillator, whose output is fed to the capacitor being tested. Put simply, the current flow through the capacitor is sensed then amplified as a voltage. It's finally detected and measured by the meter movement.

The better the capacitor, the lower its ESR and the higher the meter indication. It's not quite this simple, because the meter must ignore the other components connected to the capacitor being tested. We'll come to the solution to this problem later.

The Oscillator – History

At the heart of the meter there's a Wien bridge network oscillator. This form of oscillator has an interesting history which is worth a few paragraphs.

In 1939 William Redington Hewlett (co-founder of Hewlett-Packard) produced his Stanford thesis *A New Type Resistance Capacity Oscillator*. It made use of a resonant *RC* network that had been conceived by Max Wien (pronounced Vene) in 1891. The American inventor Lee DeForest (yes, we can blame him) hadn't started the ball rolling yet with the creation, in 1906, of the triode valve. So there had in 1891 been no means of obtaining electronic amplification and Max couldn't have got his network to oscillate. That wouldn't have troubled him, as he was using the network for AC bridge measurement. Amazing what people got up to over 100 years ago, isn't it? I think it was, once again, something to do with telephones.

But Hewlett had the pentode valve at his disposal. He also had Harold S. Black's pioneering work on negative feedback to assist him. In addition there was Nyquist's *Regenerative Theory*, which described the conditions necessary for oscillation.

Hewlett showed that the Wien network could be made to oscillate. A crucial problem had to be resolved however, that of stage gain. With a gain of less than unity there would be no oscillation. With a gain of greater than unity there would be distortion. With unity gain there will be what Hewlett wanted, a sinewave. He had a flash of inspiration: the solution was literally staring him in the face – the electric light bulb.

Hewlett's oscillator was a two-valve affair, with a 6J7 as the oscillator and a 6F6 as the output stage. His solution for gain stability was to wire a tungsten bulb between the cathode of the 6J7 and earth. The negative feedback was applied between the anode of the output valve back to the cathode of the triode oscillator valve. If the output increases for any reason, so does the current flowing through the bulb. As it warms up, its resistance increases. So does the level of negative feedback, thereby stabilising the oscillator's output. Hewlett's idea of employing a light bulb was brilliant in its simplicity. It survived in the HP200 series audio oscillator during a fifty-year production run – into the mid Eighties.

About fifty years after Hewlett built his oscillator Jim Williams, who was working for Linear Technology Corporation, was sitting in his den one rainy Sunday trying to think of something to do. His old HP200 caught his eye. Peering into the back, he saw the light bulb where it had been placed half a century ago, and wondered how Hewlett's oscillator would perform using a modern op-amp. He went on to knock one up – the original circuit is shown in Fig. 2 – and was pleased to find that it had a distortion figure of only 0·0025 per cent.

Perhaps he could improve on it, by eliminating the bulb? Jim was the first to use a JFET in place of the bulb, but with this device the distortion figure rose to a massive 0·15 per cent. Unfortunately there's not space to explain why the use of a JFET gives such inferior results compared to a bulb. In the event Jim discarded the JFET in favour of an optically-driven CdS photocell. This, in conjunction with five op-amps etc., produced an analyser-limited distortion figure of 0·0003 per cent (three parts per million). At one point during his quest Jim writes (*Analogue Circuit Design*, Butterworth-Heinemann) "I could almost hear Hewlett's little light bulb, which worked so well,

laughing at me". So no apologies for the use of a light bulb in this design.

Operation of the Oscillator

Fig. 3 shows the Wien bridge network oscillator as you probably won't have seen it drawn before. It illustrates the situation at the peak of the positive-going half cycle. The positive feedback network consists of the series-parallel *RC* (lead-lag) network: the negative feedback loop consists of the preset Rf and bulb Rin.

We'll consider the *RC* network first. At very high frequencies the shunt capacitor in the lower arm of the bridge will appear to be a short-circuit and there will be no signal at the op-amp's + input. At very low frequencies the series capacitor will appear to be open-circuit and again there will be no input from the feedback network. At some point in between there will be maximum output from the network. The frequency at which this occurs is equal to $1/(2\pi RC)$, which is called the resonant frequency (fr) of the bridge network. At this point there is no phase shift across the bridge, and the upper arm of the network has twice the impedance of the lower arm, giving a transmission loss of 1/3. To overcome this loss and achieve the required stage gain of unity, the closed-loop voltage gain (ACL), which is set by the ratio of Rf to Rin, must be three. The formula for the closed-loop gain of a *non-inverting* amplifier is ACL = Rf/Rin + 1, so Rf/Rin must be two in order for ACL to equal three.

At power up the negative feedback is low, because the bulb is at its lowest resistance, and the gain is high. As a result oscillation begins immediately, and the bulb is warmed by the current current flow. Within a fraction of a second the resultant increase in its resistance reduces the oscillator's output. It settles at the level at which the bulb's resistance is half that of the feedback resistor Rf. So the value of Rf sets the amplitude of the output. Note that the bulb's thermal delay means that it cannot follow oscillations at relatively high frequencies. It responds to the RMS current only, and thus behaves as an ordinary resistor.

The Bulb

Although the Wien bridge oscillator is the accepted standard at frequencies up to say 1MHz, the use of a bulb for gain control, popular in the USA, has never found favour on this side of the Atlantic. I think I know the reason for this. In most textbooks things begin to get a bit vague when it comes to the actual type of light bulb to use.

It is often said that any low-voltage, low-current bulb can be used. This is not so. I have seen the following flawed reasoning in some books. Take a 12V, 50mA bulb which has a resistance of 12V/50mA = 240Ω. The feedback resistor must be twice this, i.e. 480Ω or a 1kΩ preset. There's nothing wrong with this value for the feedback resistor, but it won't work with such a bulb. The point that's been missed is this: the bulb must be operated at a current level that gives a large change of resistance.

This occurs when the current is only a few milliamperes, and nowhere near bulb incandescence. What we require is a bulb that has a resistance of about 200Ω *when cold*. When the type of bulb normally specified is used, the result is overloading of the op-amp, distortion, heavy current drain and dependence on the supply voltage for regulation rather than correct bulb operation.

I didn't do what Hewlett did, which was to plot the *IV* characteristics of various bulbs carefully. I simply measured the resistance of bulbs that I thought might be suitable, and found that the cold resistance of a 28V, 24mA bulb is 170Ω. This seemed to be about right. When I tried it – bingo! So when, in this connection, you see "any low-voltage, 50mA or so bulb" you can in future read "a 28V, 24mA bulb". The oscillator will work a treat.

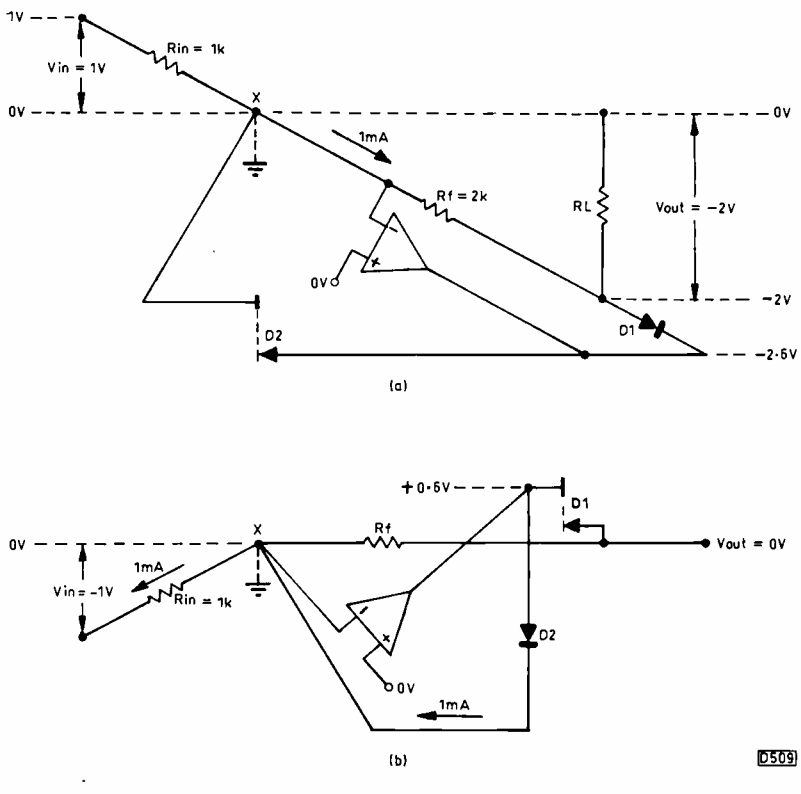


Fig. 4: Precision rectifier circuit, (a) with positive input, (b) with negative input. In (a) the op-amp's output goes as low as required to overcome the forward voltage drop across D1 and still satisfy Ohm's law as far as Rf and Rin are concerned. D2 is off as the voltage at its anode is 2·6V less than that at its cathode. In (b) D1 is off, its cathode voltage being 0·6V higher than its anode voltage. The conduction of D2 limits the positive output at 0·6V. This limiting factor speeds up the recovery of the op-amp when the input goes positive again.

The Precision Rectifier

The final stage of the basic meter uses an op-amp as a precision rectifier. Keeping to the type of representation we've used before, Fig. 4 shows its method of operation.

With a conventional rectifier there's the drawback that the signal must rise above the diode's forward-voltage drop before conduction begins. This can be overcome by the use of an op-amp in the circuit. At (a) in Fig. 4 the input is positive and the output reduces the voltage at the cathode of D1. This enables the input to carry on via Rf to the amplifier's output. As in the case of the inverting amplifier circuit, the output is again Vin x Rf/Rin. The diode's forward voltage drop, which is 0·6V with a silicon diode, is overcome because the op-amp's output goes lower by this amount, satisfying Ohm's law as far as Rf and Rin are concerned.

Point X is still held at earth potential by feedback action from the output. D2 is off at this time, as the voltage at its anode is lower than that at its cathode. When the input goes negative however, as shown at

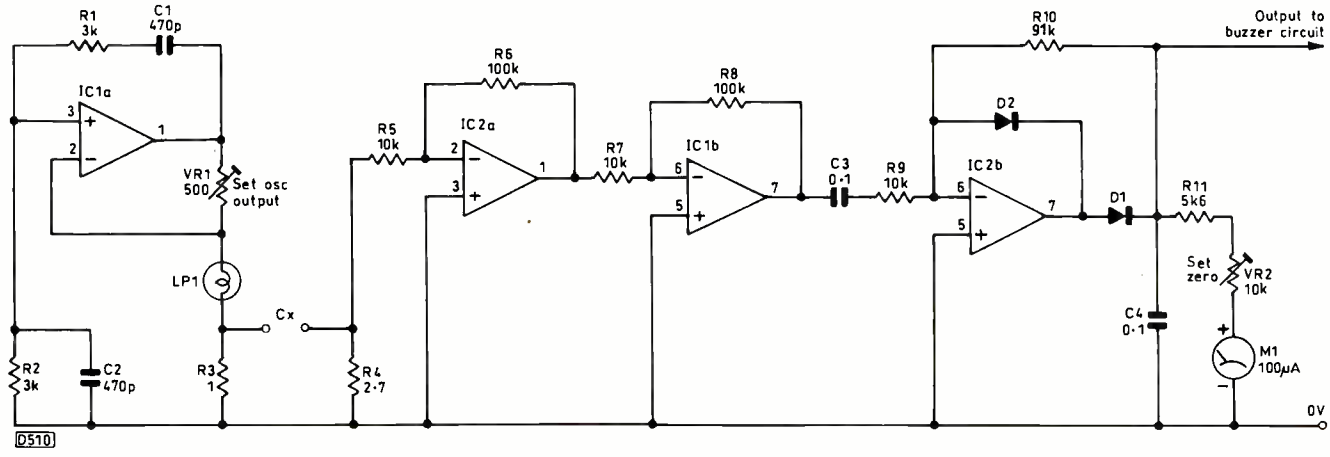


Fig. 5: The basic meter circuit. VR1 sets the oscillator's output level. Pin 8 of IC1 and IC2 is connected to the +ve supply, pin 4 to the –ve supply.

(b), the op-amp's output rises to the point at which D2 conducts. The current then flows via Rin, point X and D2. D1 is now off and the output is zero.

Basic Meter Circuit

The circuit of the meter itself is shown in Fig. 5. The Wien bridge oscillator, redrawn, is the same except for the inclusion of a 1Ω resistor (R3) between the bulb and the 0V line. Depending on VR1's setting, the bulb's current is typically 3·5mA RMS. As a result, in the absence of a capacitor under test about 10mV peak-to-peak at 100kHz is developed across R3.

VR1 sets the amplitude of the oscillator's output. In this case the output is used only for feedback, and is set at 5V peak-to-peak. There is nothing magical about this figure, and with this application no test equipment is required to set it. It's just that to get a higher level output you would have to use a higher supply voltage. In fact however the higher the output voltage the better.

The ESR of the capacitor being tested forms part of a potential divider with the 2·7Ω resistor R4. The voltage waveform across this resistor, as a result of the current in the capacitor, is amplified by the rest of the meter circuit. Bear in mind that with the range of ESR values we are measuring an ideal mid-scale figure would be about 3Ω. With low ESR values (good capacitor) the signal across R4 is high, while with a poor capacitor it will be low – often, in relation to 2·7Ω, there can be an effective open-circuit.

Now if, for example, the ESR is 2·7Ω, half the source voltage across R3 would be passed to the meter and a half-scale reading would be expected. It doesn't quite work out like this however, because the source voltage is not independent of the load, and we will be setting full-scale deflection with R3 and R4 in parallel (test leads shorted).

If the ESR tends to go below the value of R4, it becomes more effective in increasing the voltage across R4. As the ESR rises above the value of R4, it becomes less effective at increasing the voltage across R4. Hence the non-linear scale, which is ideal with this application. R3 and R4 are of necessity low in value, because they compare with the values of ESR in which we are interested. The bonus here is that because of their low values the effect of associated in-circuit components becomes insignificant.

The design of this little network is such that the waveforms across R3 and R4 are virtually in-phase regardless of the value of the test capacitor. So we are measuring *the total in-phase AC resistance* to which Doug Jones refers (see quotation earlier).

You might wonder why the test signal amplitude is so small. It isn't because we want to avoid turning on semiconductor devices – we could go up to a couple of hundred millivolts before there would be any worries about that. It's simply a matter of power consumption. Even our little 10mV requires 3·5mA, and in this case I have (dare I claim cleverly?) used a current source that's already there. A 100mV test source would require a hefty 35mA, quite a drain on resources. If anything the value of the 1Ω resistor could be even lower, so that with respoect to 2·7Ω it would more closely approximate a constant-voltage source.

You may think that to test an electrolytic capacitor effectively a fair old current should be pumped through it. Not so. A healthy 1,000µF capacitor will still present 0·05Ω or so to a couple of millivolts and thus be produce a reading.

The signal across R4 passes through two stages of amplification each with a gain of ten, and is then detected for the meter movement. There is further amplification in the detector stage. The output is integrated by C4 to produce a DC output of about 1·3V with the test leads shorted – this corresponds to zero ESR.

The basic meter circuit uses two dual op-amps. You will see that the signal path from the oscillator in IC1 passes to IC2 then back again. This is done to prevent the first, sensitive stage of amplification picking up a strong oscillator signal in the same package.

The Power Supply

There is no need for a regulated supply, because the bulb stabilises the oscillator and the amplification factor of the op-amps is fixed by the ratio of the feedback and input resistors.

The power supply arrangement used is shown in Fig. 6. IC3a generates split rails from a single supply line. The voltage at its output pin 7 is at half the supply voltage, because the voltage at its – input (pin 6) is equal to the half-voltage level set by R12 and R13 at its + input (pin 5). This way of using an op-amp is known as the voltage-follower. There is total negative feedback, and the closed-loop gain is unity.

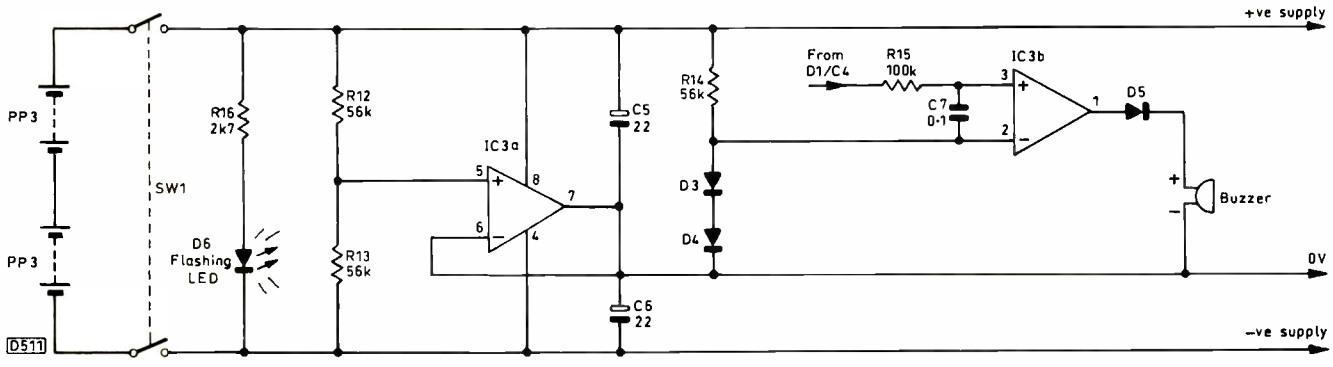


Fig. 6: The split-rail generator and buzzer comparator circuits.

The meter's total current requirement is only some 10mA, plus a couple of mA for the on indicator D6. Two PP3 batteries in series are ideal. Long life is assured – if the oscillator's output is set as described later, the meter's accuracy will be maintained until the supply drops to about 5V per battery.

If the link between the batteries was connected to the 0V rail this split-rail arrangement would be unnecessary. It's included to enable a DC adaptor to be used as an alternative power source. An adaptor with an output from 12V to 30V can be used. A regulated type is best, as ripple on the supply could cause problems.

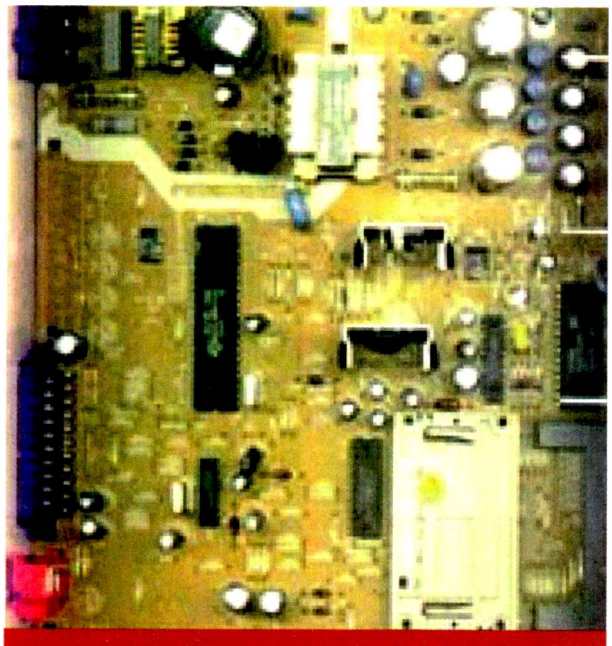
The Buzzer

IC3b serves as a comparator for buzzer operation. The output from the meter rectifier circuit, across C4, is applied to the + input (pin 3) for comparison with the voltage at the – input (pin 2). If the voltage at pin 3 exceeds that at pin 2, the output at pin 1 goes high (see comparator circuit description earlier) and the buzzer sounds. About 1V is developed across the series-connected diodes D3 and D4. When the ESR value of the capacitor being tested is about 1Ω or less, the voltage across C4 rises above this 1V reference.

Next Month

In Part 2 next month we will deal with construction, setting up, use and inductance measurement, and in addition provide a bit more information on ESR. A detailed components list will be included.

Satellite WORKSHOP



Jack Armstrong

Interference

I've had numerous calls from professional dish installers who think that I, a bench-bound repair man, should be able to solve their problems. Surprisingly, I often can!

The same symptom has been occurring repeatedly: a noise in the background with Sky Premiere movies or whatever they call it this week. In addition the the complaints include sparkly pictures on channels such as UK Living, MovieMax and Sky Sports.

The cause of the problem is the new Eutelsat W2 satellite at 16°E. It transmits at up to 135W per transponder. At least three channels are being transmitted adjacent to Astra ones. Nile TV affects Sky Sports, ESC affects MovieMax while Egypt TV affects UK Living. The answer is to ensure that the dish is not distorted and is accurately aligned. Adjustment is very critical. In some cases a spectrum analyser may be needed. So you will have to charge the customer lots of money – unless it's a crappy installation that you carried out in the first place.

If adjustment doesn't cure the problem, because the dish is twisted or of poor quality, the only solution is a new dish – possibly a slightly larger one to provide a narrower beam width. Another possibility is to try a different type of receiver, as some seem to be better than others at rejecting this type of interference.

Note that Hot Bird 5 also has higher power, and is likely to cause problems with reception from 10°E.

Another form of interference comes from ONdigital terrestrial transmissions. These can make the satellite pictures very grainy. The answer is to retune the satellite receiver's UHF output to a different channel.

The Pace MSS100

Wossname up Church Street brought me two Pace MSS100 receivers for repair. "No hurry" he said, "just for stock. Won't cost much will it?"

I told him it wouldn't, provided he wrote the actual fault symptoms on a label attached to each unit. He looked a little put out.

"All right then, I'll just fix every fault I can find and charge you accordingly."

He scribbled some notes furiously, then departed!

The label on the first one said "blew screen no signal." I could tell which school he had attended. The receiver came on with a blue screen that displayed the "no signal" message.

There was no LNB output voltage from the tuner, though the voltage was present at the relevant tuner connection beneath the board. I unsoldered the tuner and found that the F socket's centre pin was disconnected inside.

The second label said "chanle names float leftwards and no pleese insert card message".

I confirmed the symptom and set about trying to find the cause. A few oscilloscope checks indicated that the PTV110 chip was not operating correctly. A replacement cured the fault.

Making a Profit

I'm often told that the satellite market is dying, mainly because of low high-street prices. But there are many things an independent dealer can do that a large store wouldn't even consider – like installing a motorised 2m dish. You can virtually name your price for this sort of thing. Be sure to check on local council planning requirements, and find out from your wholesaler exactly what's needed.

Here's a simple question: would you rather do twelve jobs a day at £25 each or six at £45 each? You get more income with the former, but do you make as much profit? Think about the amount of travelling per job, and the fact that your parts expenditure is doubled when you do twelve instead of six jobs. While your turnover increases your profit is actually lower and you have to spend more hours to produce it. In addition you may be pushed over the VAT limit.

Instead of concentrating on fast, low-cost jobs, concentrate on providing good value for money. You will get more referrals, work fewer hours for a better type of customer and earn more money.

I often hear the complaint that it's impossible to make a profit selling just receivers. This is true of new ones – the trade warehouses are lucky to make ten per cent profit, and their prices are sometimes higher than those of the high-street stores. If all you customer wants is a receiver, why not supply him with a refurbished second-hand model? Thousands are scrapped when people change over to cable or digital TV. You find them advertised for a tenner, while lots end up at car boot sales. You can get a Pace PRD series receiver for a song, and the Amstrad SRD510 and later models have at least 99 channels. If you can buy them cheaply enough, it's worth paying someone like me £25 a time to refurbish and upgrade them to work with an enhanced LNB. The result is a 99-channel enhanced receiver at little more than £35 and a reasonable sale-on profit.

Pace SS9200

The last occasion this angry farmer's wife visited me was when

her Pace SS9200 receiver had died for the seventh time in as many weeks. The cause of the trouble was traced to surges that occurred on saturdays, when the milking machine was used. The other day she came back to say that it was "dead again". It wasn't, but there was no picture when I connected the receiver up on the bench.

I checked the video output from each scart socket. There was the normal flickering picture from the decoder socket, but no output at all on any channel when I tried the TV and VCR sockets. I then checked for outputs from the TEA2029C sync separator chip U6 to the decoder board connector and found that they were missing. A new chip cured the fault. This is quite unusual. According to *The Satellite Repair Manual*, edition 5, the usual cause is Q24 or Q29 (BC547).

A Grundig GSR1 Mk 2

I groaned when Wossname from up Church Street waddled into the workshop with a Grundig receiver. He always arrives when I'm trying to solve a most frustrating problem.

"Nuffin' wrong wiv it" he said, "jus locked menus."

Now I haven't come across a GSR1 before, so it's not a model with which I am familiar. I searched through my notes and various *Satellite Repair Manuals*, but couldn't find a reset code anywhere.

"OK" I said, "let's try the internet."

Wossname looked puzzled. So I told him to put the kettle on while I entered the search words into Sherlock on my new Apple Mac G3 computer, which took about thirty seconds to find the answer at the SatCure web site. Here it is: to unlock menus, enter the lock menu and 'Reset PIN' – this sets the PIN to 1515.

Wossname tiptoed back with a cup of tea in his hand.

"Where's mine?" I asked.

Amstrad SRD650

I don't repair D2-MAC decoders nowadays. The type of person who uses them is often the type that doesn't want to spend any money! That, plus the fact that a pirate smart card was required to test them, forced me to give up.

The lady who brought along an SRD650 didn't look like a typical viewer of questionable films however, so I agreed to take a quick look – at the receiver, I mean! She explained that it would turn itself off occasionally. She could turn it on again after a few seconds, with the remote control unit, but it was annoying.

I checked the power plug for poor connections – it's always sensible to start with the obvious. I've had this problem with the SRD510 because of a bad low-voltage connector inside, so I looked at the plug that connects the 5V/12V/27V/13-17V supplies to the main board and cleaned its sockets, using a switch-cleaner aerosol. This seemed to work, so I left the unit on test. It was still on next morning. I reckon my guess was correct.

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 435

Joe Bright used to run a rival TV/video business in this town. Since giving it up he's become a sort of wheeler-dealer, trading in anything that might turn a buck – though he came badly unstuck with those Christmas trees! He bought a job-lot of TV sets and VCRs at auction recently, and here he was in the big JB-reg Mercedes with the only one he couldn't get going himself, a 21in. Hitachi Model C2114TE.

The problem was that it flipped back to the standby mode as soon as it was turned on. The line timebase seemed to be OK, as a rustle of EHT and 'static' was discernible at the moment of switch-on. TechnoCrat checked the HT supply at the over-voltage avalanche diode ZD952, using a DC-coupled scope, and saw that it hit 130V in the moment before the set reverted to standby – in this model the HT should stabilise at 110V. Television Ted had already highlighted in yellow on the circuit diagram in the service manual the two most likely components to be the cause of this problem. TechnoCrat replaced them and adjusted the set-HT control VR951 for 110V at ZD952. This solved the main problem. What were the two components? Not difficult to identify really, even without the benefit of Ted's service manual . . .

But we weren't out of the woods yet! If you made a good guess at the first part of this puzzle, you could maybe solve what turned out to be a bigger problem, at least as far as TechnoCrat was concerned! To his consternation he found that control of the TV set, using the zapper Joe Bright had so thoughtfully brought along, was very limited.

For some reason the set came on from standby on programme 3, though 1, 2, 4 and 5 could be selected thereafter. They were all tuned to the Walmington-on-Sea relay however, while the Test Case workshop's aerials are aligned with the main Heath Hill transmitter. Try as he might, TechnoCrat couldn't get the set into the tuning mode. As his manual contained no user instructions, he got the shop to fax him a copy of the relevant pages in the user's guide. But following the instructions brought him no joy: the set simply didn't want to be tuned!

To permit further investigation, TechnoCrat connected a signal generator to the aerial socket, tuned its output to the Hitachi set's programme 1 vision carrier frequency and modulated it with a Sky News signal. This proved that the set worked correctly from the video point of view. The sound output was very limited however. No matter how long the volume-up key was held down, the sound level soon hit a 'ceiling' and stayed there. Joe Bright had made no mention of this. But he couldn't have been expected to know about it, could he? TechnoCrat had to pursue this fault, if only to be able to provide Joe with a realistic repair estimate.

More tests suggested that the cause of the trouble lay with (or near) the microcontroller chip IC001. Maybe it was faulty, or maybe the EEPROM chip was in trouble. But neither was in stock. Time to phone the excellent Hitachi technical helpline! After a short conversation and receipt of a faxed document the problem was solved.

Any ideas? For the solution, turn to page 362.

Servicing the Panasonic NVSD25/30/40/HD100

Brian Storm describes the changes introduced with these machines, including the K deck, the fault codes and service modes, and some faults you might encounter

Use of the long-serving G mechanism finally came to an end with this range of VCRs, which introduced the K deck. Critics of the G deck had complained about the solenoid's clicking and clunking as the loading motor mechanism engaged with the capstan motor, and by now other VCRs in wide use had quicker response times between modes, with almost instant response to the play and record keys.

The K mechanism was developed to meet these criticisms. It has a conventional loading motor, and stays fully-loaded for all functions. Because of this the mechanism is quieter, while switching between modes is much faster as the mechanism no longer unloads the tape from the drum for fast-forward and rewind. In addition you can go from fast-forward to cue-forward almost instantly, which makes it much easier to find programmes on a tape.

Other changes introduced with these machines include enlarged front illuminated panels with clearer indications, larger main operating controls, and a reduced number of controls on the front panel.

VideoPlus coding is used for the timer operations instead of the bar-code scanner previously employed. There's even an add-on PDC panel that can be fitted internally, part no. VWPDC1E.

Remote Controls

The remote control units are more complex, though they have a simpler external appearance. The main VCR controls are larger and are on top of a flap that conceals the multitude of additional, more complex controls – these include VideoPlus programming, index search, editing features and VCR/TV remote switching. The units can also control basic TV functions: depending on model type, different manufacturers' codes are included as well.

Servicing Features

The servicing facilities were substantially increased, with the machines' internal software able to monitor many processes to assist with fault location.

For access to a stored fault code, you press eject, fast-forward and rewind together (or eject and cue-forward with machines that have a jog-and-shuttle dial). The fault-code information is displayed for a minute. Alternatively you can obtain a permanent display by shorting test points TPSERV and TPGND on the main PCB.

The fault codes are as follows:

0 Normal, no problems.
1 Drum motor has stopped.
2 Tape reel has stopped.
3 The mechanism has stopped while loading to the drum.
4 The mechanism has stopped while unloading from the drum.
5 Faulty capstan rotation.
6 The mechanism has stopped during the cassette-in or eject mode.

Service Modes

Once the fault code information is displayed you can, by still holding the other control or controls and pressing eject again, step through six more service modes. These are as follows.

Service mode 1: This checks the tape end-sensor circuits. If the light to both sensors is blocked, 00 will be shown. If the supply sensor only is blocked, the indication will be 01. 02 indicates that the take-up sensor only is blocked, while 03 indicates that neither sensor is blocked.

Service mode 2: Checks the mode-switching circuit by displaying the mechanism positions as they are reached in operation.

Service mode 3: Checks and confirms the mechanism operations. When a mechanism mode change is achieved in the correct sequence and time, 00 is displayed. This confirms that the operation worked correctly within specification.

Service mode 4: Checks the buttons on the front panel by providing a two-digit indication when any button is pressed. By confirming that the microcontroller chip received a command or didn't receive it, this gives a quick check on whether the buttons work. If a button doesn't work, there may be a key-scan circuit fault or a crack in the front PCB.

Service mode 5: Checks the operation of the capstan motor control circuitry. There is a two-digit indication for the various different drive conditions. This indication can be checked with the service manual.

Service mode 6: Similar to mode 5, but checks the drum motor drive circuitry.

An additional service mode is available by shorting across SW7512, which is a PCB marking on the timer panel for a switch that's not fitted, while at the same time accessing the fault-code display (press eject, fast-forward and rewind, or eject and cue-forward). It enables you to control the loading motor by simply holding play to load or stop to unload.

Use of these controls provides manual operation of all the mechanism functions, enabling you to check a mechanism thoroughly without the risk of damage to a good tape.

The Mechanism

The K mechanism is less complex than its predecessors and gave little trouble initially. There are some significant differences.

As there's no longer a mode switch on the cassette carriage, loading is initiated differently. When a tape is inserted, part of the right-side cassette holder is pushed across the tape sensor, blocking it. This tells the loading mechanism to operate.

So one unusual symptom you can get if the centre LED is faulty is the mechanism attempting to load without a tape being inserted, the machine then lapsing into the standby mode.

When a tape is lowered into the mechanism, there is a slight pause before the main loading arms pull the tape around the drum. The capstan motor rotates briefly during this time, to prove to the system-control circuitry that it can be relied upon to wind the tape back into the cassette body when the tape is ejected. If the capstan motor doesn't rotate or, more correctly, doesn't generate FG pulses, the tape will be ejected immediately, before the loading arms pull the tape around the drum, thereby preventing possible tape damage. With no capstan rotation the take-up and supply spools can't be driven, so the tape would be left loose and could snag when the tape is ejected.

Arm P5 which, in the G mechanism, can cause tape damage by bending slightly when the tape is tight, was improved by the addition of a housing into which the P5 post is located. It forces arm P5 to be perpendicular when fully loaded, even if it's actually slightly bent.

The audio/control head was simplified by mounting it on a base that's supported by three sprung screws. All three screws set the height then the azimuth, the zenith being set last by the relevant screw. Lateral adjustment was changed to a sliding plate instead of the more common conical-nut arrangement.

Common Mechanism Faults

Machine accepts then ejects a tape: Capstan stator (part no. VEK5927) is faulty or arm P5 (part no. VXL2306) is badly bent.

Fault 03-04 or 06 occurs intermittently: Check for dry-joints at the loading motor or a split loading-motor coupling (part no. VDP1434).

Tape path variations, with the picture rolling or jumping: The input guide (part no. VXA4982) is slack.

The drum speed changes in cue and review: Capstan motor top bearing is dry.

Drum speed changes in cue only: Usual cause is a worn drum.

Excessive tape tension across the drum: Brake arm (part no. VXZ0313) is broken.

Electronic Changes

In Models NVSD30 and NVSD40 the system control and servo processor chip IC6001 was upgraded to provide faster wind and rewind times with certain non-standard tapes. The part numbers are MN67434VRSH for Model NVSD30 and MN67434VRSG for Model NVSD40.

The timer and front-panel display driver chip IC7501 was also upgraded, to provide a consistent clock accuracy of ±15 seconds a month. The new part number is MN187164VZBE.

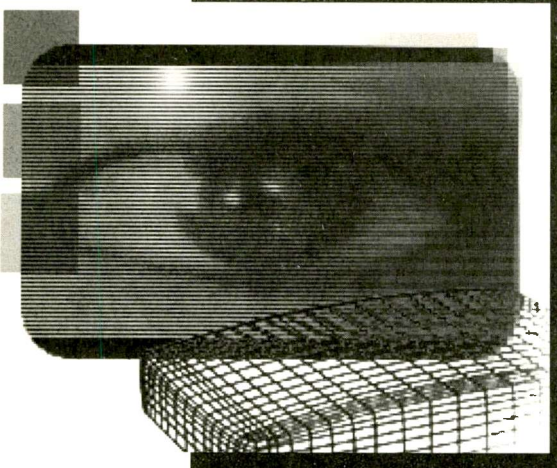
Tuners

The UHF tuner unit used in these machines can sometimes be less than completely reliable, giving various intermittent problems such as tuning drift from cold, losing some channels when warm and being off tune after a timed recording. The part number is ENV87837H3Y.

Model NVHD100

Some owners of this model complain about no remote-control operation. The cause is always switch VCR1/VCR2 being in the wrong position. It's hidden under a flap at the front of the machine.

IC7001 in this model can be responsible for various faults such as no AV or E-E switching, no VU meter operation or no tuning because the UHF tuner is busily trying to scan a VHF band. The part number is M66006FP.



Monitors

Reports from
Philip Blundell, AMIIEelec
Giles Pilbrow
Chris Hawkins
Ian Field
Gerry Mumford and
Adrian Spriddell

Mitac AM4050PD

This monitor would work for about ten minutes then go to line collapse followed by off. A check on the HT (+B) voltage at R924 showed that it was high at 175V instead of 145V. Further checks revealed that R921 (68kΩ) had gone high in value. **P.B.**

Eizo

Most of the recent Eizo monitors have the option to lock out the picture geometry controls at the front. Depending on the model, the procedure is either to switch on at the mains while holding the autosize button down, or to switch on at the mains while holding the vertical stat button then, while still holding the stat button down, press the side pincushion button for five seconds.

Spares for Eizo monitors can be obtained from Professional Display Systems, Genesis Business Park, Albert Drive, Sheerwater, Woking, Surrey GU21 5RW. Phone 01483 719 500, fax 01483 719 560. **P.B.**

IBM PS/1 Model 028 002

Frame collapse was the symptom with this monitor. I found that the 3·3Ω, 1W safety resistor R301 had gone open-circuit. No other components had to be replaced. **G.P.**

Mitac 1450PD

The owner said he was fed up with not being able to see the beginning and end of each line of text. They were hidden out of sight at the sides of the screen. The user controls had no effect. While scanning the board with the aid of a magnifier I noticed a tiny out-of-sorts bipolar capacitor, C509 (10µF, 50V), which had literally lost all its electrolyte. A replacement cured the fault.

The chroma output chip in this monitor is an MM1203: an LM1203N is a possible replacement. **C.H.**

Philips 14C

The first of two of these monitors presented a display that looked like a case of magic mirrors at the funfair. It had not been helped by the pot-twiddling owner. Once the potentiometers had all been restored to their normal positions there was a reasonable display with linearity problems. I decided to replace C2403 (470µF, 16V), C2407 (47µF, 100V) and C2539 (47µF, 25V), using components rated at 105°C instead of 85°C. This did the trick.

The second one produced just a horizontal line. A quick check with the Philips data book showed that the TDA4860 frame output chip has two supplies, one from the power supply and the other from the line output stage. The former supply was missing because D6114 (BYD33M) was short-circuit while the associated fusible resistor R3134 (0·22Ω) was open-circuit. I replaced the TDA4860 chip and filter capacitor C2123 (1,000µF, 35V) as well for good measure. **C.H.**

Royal CX1469

The width had decreased to 2cm. I found that one leg of coil L401 had burnt a hole of about 1cm diameter around it. Odd how customers sometimes soldier on despite everything, sometimes letting a trivial fault become a major one. **C.H.**

Compaq 470

This monitor was dead. The 2SD1878 line output transistor Q502 had been removed and was taped to the front. A quick check showed that it was short-circuit all ways. As I seldom enounter this type of monitor I had no spares. A look at the circuit showed that there were no efficiency diodes, so a transistor with an integral diode was obviously required. In a situation like this a 2SC4742 is one of the first choices. It proved to be suitable here.

If you suspect that the transistor has an inadequate maximum collector current rating, a good check is to view a test card. If the transistor cannot cope, the linear forward scan ramp will begin to level out. This will be evident as cramping at the centre of the screen, increasing towards the right-hand side.

The replacement transistor was fine, but judging by the state of the PCB its predecessor hadn't been. When I traced back from the base pin to the driver transformer I found out why. The 47µF, 25V coupling capacitor C512 was very leaky. **I.F.**

Compaq 420

Three of these monitors came in together recently. If there's a red cast on the grey scale, check R441. It's directly above the hot CRT neck and seems to be the only one of the three to be affected.

A 420T in the batch made a sizzling noise though there was no obvious disturbance to the picture. I found that R5 (220Ω, 5W) in the power supply snubber network was dry-jointed. As usual D1, D15 and R29 were bridged by brown glue. It hadn't produced a power supply blow-up so far, but when it was chipped away I found that the leads affected were significantly corroded.

The final unit was a 420S. I thought that the S might indicate manufacture in Singapore, but the chassis was definitely of European

origin, possibly Nokia. I could neither find nor instigate a fault, though there were some rather dubious-looking connections on the CRT panel. I resoldered these and balanced the grey scale. The result was a happy customer. **I.F.**

Elonex SV14LR

The chopper power supply had blown up. As the mains rectifier was short-circuit, I suspect that failure had occurred during a thunderstorm. I802 (UC3842), R810 (47Ω), R811 (20kΩ), D806 (18V zener diode), R825 (0·39Ω, 2W) and the 2SK794 chopper FET all had to be replaced. As a precaution, I always replace the 4N35 optcoupler when one of these power supplies blows up. 1N5398 diodes are suitable for the mains bridge rectifier circuit.

Once the monitor was up and running there was a flooded screen. The tube's first anode voltage is derived from line flyback pulses, not from the LOPT (though the LOPT has an A1 preset, which could be misleading). There's an A1 preset on a separate PCB next to the heatsink. Adjustment of this preset had no effect. Right next to it, alongside the heatsink, there's a 2MΩ resistor which was open-circuit. A replacement enabled the first anode voltage to be set up. **I.F.**

AST LR14/NCR 0261

I've mentioned before that C322 tends to fail, destroying the line output transistor. In the AST model its value is usually 6·2nF, rated at 1·6kV. In the NCR versions the value has always been 5·6nF, with the same voltage rating. This lower value capacitor seems to fail more often. In desperation I've sometimes used a 6·8nF capacitor. This has no obvious effect on performance, and there have been no returns. I upgrade the voltage rating from 1·6kV to 2kV, except when using a 6·8nF capacitor in which case the 1·6kV rating probably has an adequate safety margin.

A very odd case of field bounce/collapse came along recently. Remaking all the dry-joints I found made no difference. I then noticed that when the chassis was reassembled the odd-shaped subpanel above the row of presets, whose spindles point downwards under the side edge, wasn't seating correctly in the two plastic connectors on the main PCB. The cause was faulty metal brackets, which are clipped to the subpanel with plastic pop-rivets. They prevented the connectors being pushed fully home. The brackets had to be clamped in a vice and kinked. The monitor worked perfectly once the reshaped brackets enabled the connectors to fit correctly. **I.F.**

Dell 1528LS

This monitor was tripping because the 2SC5129 line output transistor had failed. Its connections were all short-circuit, which is unusual. The 2SC5XX9 series of transistors usually pretend to be diacs for cold checks: this one had failed properly! I then saw that the manufacturer's trade mark differed from the one usually seen. The 2SC4742 is a more reliable replacement, but it needs a separate insulating kit. **I.F.**

Compaq 420S

The European manufactured versions are even more of a pain to dismantle than previous ones. So, if you have an EW fault, try some switch cleaner on preset RT4 before starting on a protracted conflict with the unit. I accidentally picked up the Electrolube DFL200D PTFE spray by mistake this time. In theory it should have made matters worse, because of the insulating properties of PTFE. Instead, all traces of coarseness in the rotation of the preset vanished after a few turns back and forth, and the effect on the raster was just as smooth! As an added bonus, PTFE spray is not as messy as switch cleaner. **I.F.**

AST LR14

My most recent encounters with this chassis suggest that there has been a redesign. The Welltrend chip on the sync panel has been replaced with a number of LS TTL, HC chips and transistors. At first I though it must be an earlier version, but the date codes on the ICs were 92/93. Some new MOSFETs have appeared in the line output stage. C322 (6·2nF, 1·6kV) remains a common failure. C35 and C40 (100μF and 200μF respectively, both 100V) often seem to pull from their solder fillets, especially while handling. They should be given a fresh application of solder as a metter of course. **I.F.**

Dan CX1428LR

Because of a power supply blow up this monitor was dead. The BUZ90A chopper transistor Q101 and the TDA4605 control chip IC101 were short-circuit. This had destroyed the mains bridge rectifier D101 and the surge limiter thermistor TH101. In addition, R117 (150kΩ, 2W) was open-circuit. This had probably been the original cause of the trouble, as it forms part of an *RC* time-constant network that determines the end time of the FET's drive pulses. **G.M.**

Commodore 1084D

This is a good example of the oddball monitors that sometimes come along. It's used with the Amiga computer, and a programmable generator (or an old Amiga of course) is required to drive it. The unit was dead. R106 (1Ω, 2W fusible) had a large burn mark and was open-circuit.

The power supply is based on the STK73410II switching regulator, which had failed along with R109 (68Ω, 2W). As a precaution, C110 (10μF, 50V) and C111 (1μF, 50V) were also replaced – they read a little low. With this type of power supply it's usual for low-value electrolytics to dry up slightly, causing failure of the STK module. **G.M.**

Panasonic C1381

This monitor powered up but failed to produce a picture. Inspection showed that the tube's heaters were out. I then saw that there were massive dry-joints at all the CRT base socket connections. This seems to be a common problem with these monitors. **G.M.**

Tatung TM3401

There was very low width with R465 (4·7Ω) open-circuit. After replacing various items in the EW circuit to no avail I finally found that C423 (3·3μF) had fallen in value – the reading was 330nF. **A.S.**

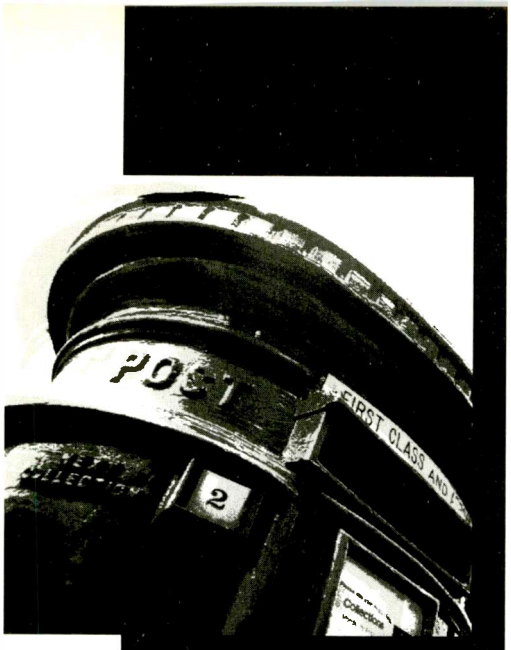
Opus CM1438T

If there's serious line drift with frame cramping at the top, check for 12V at P405 (next to the data cable entry at the rear of the main PCB). If the reading is low, it's probable that the 12V rail is trying to run the monitor unaided. Check Q001 (2SA966) on the secondary side of the power supply. It should have about 18-19V at each of its pins. If in doubt, replace it. **A.S.**

Western Systems HL4850

This monitor was dead: the power supply was in standby with the amber LED alight. The STR17006 chip U702 had failed. **A.S.**

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.

Digital TV

During my many years as a TV technician (since 1965) I've seen the transition from 405 lines, black and white, with poor recording capabilities, to 625 lines black and white then 625 lines with full colour. Since then there has been a gradual improvement in picture quality, because of technological developments at the studios and in the display. Today we have a 625-line analogue system able to produce full 5·5MHz bandwidth video. My own Panasonic TV set displays detail and picture quality that was never seen prior to the Nineties. Test card F, when it is on rare occasions seen, has the 5·5MHz grating clearly visible.

What we have seen with every advance in the technology until now has been an improvement. It may be early days yet to make a decisive judgement, but from what I have seen so far of digital TV I must say that I am very saddened.

The definition of digitally transmitted pictures, especially with the subscription multiplexes, is reduced and I have even noticed peak-white difficulties with some transmissions. I can only assume that the cause is broadcasters using excessive compression for the sake of quantity, thus reducing quality. But the systems are being sold as having improved quality! While this may be so if someone changes from a set-top aerial in a poor signal area – anything would be an improvement on that – it doesn't seem to me that someone who has spent a little cash on achieving a decent analogue signal input will see any improvement with digital TV.

We appear to be having a system forced on us by bandwidth greed. Even the 16:9 promotion is a compromise, with only a portion of the transmitted lines being used, wasting about thirty display lines at the top and bottom of the scan.

I hope my disappointment is premature, and that with time the digital age will produce pictures as crisp as our present analogue ones. If not, it seems that any improvement in display technology will be a waste of time for ordinary viewers.

E.C. Westcott,
Ivybridge, Devon.

Is digital TV a rip-off? This depends on what the public is being led to believe is on offer. The marketing people are trumpeting several 'benefits', one of which is better picture quality. In some cases however digital TV will give viewers pictures that are subjectively of poorer quality than those they can receive at the moment, in particular those viewers who live close to a high-power analogue transmitter and are used to ghost- and noise-free reception. In other cases there will be a dramatic improvement. It really depends on what the viewer is currently getting. The only thing that can be said with certainty is that with digital TV the quality of the pictures will be pretty much the same for everyone, and can be improved or worsened by broadcasters depending on how they wish to use their allocated bandwidth: the more channels they squeeze in, the higher the compression ratio required and the lower the picture quality.

Another of the supposed 'benefits' is widescreen displays. But, unless you are prepared to buy a new set, widescreen pictures are a distinct disadvantage. Which brings me to the point raised by Chris Plaice (Letters, January) who says that he has yet to see a widescreen set that shows any more picture than a conventional one. I agree! Widescreen sets are invariably displayed showing either squashed or cropped 4:3 pictures. In the latter case this means that you see less picture than with a conventional set! In my opinion the way to display and sell a widescreen set is to place it beside a 4:3 set with the same picture height, with the widescreen set showing a true widescreen picture and the conventional set showing the same programme. This way the customer can see that there is more picture to be had with a widescreen set. Until recently this was not possible, as there were no sources of widescreen material. This is no longer the case of course, so there is no excuse for retailers not showing off widescreen sets to their full potential.

It seems to me that the move from analogue TV to DTT is simply the next step forward, like the move from 405/VHF to 625/UHF in the Sixties. Then as now there was concern about equipment becoming obsolete, but the eventual shutdown of the 405-line service was inevitable. John Hopkins (Letters, January) makes the point that having to buy a separate £200 digital set-top box for each receiver in a house that has a distribution system would be ludicrously expensive. Well, yes, at current prices. But surely what will happen is that digital tuners will start to appear in sets of all sizes and lower and lower prices, so that by the time analogue TV is switched off even 14in. portables will be equipped with built-in digital front-ends producing perfect pictures just about anywhere with a loop aerial – and probably for less than £100!

Graeme Steer,
Chessington, Surrey.

Warning

What started off as a straightforward mechanism removal with a

Sony SLV-E720 VCR became a rush to the local Casualty Dept. to have a badly scalloped piece of flesh on my little finger refitted and dressed. The cause of the accident was the dangerously sharp upper edge of the rear metal case. In grasping and applying upward pressure to the head amplifier daughter board to remove it, and at the same time spring open its sockets, I was unaware how close my fingers were to this plate. When the board sprang out of its socket, well you know the rest.

I had to bandage the wound rapidly, shut down my service unit and then lose an hour's income. Am I the first casualty of this knife-edged plate, and would Sony care to reimburse me?

Bob Longhurst,
East Grinstead, West Sussex.

Clanger?

My earlier letter (February issue) on the tuning circuit used in the Hitachi Model 2118 suffered from being edited. I had emphasised that Q003 is a switching and not an integrating transistor. My letter made it clear that the integration in this digital-to-analogue converter is carried out solely by the low-pass filter that follows Q003 in the circuit.

Michael Dranfield originally suggested (Letters, January) that the voltage across the 33V stabiliser ZD002 can never reach 33V unless Q003 is cut off. The fact of the matter is that Q003 is indeed cut off for much of the time, that the voltage across ZD002 *does* reach 33V, and that the tuning *is* stabilised. Michael's additional resistor does nothing to alter the circuit operation, which is based on chopping a 33V supply. The waveform at the collector of Q003 remains a pulse train, and the measured mean DC voltage here is as meaningless as before. The effects of the suggested modification are as follows:

(1) The stabilised 33V supply can be measured using a conventional meter.

(2) The power dissipated by the stabiliser is increased. This is significant, as this component does tend to run quite hot.

(3) The pulses at the collector of Q003 are less accurately defined.

(4) The current through Q003 is reduced. Power dissipation is not affected, as a switching transistor is either off (no current) or saturated (no voltage).

(5) The power dissipated by the feed resistors is marginally reduced.

On the whole the circuit is better without the presence of the resistor. This brings us to the question of why the resistor is usually included in this type of circuit, when it is clearly not required? I would suggest that it is included to satisfy condition (1) above.

I disagree with the editor when he says the original circuit is "not likely to be able to provide effective stabilisation". Far from it. With or without the resistor in question the tuning arrangement, taken in its entirety, is far more stable and tolerant of component changes (ageing) than the traditional method of simply tapping off a tuning voltage from the regulated 33V supply. In conclusion, there are no shortcomings in the Hitachi circuit, which is fully described in the first-class manual for this model.

My thanks to Colin J. Guy for his reply to my letter regarding the ESR figure expected with a 2,200µF capacitor. I did indeed miss the meaning of his remarks. The main point I was trying to make is that one can be fooled by an OK from the Capacitor Wizard's buzzer, and that with this sort of capacitance value it is important to watch the meter and confirm that the ESR is less then 0·1Ω. Again, the wording of my letter on this subject had been changed.

Alan Willcox,
Cardiff.

Test Card Music – and Storage Heaters

In his column a few months back Donald Bullock mentioned the subject of test card music. During the Sixties and Seventies I could whistle whole sequences, an achievement that pales into insignificance when compared with the late Gerard Hoffnung's ability to whistle complete symphonies while walking his dog! I believe that a CD of test card music, entitled "The Girl on the Test Card", was produced but don't know where to buy it or if it's still available. If anyone out there has any information on this, I am sure that many people would like to know. Nostalgia becomes more significant as the years go by: even catching sight of a test card is a rare event these days.

Don also mentioned suffering with old-type storage heaters. Modern ones are much improved. After a recent house move to an area where there is no mains gas I installed a new storage-heater system, running on the Superdeal tariff. The meter records units at three different rates. Contactors for switching hot-water and storage-heater supplies are contained within the meter, which consequently has three outputs: the unrestricted supply, which is charged at full rate during the day and half rate at night; the restricted supply for water heating; and the restricted supply for the storage heaters.

Although the water-heating and storage-heating units cost the same, about a third of the full rate, the two restricted supplies can be controlled remotely by the electricity authority to switch separately and at different times of the day, depending on the loading. A radio receiver within the meter decodes control and time transmissions, which are provided by phase modulating the 198kHz carrier of long-wave Radio Four. Unlike the Economy Seven tariff, Superdeal provides an afternoon boost period to top-up the heaters ready for the evening.

Modern storage heaters use bricks with improved thermal capacity, which has enabled their size to be reduced. Control is more elegant: a differential thermostat monitors both the core and ambient temperatures, thereby optimising the heat stored. It's claimed that this saves up to 15 per cent on running costs. An output control sets the working point of a shutter that's operated by a bimetallic spring. This simple device regulates the output in response to changing ambient temperature.

The system works well, and has the added advantage that hot water is inexpensive all year round.

Keith Cummins,
Chale Green, Isle of Wight.

DTT Frequency Allocations

While back in the UK recently I was able to see some of the ONdigital transmissions in Devon. The digital multiplexes transmitted from Stockland Hill have very much reduced power to the south, presumably to avoid interference with group A analogue transmissions from Caradon Hill and also stations in Northern France. I doubt whether relay transmitters could be provided to get round the problem, which is similar to Channel 5's near the south coast,

because of the lack of frequencies.

What will happen when it's time to switch off the analogue transmissions? The existing high-power analogue frequencies could be used, but won't be available for digital purposes until then. This would free only four UHF channels of course, while six are needed for all the digital channels. People in such locations will have relied on the analogue transmissions and, when the digital changeover is made, could simply get a blank screen.

Hugh Cocks,
Algarsat Ltd., Portugal.

Video Resolution

In his report (October 1998 issue) on the video alignment test tape available from SEME, Eugene Trundle said he was puzzled by the fact that his VHS players reproduced the test tape's 3MHz grating though their maximum horizontal resolution is specified as being about 260 lines. This inconsistency has for a long time puzzled me as well.

As stated by Eugene, a 3MHz grating must correspond to a horizontal resolution of 156 line-pairs, i.e. 312 lines. This must be so since at 3MHz there are 156 electrical cycles, taking 52µsecs, across the width of the picture, and each cycle represents one line-pair. We therefore have a correspondence between the horizontal picture spatial domain and the video-frequency domain of 104 lines per picture width per MHz (exactly as Eugene implies). To put it another way, if the 3MHz grating can be resolved and occupies the full width of the screen, one could count the number of vertical black and white bars and there would be 156 black and 156 white ones, making 312 in total. This is surely a 'real-world' resolution of 312 lines, and hence confirms the relationship of 104 lines per picture width per MHz.

But video manufacturers seem to quote horizontal resolutions that equate to about 80 lines per MHz (though, interestingly, they never seem to quote the electrical bandwidth). This applies with S-VHS and Hi-8 as well, where a figure of 400 lines is typically quoted for the horizontal resolution. In fact my Hi-8 and S-VHS machines both easily reproduce the 4·5MHz bars of test card F, which should correspond to a 468-line resolution, and indeed the 5·25MHz bars are visible – corresponding to a 546-line resolution! (A comb filter is used between the output from the vision demodulator and the VCRs' S-video inputs.)

The real mystery is why manufacturers should deliberately choose to understate this important aspect of the performance of their products – by about 30 per cent. This seems highly uncharacteristic of the commercial world!

In a letter in the November issue Andy Barkley suggested that the answer lay in the Kell factor. But this can't be used to justify modifying the relation between a given bandwidth and the corresponding resolution in lines, e.g. changing 104 lines per MHz to 80 lines per MHz. The Kell factor arises as a result of the scanning line structure, which 'samples' the picture in the vertical direction at the source and display. There is no equivalent in the horizontal direction, which is scanned by a continuous beam.

Another suggestion I've come across, but with no rational justification, is that the horizontal resolution is being expressed as the equivalent number of lines of vertical resolution required to give equal vertical and horizontal resolution. At least that's my interpretation of what was written, but I can't find the original to check. In other words, horizontal resolution is being expressed in lines per picture height! This seems to be a bizarre and highly misleading way of expressing horizontal resolution. It means that two systems with genuinely equal horizontal resolution would be stated as having different horizontal resolutions depending on picture aspect ratio. Most significantly, from the commercial point of view, it will always give a lower horizontal resolution value than the true value, since all domestic TV pictures are wider than they are high.

Does anyone have a logical explanation for the original problem brought up by Eugene, or are manufacturers' specifications and magazine test reports etc. just plain wrong in this matter?

J. Alan McKeown,
Wester Ross, Scotland.

I don't recall all these bandwidth problems when we first wanted to display computer-generated characters on a TV broadcast, circa 1965, RCA Divcon. It wasn't long before practical requirements demanded an easy-to-digest explanation. This is how I did it:

(1) A revolving pattern, say a ball with black-and-white lines, will at some distance fit on to the line structure. Unless the video response can match that, the pattern will flicker as it revolves.

(2) There are 52µsecs of forward scan during which the video must be able to switch at 4/3 (aspect ratio) x 575 (number of active lines) = 767. This can be divided by two, as each cycle can do a black/white pair. So 383·5 iterations in 52µsec will do it. To find the frequency, $10^6/52 \times 383{\cdot}5 =$ 7·375MHz.

(3) Using a computer/logic source to provide the video chequerboard (worst case), this is indeed the very minimum requirement – and in fact it isn't nearly enough! At the band-pass limit the video is reduced to its fundamental sinewave, and the time spent at peak white is very brief. This reduces the perceived brightness of the peak beam, and the vertical white lines appear very much more dim than the horizontal lines. This makes them look narrow too!

Berry Greene,
Chichester, West Sussex.

Digital Quality

When I was in Spain a while back I saw the VHS version of the film Titanic. Despite the impressive opening piece, which declared that the film had been digitally remastered etc., the whole thing was marred by an irritating effect: as long as no one moved, the picture was normal VHS; as soon as some action took place, edges became ragged and the action was jumpy – like a poor NTSC conversion on a bad day. When I saw it at the cinema it was RGB/full definition all the way, so what had been done to it?

Upon my return the digital era had arrived. So far I have seen pictures that appear to be of the same quality as long-play VHS. The captions are great, straight from the chip inside the box, but where has the promise of MAC quality gone? It seems to me that, despite the problems with analogue reception, the choice for the next millennium is a retrograde step.

I can't see a future for something that offers inferior quality to existing technology – just as the rip-off Titanic tape.

D.J. Long,
Cleckheaton, W. Yorks.

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	BUV93	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	350p	MJE13005	60p
BC184L	7p	BD678	40p	BU406	60p	BUX11	200p	MJE13007	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	MJE18004	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	160p	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	75p	TIP36C	65p
BC639	20p	BDY66	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	16p	BUT11A	35p	IRF9640	280p	TIP2955	50p
BD239	30p	BF596	16p	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

Part	Price
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

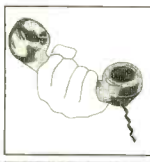
5mm x 2.5mm

RED	5p
YELLOW	8p
GREEN	8p

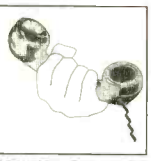
LINEAR ICs

Part	Price
AN203	210p
AN210	165p
AN211	150p
AN214Q	170p
AN217P	95p
AN228	2828p
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
AN3215K	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
AN5150	400p
AN5151	200p
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
AN6899	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	125p
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
AN7161N	375p
AN7163	175p
AN7166	350p
AN7168	200p
AN7169	225p
AN7170	260p
AN7171K	400p
AN7172K	325p
AN7173K	450p
AN7177	375p
AN7178	180p
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	160p
BA612	120p
BA614	70p
BA618	55p
BA631	280p
BA656	150p
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	180p
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
CX20015A	600p
CX20106A	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
HA11708	280p
HA11710	500p
HA11713	250p
HA11715	250p
HA11716	480p
HA11718	700p
HA11724	650p
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

K.P. HOUSE, UNIT 15, POP IN COMMERCIAL CENTRE, SOUTHWAY, WEMBLEY, MIDDLESEX HA9 0HB, ENGLAND
Telephone: 0181-900 2329 Fax: 0181-903 6126 E-Mail: grandata.ltd@btinternet.com



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	880p	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	TA7610	210p
L295	450p	LA4480	225p	LB1405	70p	M51161P	250p	SAA1300	200p	STK086	1000p	STK4803	1000p	STR371	400p	TA7075P	300p	TA7611	210p
L297	525p	LA4485	300p	LB1407	130p	M51162P	250p	SAA1310	200p	STK0100	900p	STK4813	800p	STR380	350p	TA7089	300p	TA7612	300p
L298	400p	LA4495	250p	LB1409	200p	M51164AL	80p	SAA1350	275p	STK0100II	1200p	STK4833	850p	STR381	390p	TA7102P	500p	TA7613AP	90p
L465A	525p	LA4496	250p	LB1412	300p	M51166P	300p	SAA1351	750p	STK420	400p	STK4843	720p	STR383	410p	TA7119	150p	TA7614	170p
L482	400p	LA4498	275p	LB1415	100p	M51182L	110p	SAA1900S	475p	STK430	500p	STK4853	1700p	STR384	350p	TA7120	55p	TA7615	210p
L497B	525p	LA4500	200p	LB1416	85p	M51191L	85p	SAA3004	400p	STK433	400p	STK4863	700p	STR440	800p	TA7124	250p	TA7616	300p
L702B	400p	LA4505	220p	LB1426	125p	M51231P	200p	SAA3006P	225p	STK435	375p	STK4873	1100p	STR441	950p	TA7130P	85p	TA7618	90p
L702N	325p	LA4508	200p	LB1450	110p	M51308SP	550p	SAA3007P	130p	STK436	430p	STK4893	1000p	STR442	1600p	TA7137	60p	TA7620	300p
L2720	150p	LA4510	100p	LB1615	270p	M51310AP	900p	SAA3008P	200p	STK437	600p	STK4913	900p	STR450A	700p	TA7140	100p	TA7621	300p
L2722	175p	LA4520	170p	LB1620	210p	M51316P	300p	SAA3010P	300p	STK439	500p	STK5314	475p	STR451	800p	TA7141	825p	TA7622	420p
L4960	325p	LA4550	200p	LB1622	220p	M51320	200p	SAA3027P	375p	STK441	680p	STK5315	500p	STR452	600p	TA7150P	250p	TA7628	110p
L6203	600p	LA4555	120p	LB1630	80p	M51356P	400p	SAA3049P	550p	STK443	700p	STK5322	500p	STR453	500p	TA7157	100p	TA7629	220p
L6210	250p	LA4557	150p	LB1639	300p	M51358P	150p	SAA4700	425p	STK457	470p	STK5323	600p	STR454	1300p	TA7172P	150p	TA7630	200p
L6221AS	300p	LA4558	125p	LB1640	150p	M51365P	350p	SAA5000	200p	STK459	560p	STK5324	450p	STR455	550p	TA7193	320p	TA7632	400p
L6506	300p	LA4570	130p	LB1641	75p	M51366P	360p	SAA5010	220p	STK460	660p	STK5325	370p	STR456	470p	TA7200	200p	TA7640	90p
LA1130	240p	LA4571	175p	LB1642	150p	M51381P	200p	SAA5012	400p	STK461	600p	STK5326	750p	STR457	600p	TA7205	1200p	TA7641	140p
LA1135	120p	LA4581	175p	LB1645	100p	M51384AP	750p	SAA5020	350p	STK463	950p	STK5330	850p	STR470	400p	TA7207	150p	TA7642	120p
LA1145	200p	LA4597	125p	LB1648	200p	M51387P	600p	SAA5030	440p	STK465	900p	STK5331	300p	STR1096	275p	TA7208	125p	TA7644BP	480p
LA1150	150p	LA4620	400p	LB1649	190p	M51392P	300p	SAA5040A	280p	STK501	550p	STK5332	180p	STR1195	350p	TA7210	200p	TA7645P	65p
LA1170	90p	LA4630	325p	LB3500	125p	M51393AP	350p	SAA5040B	400p	STK561	450p	STK5333	650p	STR1229	325p	TA7214	220p	TA7658	100p
LA1177	130p	LA4700	350p	LC4966	65p	M51395AP	450p	SAA5041	550p	STK563	415p	STK5335	350p	STR2005	400p	TA7217	145p	TA7659P	400p
LA1180	75p	LA4705	400p	LC7011	500p	M51397AP	425p	SAA5042	425p	STK583	500p	STK5336	350p	STR2012	400p	TA7220	220p	TA7660P	325p
LA1185	150p	LA5005	90p	LC7060	600p	M51436P	350p	SAA5050	650p	STK760	600p	STK5337	500p	STR2013	300p	TA7222	90p	TA7666P	100p
LA1186	35p	LA5112	200p	LC7120	350p	M51496P	275p	SAA5051	400p	STK770	400p	STK5338	295p	STR2015	550p	TA7223	210p	TA7668	100p
LA1201	75p	LA5511	50p	LC7130	300p	M51533	300p	SAA5052	500p	STK772	650p	STK5339	400p	STR2024	575p	TA7225	300p	TA7672	400p
LA1205	75p	LA5512	50p	LC7131	260p	M51544	150p	SAA5054	500p	STK772B	480p	STK5340	350p	STR2105	600p	TA7226	290p	TA7676AP	450p
LA1207	120p	LA5522	45p	LC7132	400p	M51848	150p	SAA5230	850p	STK780	575p	STK5342	245p	STR2124	675p	TA7227	700p	TA7679	475p
LA1210	140p	LA5523	150p	LC7137	450p	M54523P	200p	SAA5231	170p	STK795	450p	STK5343	380p	STR3105	525p	TA7230	100p	TA7680AP	200p
LA1222	80p	LA5524	80p	LC7181	350p	M54563P	200p	SAA5240PA	600p	STK1039	460p	STK5353	400p	STR3113	225p	TA7232	95p	TA7681AP	425p
LA1230	130p	LA5527	150p	LC7185	350p	M58484	500p	SAA5243PE	360p	STK1040	640p	STK5361	375p	STR3115	400p	TA7233	120p	TA7687AP	100p
LA1235	130p	LA5530	65p	LC7191	300p	M51516	260p	SAA5244AP	950p	STK1049	700p	STK5362	400p	STR3123	400p	TA7237	300p	TA7688	150p
LA1240	80p	LA5531	65p	LC7207	275p	M51518	200p	SAA5246AP	380p	STK1050	650p	STK5372	260p	STR3125	480p	TA7238	400p	TA7698	400p
LA1245	110p	LA5537	45p	LC7215	160p	M51995P	250p	SAA5246P	750p	STK1060	700p	STK5373	375p	STR3130	500p	TA7240	160p	TA7699	600p
LA1260	75p	LA5655	175p	LC7217	350p	M51977P	300p	SAA5250P	750p	STK1070	850p	STK5391	375p	STR3135	250p	TA7241	165p	TA7705	300p
LA1261	75p	LA5658	225p	LC7218	250p	M52307P	900p	SAA5351	375p	STK1080	940p	STK5392	500p	STR3212	275p	TA7242	190p	TA7709P	150p
LA1265	125p	LA5665	250p	LC7230	700p	M54646AP	400p	SAA7000	550p	STK2025	620p	STK5421	450p	STR3214	275p	TA7243	320p	TA7719P	200p
LA1266	130p	LA5667	200p	LC7267	550p	MB3708	275p	SAA7020	600p	STK2028	500p	STK5422	375p	STR3215	275p	TA7245	225p	TA7727P	125p
LA1267	150p	LA5700	300p	LC7351	200p	MB3712	600p	SAA7210P	1300p	STK2029	480p	STK5431	550p	STR3315	275p	TA7245BPO	200p	TA7750	200p
LA1354	225p	LA6339	35p	LC7364	200p	MB3713	130p	SAA7220PA	550p	STK2030	1000p	STK5434	570p	STR4090A	650p	TA7248P	575p	TA7757	200p
LA1363	90p	LA6355	50p	LC7432	425p	MB3714	225p	SAA7274P	600p	STK2038	700p	STK5436	500p	STR4142	450p	TA7250B	325p	TA7769	130p
LA1364	200p	LA6510	150p	LC7522	350p	MB3715	250p	SAA7280P	1450p	STK2048	950p	STK5441	400p	STR4211	315p	TA7251BP	325p	TA7772P	150p
LA1365	120p	LA6515	150p	LC7535	300p	MB3722	200p	SAA9050	450p	STK2058IV	1600p	STK5443	575p	STR4512	400p	TA7256P	225p	TA7784	250p
LA1368	220p	LA6520	175p	LC7537AN	400p	MB3730	900p	SAA9057	475p	STK2101	1050p	STK5446	350p	STR5015	500p	TA7259P	225p	TA7792P	250p
LA1369	200p	LA6531	250p	LC7537N	450p	MB3731	220p	SAB0600	600p	STK2110	550p	STK5451	390p	STR5100	550p	TA7262P	400p	TA7796P	75p
LA1385	170p	LA7007	400p	LC7560	750p	MB3732	240p	SAB0601	525p	STK2125	580p	STK5461	500p	STR5214	475p	TA7263P	325p	TA8101N	230p
LA1503	120p	LA7011	220p	LC7565	300p	MB3735	400p	SAB0602	625p	STK2129	750p	STK5462	500p	STR5315	575p	TA7265AP	300p	TA8105N	140p
LA1805	175p	LA7016	45p	LC7582E	300p	MB3756	160p	SAB1009BP	225p	STK2139	675p	STK5464	300p	STR5412	280p	TA7267	220p	TA8110AP	110p
LA1810	130p	LA7018	100p	LC7800	175p	MB3759	200p	SAB1016	600p	STK2155	900p	STK5466	500p	STR6020	270p	TA7267BP	120p	TA8119P	70p
LA1851	300p	LA7019	130p	LC7815H	175p	MB3771	110p	SAB1046P	350p	STK2230	470p	STK5467	400p	STR7001	600p	TA7269	260p	TA8122AN	250p
LA2000	150p	LA7033	400p	LC7818	280p	MB3773	110p	SAB2015P	525p	STK2240	740p	STK5468	300p	STR9005	400p	TA7270	170p	TA8127N	100p
LA2001	200p	LA7042	280p	LC7820	325p	MB8719	360p	SAB2016P	150p	STK2250	650p	STK5471	900p	STR9012	300p	TA7271	220p	TA8132AN	200p
LA2101	270p	LA7046	300p	LC7821N	250p	MC1391	120p	SAB2022P	525p	STK3041	370p	STK5472	375p	STR10006	450p	TA7272	260p		
LA2110	150p	LA7051	130p	LC7822N	160p	MC1455	45p	SAB3012	675p	STK3042	375p	STK5473	480p	STR11006	325p	TA7273	300p		
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	200p	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	300p	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	450p	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
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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	160p	2SK539	1100p
2SC1846	35p	2SC2347	35p	2SC2839	40p	2SC3352	200p	2SC3927	250p	2SD438	35p	2SD1010	40p	2SD1412	75p	2SD1879	275p	2SK544	30p
2SC1847	45p	2SC2353	120p	2SC2853	70p	2SC3353	280p	2SC3940	40p	2SD467	15p	2SD1012	40p	2SD1413	60p	2SD1880	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	2SJ48	425p
2SC1971	400p	2SC2534	150p	2SC3026	450p	2SC3468	70p	2SC4199	400p	2SD669	35p	2SD1159	65p	2SD1509	100p	2SD2151	175p	2SJ56	700p
2SC1972	600p	2SC2535	300p	2SC3030	300p	2SC3481	300p	2SC4204	60p	2SD673	350p	2SD1160	150p	2SD1511	75p	2SD2255	175p	2SJ74	60p
2SC1973	150p	2SC2538	100p	2SC3037	125p	2SC3482	275p	2SC4231	250p	2SD676	250p	2SD1163A	220p	2SD1519	250p	2SD2331	250p	2SJ76	220p
2SC1975	120p	2SC2540	1900p	2SC3038	125p	2SC3486	275p	2SC4235	300p	2SD717	180p	2SD1164	75p	2SD1521	70p	2SD2333	150p	2SJ77	350p
2SC1980	30p	2SC2542	300p	2SC3039	80p	2SC3502	50p	2SC4236	450p	2SD718	85p	2SD1168	270p	2SD1525	450p	2SD2340	225p	2SJ79	225p
2SC1983	75p	2SC2545	55p	2SC3040	260p	2SC3503	50p	2SC4237	500p	2SD722	240p	2SD1169	280p	2SD1526	100p	2SJ48	425p	2SJ103	75p
2SC1984	150p	2SC2546	25p	2SC3042	300p	2SC3504	120p	2SC4242	120p	2SD725	200p	2SD1173	350p	2SD1541	350p	2SJ56	700p	2SJ109	200p
2SC1985	100p	2SC2547	65p	2SC3052	30p	2SC3505	240p	2SC4278	175p	2SD726	275p	2SD1185	280p	2SD1545	275p	2SJ74	60p	2SJ113	1050p
2SC1986	100p	2SC2550	50p	2SC3057	150p	2SC3506	250p	2SC4288A	650p	2SD731	250p	2SD1186	400p	2SD1546	350p	2SJ76	220p	2SJ114	1150p
2SC2001	15p	2SC2551	70p	2SC3068	60p	2SC3507	650p	2SC4300	200p	2SD732	250p	2SD1189	55p	2SD1548	400p	2SJ77	350p	2SJ116	1200p
2SC2002	15p	2SC2552	60p	2SC3070	35p	2SC3509	750p	2SC4301	300p	2SD734	15p	2SD1191	120p	2SD1554	170p	2SJ79	225p	2SK903	500p
2SC2003	20p	2SC2553	200p	2SC3071	25p	2SC3514	170p	2SC4304	225p	2SD741	120p	2SD1192	90p	2SD1555	150p	2SJ103	75p	2SK904	500p
2SC2004	20p	2SC2555	120p	2SC3073	100p	2SC3518	120p	2SC4313	600p	2SD743	130p	2SD1196	150p	2SD1556	225p	2SJ109	200p	2SK951	275p
2SC2022	110p	2SC2562	90p	2SC3074	200p	2SC3519	250p	2SC4381	150p	2SD757	120p	2SD1197	150p	2SD1565	75p	2SJ113	1050p	2SK952	275p
2SC2023	180p	2SC2563	200p	2SC3075	150p	2SC3526	45p	2SC4382	200p	2SD760	70p	2SD1198	60p	2SD1571	170p	2SJ114	1150p	2SK955	450p
2SC2026	30p	2SC2568	120p	2SC3077	120p	2SC3528	750p	2SC4386	275p	2SD762	100p	2SD1207	40p	2SD1572	100p	2SJ116	1200p	2SK956	400p
2SC2027	200p	2SC2570	30p	2SC3086	150p	2SC3531	225p	2SC4387	425p	2SD763	140p	2SD1210	280p	2SD1575	200p	2SJ117	550p	2SK962	700p
2SC2036	50p	2SC2571	350p	2SC3089	130p	2SC3549	200p	2SC4408	50p	2SD768	180p	2SD1211	120p	2SD1576	150p	2SJ119	700p	2SK1023	550p
2SC2037	50p	2SC2577	110p	2SC3101	750p	2SC3552	270p	2SC4429	275p	2SD772	200p	2SD1213	220p	2SD1577	250p	2SJ162	680p	2SK1036	450p
2SC2053	120p	2SC2578	170p	2SC3112	35p	2SC3568	200p	2SC4431	90p	2SD773	20p	2SD1218	75p	2SD1579	80p	2SJ175	200p	2SK1057	600p
2SC2055	150p	2SC2579	110p	2SC3114	40p	2SC3577	275p	2SC4466	325p	2SD774	30p	2SD1223	75p	2SD1589	60p	2SJ182	150p	2SK1058	800p
2SC2058	20p	2SC2580	175p	2SC3116	75p	2SC3584	200p	2SC4467	175p	2SD777	400p	2SD1225	70p	2SD1590	100p	2SJ200	625p	2SK1081	700p
2SC2060	40p	2SC2581	225p	2SC3117	120p	2SC3591	200p	2SC4468	250p	2SD784	650p	2SD1227	40p	2SD1591	310p	2SJ307	175p	2SK1082	450p
2SC2061	75p	2SC2588	600p	2SC3122	50p	2SC3595	220p	2SC4517	200p	2SD786	100p	2SD1229	250p	2SD1593	125p	2SK19	45p	2SK1102	375p
2SC2068	60p	2SC2590	40p	2SC3148	145p	2SC3597	75p	2SC4517A	225p	2SD787	20p	2SD1237	300p	2SD1595	70p	2SK33	40p	2SK1117	250p
2SC2071	140p	2SC2591	50p	2SC3149	180p	2SC3599	140p	2SC4531	450p	2SD788	30p	2SD1238	300p	2SD1608	210p	2SK40	50p	2SK1118	225p
2SC2073	40p	2SC2592	200p	2SC3150	100p	2SC3600	175p	2SC4532	1000p	2SD789	20p	2SD1244	25p	2SD1609	45p	2SK55	100p	2SK1120	550p
2SC2075	60p	2SC2603	10p	2SC3151	175p	2SC3606	100p	2SC4542	400p	2SD792	400p	2SD1246	20p	2SD1632	320p	2SK68	100p	2SK1190	350p
2SC2078	95p	2SC2610	60p	2SC3152	130p	2SC3607	150p	2SC4742	275p	2SD794	33p	2SD1247	40p	2SD1637	50p	2SK73	75p	2SK1191	800p
2SC2085	100p	2SC2611	30p	2SC3153	175p	2SC3608	65p	2SC4744	350p	2SD795A	140p	2SD1251	180p	2SD1647	40p	2SK97	200p	2SK1217	700p
2SC2086	60p	2SC2621	70p	2SC3156	350p	2SC3616	45p	2SC4745	550p	2SD798	175p	2SD1254	55p	2SD1649	260p	2SK106	40p	2SK1221	200p
2SC2092	100p	2SC2625	190p	2SC3157	200p	2SC3636	280p	2SC4747	375p	2SD799	150p	2SD1263	90p	2SD1650	150p	2SK107	40p	2SK1275	275p
2SC2094	1200p	2SC2626	600p	2SC3158	260p	2SC3642	225p	2SC4757	200p	2SD809	45p	2SD1264	55p	2SD1651	150p	2SK109	150p	2SK1296	350p
2SC2097	2300p	2SC2630	1800p	2SC3159	200p	2SC3657	400p	2SC4762	300p	2SD811	450p	2SD1265	75p	2SD1656	250p	2SK117	50p	2SK1299	450p
2SC2099	2500p	2SC2631	20p	2SC3164	270p	2SC3659	600p	2SC4769	220p	2SD819	300p	2SD1266	180p	2SD1663	350p	2SK118	50p	2SK1317	900p
2SC2118	1100p	2SC2632	35p	2SC3169	150p	2SC3668	120p	2SC4770	250p	2SD820	250p	2SD1267	55p	2SD1666	50p	2SK125	100p	2SK1338	250p
2SC2120	10p	2SC2634	10p	2SC3170	300p	2SC3675	100p	2SC4820	225p	2SD821	550p	2SD1271	55p	2SD1667	120p	2SK133	650p	2SK1341	500p
2SC2122A	300p	2SC2636	40p	2SC3173	180p	2SC3678	280p	2SC4826	70p	2SD822	290p	2SD1271A	225p	2SD1668	90p	2SK147	160p	2SK1342	500p
2SC2131	550p	2SC2637	120p	2SC3175	150p	2SC3679	140p	2SC4891	800p	2SD826	30p	2SD1272	200p	2SD1669	85p	2SK152	40p	2SK1350	200p
2SC2141	60p	2SC2640	1800p	2SC3178	125p	2SC3680	380p	2SC4923	400p	2SD829	375p	2SD1273	50p	2SD1677	200p	2SK161	30p	2SK1356	225p
2SC2153	40p	2SC2653	100p	2SC3179	70p	2SC3685	450p	2SC4924	250p	2SD836	50p	2SD1274	80p	2SD1680	225p	2SK163	40p	2SK1357	350p
2SC2166	80p	2SC2654	180p	2SC3180	175p	2SC3687	300p	2SC4927	500p	2SD836A	50p	2SD1275	50p	2SD1683	45p	2SK168	40p	2SK1358	400p
2SC2168	120p	2SC2655	50p	2SC3181	200p	2SC3688	550p	2SC5002	300p	2SD837	55p	2SD1276	60p	2SD1684	70p	2SK170	50p	2SK1377	150p
2SC2188	70p	2SC2656	550p	2SC3182	120p	2SC3692	150p	2SC5003	350p	2SD838	500p	2SD1277	190p	2SD1706	325p	2SK184	35p	2SK1400	250p
2SC2200	250p	2SC2660	100p	2SC3198	30p	2SC3715	480p	2SC5027	100p	2SD841	110p	2SD1279	600p	2SD1707	400p	2SK192	45p	2SK1404	290p
2SC2209	50p	2SC2665	200p	2SC3199	40p	2SC3717	120p	2SC5048	300p	2SD844	200p	2SD1288	175p	2SD1708	375p	2SK193	40p	2SK1461	220p
2SC2216	50p	2SC2668	10p	2SC3202	25p	2SC3729	450p	2SC5044	250p	2SD850	170p	2SD1289	250p	2SD1710	200p	2SK195	150p	2SK1462	425p
2SC2221	650p	2SC2671	100p	2SC3209	120p	2SC3746	100p	2SC5086	250p	2SD856	48p	2SD1291	280p	2SD1718	275p	2SK197	140p	2SK1487	250p
2SC2228A	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	2SK1767	275p
2SC2236	20p	2SC2705	40p	2SC3244	45p	2SC3783	300p	2SD198	140p	2SD867	350p	2SD1308	80p	2SD1748	90p	2SK241	30p	2SK2038	295p
2SC2237	540p	2SC2706	250p	2SC3246	50p	2SC3787	100p	2SD199	195p	2SD868	260p	2SD1309	140p	2SD1756	275p	2SK246	30p	2SK2039	750p
2SC2238	45p	2SC2710	50p	2SC3259	350p	2SC3788	60p	2SD200	180p	2SD869	150p	2SD1310	140p	2SD1758	60p	2SK300	25p	2SK2134	225p
2SC2240	15p	2SC2712	20p	2SC3260	220p	2SC3789	75p	2SD201	260p	2SD870	140p	2SD1311	65p	2SD1760	80p	2SK301	40p		
2SC2258	30p	2SC2714	20p	2SC3261	230p	2SC3790	120p	2SD213	250p	2SD871	260p	2SD1313	1000p	2SD1761	60p	2SK303	40p		
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	1100p
GHV1295, 1296, 1891, 8210, 8215, 1221, 1240, 1241, 1247, 1248, 2145	1100p
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
HRD154, 170, 171, 210, 211, 217, 310, 320, 321, 350, 521, 522, 525, 526.	
HRD527, 540, 550, 560, 590, 770, HRDX20, HRDX22, 8950, 8951,	
3V64, 3V65, FV10, 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, HS820	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
NVSD40	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, 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, VCA48	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, 9310,	
DD8900, DD8904, TVR4	100p
TX3650, UF20, 22 24, VCR3000, 3002, 4000, 9500	75p
VS1004	105p
BLAUPUNKT	
RTV100	200p
RTV200, RTV222, RTV224	90p
RTV202, RTX200	150p
RTV322, RTV248	100p
RTV306, 307, 309, 310, 311, 312, 328, 414, 434, 444, 707	135p
RTV211, RTV214	140p
RTV324, RTV32565p	
RTV315, RTV316, RTV319, RTV320, RTV317	50p
RTV301, RTV333, RTV338, RTV404, RTV424	85p
FERGUSON	
3292, 3V00, 3V01, 3V16, 3v22, 8900, 8901, 8902, 8903, 8904,	
8906, 8909, 8912, 8922	120p
3V23, 8923, 8924, 8929	50p
3V29, 3V30, 8930, 8931, 8933, 8940	65p
3V31, 3V32, 8941, 8942	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
FVHD220, 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, 211, 217, 230, 300, 320, 321, 330, 337, HRD350, 370, 400, 430, 440, 441, 500, 530, 700, 750,950,	
HRS5000, 5500, 8000, 9000, BR9060, BRS600, 605, 920, 925	45p
HRD227, 520, 52 1, 522, 527, 600, 610, 620, 637, 641, 650, 830,	
HRD840, HRDX20, 22, HRJ200, 205, 300, 305, SR330, HRS10	125p
HRD840, 550, 560, 580, 590, 640, 660, 670, 720, 730, 740, 770, HRD820, 860, 870, 880, 910, 960, 980, HRDX20, 25, HRJ2 10,	
HRJ215, 315, 316, 318, 400, 405, 407, 410, 411, 415, 416, 507, HRJ6 10, 615, 715, 97,	
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, VR30DV2, 35BO2, 35BO3, 635B7, 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, 7530, 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	
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, VC5100,	
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
VCPB1E	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	**Price:**
Goldstar	VXP0521	IT17		PU55373	IT09		VXP0521	IT17	**20p each**
Hitachi	6861471	IT03		PU55374	IT10		VXP0581	IT18	**16p each pack of 5**
	6861482	IT04	**National**	VXP0329	IT11	**Sanyo**	1430662T15620	IT19	**13p each pack of 10**
	6886971	IT05	**Panasonic**	VXP0343	IT12	**Sharp**	NIDL0005GEZZ	IT20	
JVC	PU48697B	IT06		VXP0344	IT13		NIDL0006GEZZ	IT21	***Packs are for each model***
				VXP0401	IT14		NPLY0107GEZZ	IT22	

PINCH ROLLERS

Model	Price
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	
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	
DD8900, 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, SVO140, 160	1250p
PINCH ROLLER ASSEMBLY PART NO: X37277701	
SLV210, 212, 270, 273, 275, 285, 300, 310, 335, 425, 427	350p
PINCH ROLLER ASSEMBLY	
SV6700.8750, 9700, VHR3100, 3200, 3300, 3310, 3400, 3700, 3800, VHRD500, 700	1350p
PINCH ROLLER ASSEMBLY	
SL100, 200, SLC20, 30, 33, 34, 40, 44, 80, 88, 9, SLF1, 20, 25, 30, 35, 45, SLF60, 65, 73, 90, SLHF100, 150, 950, SLK85, 95, SLO1700, SLS550, SLT0, 30, 50	300p
PINCH ROLLER ASSEMBLY	

VIDEO LAMPS

Models & Description	Order Code	Price
UNIVERSAL VIDEO LAMP 9V 80mV (310mm WIRES)	VL01	25p
PANASONIC VIDEO LAMPS	VL02	30p
SHARP VIDEO LAMPS	VL02	30p
HITACHI 5381682 (VT63, VT64) VIDEO LAMPS	VL04	135p
AKAI (VS10),GRANADA (VHSXJ3), TT (VR3993,3994), JVC (HR2650, 7600, 7610, 7650, 7655), TELEFUNKEN (VR530, 535, 539, 550, 630, 650), THOMSON (V309, 316, 357, VK309, 411,TX8000), FERGUSON (3V31, 8941, 8942)	VL06	40p

Models & Description	Order Code	Price
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

Models & Description	Order Code	Price
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

Models & Description	Order Code	Price
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

HRO170/180/210/230/300/320/370/400/430/530/700/750

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/HRO140/150/158/160

HRO250/257/565/566/755

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** £3.00

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

VT100/110/111/113/115/118/120/125/128/130/135/138/145/159/175/220/225/250/255/258/260/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 RDLLER 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, HRO230, 430, 530	CH03	2800p
	3V58, 3V59, 3V64, 3V65, FV11R, 8950, 8951, HRD170, HRO180, 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 to approx. 474 pages in size.
Price: 1650p only – no VAT (+ £2 Postage)
Order Code: BOOK02

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A comprehensive guide to receiver reviewing, featuring stock faults and installation tips.
Price £15.00 Only No VAT Postage 100p
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SEMICONDUCTOR COMPARISONS 1999
With over 650 pages listing more than 34,200 Semiconductors with suitable alternatives complete with descriptions and base information.
Price: 1900p only – No VAT (+ £2 Postage).
Order Code: BOOK04

SEMICONDUCTOR COMPARISONS 1999
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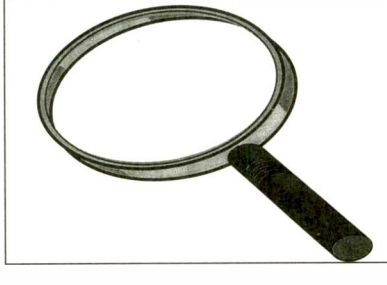

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CXAP1, CXL7, CXL8G, CXLC50P, CXZ58, DXM740, DXM75, DXM76, DXM77, LCX50, LCX7, LCX8G, LCXAP1, XC002, XC004, XC005, XC777	KSS210B	2000p
XP31, XP33, XP55, XP80G	KS220A	2500p
XP6,XP7	KSS331A	3400p
AKAI		
CD73, DC93	KSS151A	1900p
CD25, CD26, CD27, CD32, CD36, CD37, CD52, CD55, CD57, CD650, CD670, CD69, CD750, CD79, CDM480, CDM600, CDM670, CDEM770, CDM959, MX550, MX570, MX650, MX670, MX750, MX950	KSS210A	1300p
DENON		
DCD1500II, DCD1520, DCDE3520	KSS151A	1900p
DCD1400, DCD600, DCD800	KS152A	1600p
DCD1420, DCD520, DCD610, DCD620, DCD660, DCD810, DCD820, DCD860, DCD910, DCD920	KSS210A	1300p
DCD1015, DCD1290, DCD2060, DCD2060G, DCD315, DCD480, DCD580, DCD615, DCD715, DCD825, DCD890, DCD895, DN2000F	KSS240A	2000p
GOLDSTAR		
CD952A, CD952AJ, CD952LJ, CD952SJ, FFH101KL, FFH101WL, FFH222A/L, FFH272L, FFH333L, FFH373K, FJ606, FR606L	KSS210A	1300p
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CDP65	KSS331A	3400p
CD905	OPTIMA5	1600p
HITACHI		
DAW560	HOPM3	2150p
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AXC10	KSS210B	2000p
J.V.C.		
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CDRADIO CASSETTE, MINI SYSTEMS – MODELS 1990-1992	OPTIMA4S	5000p
CA-C33, CA-MX30BK, CA-MX33BK, UX-A5, UX-A6, XL-M309, XL-M403BK, XL-M408, XL-M409, XL-M504BK, XL-M505TN, XL-M508, XL-M509, XL-M705TN, XL-V131BK, XL-V151TN, XL-V221BK, XL-V241TN, XL-242BK, XL-V251TN, XL-V252BK, XL-Z1050TN, XL-Z551TN, XL-Z552BK	OPTIMA5	1600p
1994 ONWARDS – CAE48BK, CAMCG7, CAMXG9, CAS20BK, CAS30BK, VAS50, CAS60RBK, MXS20, MXS30, MXS60, PCX105, PCX130, PCX95, RCX230, RCX320, RCX520, RCX620, RCX720, UXA4, UXA5, UXA55, UXC7, UXT1, UXT3, XLF115, XLF116, XLF215, XLF216, XLMC100/M, XLMXG7, XLMXG9, XLV163TN, XLV164BK, XLV174, XLV263TN, XLV264BK, XLV274BK, XLZ463TN, XLZ464BK, XLZ574, XLZ674, XTMXG7, XTMXG9, XTS60	OPTIMA6S	1600p
KENWOOD		
DP47, DP660SG, DP8020, DP87, L1000D	KSS152A	1600p
DP1030, DP1510, DP2010, DP2030, DP3010, DP3030, DP3050, DP4030, DP491, DP5010, DP5030, DP5040, DP520, DP7030, DP7040, DP7050, DP730, DP920, DP930, DP950, DPM650,DPM6630, DPM7730, DPM850, DPM991, DX6620, M225, M25, M450, M850, PD3030, PDM991, RDX25, RXDC3, RXDC3L, UD202, UD302	KSS210A	1300p
DPC42, DPC72, DPC77, DPC80, DPC92	KSS220A	2500p
DP1050, DP2050, DP3060, DP501, DP5060, DP722, DP76, DP85, DP89, M77A, PD3060, UD502, UD70, UD701, UD90, XE5	KSS240A	2000p
DPC321, DPC521, DPC531, DPC631K, DPC721, DPC731	KSS331A	3400p
DP1060, DP2060. PART No: RCTRH8136AFZZ	RH8136A	4500p
PANASONIC		
SLP177A, SLP202A, SLP212A, SLP222A, SLP277A, SLP377A, SLP477AK, SLP477A, SLPG100A, SLPG200A, SLPG400A, SLPG500AK, SLPG500AS, SLPJ24A, SLPJ26A, SLPJ27A, SLPJ28A, SLPJ325A, SLPJ325A, SLPJ37A, SLPJ38A, SLPJ46A	691-30209	5500p
SAD30, SLCH9, SLP150, SLP170, SLP200, SLP202, SLP222, SLP230, SLP250, SLP333, SLP370G, SLP400C, SLP555, SLP777, SLP999, SLPA10, SLPC20, SLPC25, SLPJ25, SLPJ26, SLPJ27, SLPJ37, SLPJ45, SLPK25, SLPK26, SLPS50, SLPS70, SLPS700, SLPS840, SLPS900	SOAAD70A	2350p
PHILIPS		
AZ8304, CD070, CD080, 690, 910, 920. PART NO. 4822-691-20768	4822-691	3100p
CD100, CD130, CD1380, CD1482, CD200, CD204, CD210, CD300, CD303, CD304, CD380, CD480, CD482, CD500, CD502, CD582, CD583, CD584, CD610, CD620, CD630, CD780, CD781, CD782, CD840, CD883, CD960, CDF104, CDM4/19, FCD185	691-30209	5500p
AS440, AS445, AS540, AS640, AZ8048, AZ8640, CD070, CD080, CD091, CD163, CD165, CD690, CD710, CD720, CD732, CD740, CD750, CD910, CD920, CD935, FW17, FW21, FW26, FW330, FW36, FW360, FW380I, FW40, FW41, FW46, FW56, FW66, FW68	CDM12.1	1800p
CD1210/40	CDM12.4	2200p
AZ8006	KSS210B	2000p
FW11	OPTIMA6S	1600p
PIONEER		
PDM400, PDM410, PDM500, PDM510, PDM600, PDM610, PDM700, PDM710, PDM730, PDT303, PDT403, PDT503, PDX940M, PDX950M. PDZ560T, PDZ72T, PDZ73T, PDZ81M, PDZ82M, PDZ83M, PDZ960M, XDZ53T, XDZ54T	KSS151A	1900p
N32, N90M, ,PD101, PD201, PD32, PD41, PD4500, PD4700, PD52PD5700, PD65,I PD6500, PD6700, PD7700, PD8700, PD970, PDCP420, PDCP520M, PDCP520T, PDJ400T, PDJ500T, PDJ800M, PDJ900M, PDM430, PDM450, PDM550, PDM630, PDM650, PDM750, PDM901, PDP710T, PDP720T, PDP910M. PDP920M, PDS501, PDS601, PDS701, PDS701G, PDS901, PDT310, PDT510, PDZ, PDZ570T, PDZ74T, PDZ84M, PDZ970M, PXA1349, S125CDT, S135CDT, S303CDM, S303CDT, S505DM, S505DT, S707DM, S707DTM, S909DM, S990DT, XCP410M, XCP410T, XDZ54T, XDZ55T, XDZ64M, XDZ84T, XRP310, XRP320	PEA1030	4400p
PDM400, PDM410, PDM500, PDM510, PDM600, PDM610, PDM700, PDM710, PDM730, PDT303, PDT403, PDT503, PDX940M, PDX950M, PDZ560T, PDZ72T, PDZ73T, PDZ81M, PDZ82M, PDZ83M, PDZ960M, XDZ53T, XDZ54T, XDZ55T, XDZ62, XDZ62M, XDZ630, XRZ82	PWY1009	4800p
SAMSUNG		
CD20	HOPM3	2150p
CD1200, CD1310, SCM-6000, SCM6900	KSS210A	1300p
RCD1200, RCD1300, RCD1350, RCD1600, RCD2600, RCD990, RCD995, SCM6900	SOH90T4N	3600p
SANYO		
DCFS3, DCT55, DCX502, DCX701, DCX702, DCX802, DCX891, DCX891N, MCDZ10. PART No. 6142186855	614218	2300p
DCFS5, MCD450K, 660K, MCDZ30L, 60F. PART No. 6142205006	614220	5600p
DCX1000MD, DCX1003, DCX900MD, DCX903, DCX915	KSS210A	1300p
DCD10, DCD11U, DCD20, DCD30, DCD30AT, DCD6, DCD8U, DCMS1, DCX110, DCX120, DCX210, DCX220, DCX993, DCX994, MCDMS40L, MCDMS50L, MCDMS660L, MCDZ1L, MCDZ2L, MCDZ3L. PART No. 6142391303	614239	3300p
DCD12. PART No. 6450055966	645005	3700p
MCDZ31L, MCDZ41L, MCDZ61L, MCDZ71L	KSS210B	2000p
SHARP		
CD-111, CD-301, CD-302, CD-304, CD-310, CD-C3, CD-L700, CD-L800, CD-U1, CD-U10, CD-X10, CD-X12, CD X15, CD-X16, CD-X17, CD-X20, CD-X9, CKL650, CMS95CD, DX-150, DX-160, DX-450, DX-460, DX-461, DX-650, DX-660, DX-999, DX-A3, DX-N45, DX-R554, DX-R7, DX-R75, DX-R750, DX-R77, DX-R770, DX-R820, DX-R840, DX-Z100, DX-Z1000, DX-Z1500, GFCD55, QT-30CD, QT-33CD, QT-350CD, QT-37CD, QT-38CD, QT-CD20, QT-CD33, RS95, SC-77CD, SC-99CD, SC-RS95, SG-A1, SG-W1CD, SG-W2CD, SYS302, ZCD7CD. PART No. RCTRH8122AFZZ	RH8122A	5750p
QT-50CD, QT-60CD, QT80CD. PART No. RCTRH8124AFZZ	RH8124AF	2900p
DXR-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
TECHNICS		
SLP200, SLP230, SLP250, SLP333, SLP555, SLP777, SLP999,SLPA10, SLPC20, SLPJ25, SLPJ45, SLPS700, SLPS900	SOAD70A	2350p

REMOTE CONTROLS

Description	Code	Price
AKAI		
RC-V10A	RC876	650p
RCV 37 B	RC891	650p
V25A	RC896	650p
DECCA		
RC70	RC894	650p
FISHER		
RC905B	RC879	650p
GRANADA		
UNIVERSAL TEXT	RC309	650p
MK4 TEXT, 70155G, 70115G, 70133G	RC880	650p
95288E	RC882	650p
944900	RC884	650p
GRUNDIG		
TP160E	RC107	650p
TP200, TP300	RC380	650p
TP400	RC401	600p
TP590-600	RC600	650p
TP390, TP610	RC610	650p
TP621	RC612	650p
TP630, TP650	RC650	650p
TP666	RC660	650p
TP661	RC661	650p
HITACHI		
CLE800-CLE830	RC140	650p
A617402/655602	RC1920	650p
A512120/230	RC900	650p
A514790	RC901	650p
A5088470	RC902	650p
A518612	RC903	650p
SCL002	RC904	650p
C2096	RC905	650p
A511940	RC906	650p
655602H	RC1920	650p
ITT		
IFB13, 14, 15	RC143	650p
FS4	RC148	650p
RG305	RC305	650p
RG306	RC306	650p
FS9/1-10/1	RC307	650p
VS5 RUK	RC308	650p
VS4-1	RC308	650p
MULTICONTROL (17C20)	RC311	650p
LDEWE		
DC11	RC146	650p
MATSUI		
010270601	RC889	650p
VX770	RC892	650p
NOKIA		
SATELLITE	RC550	650p
ORION		
RC53	RC892	650p
PANASONIC		
EUR51200	RC200	650p
TC2200	RC204	650p
VSQ0357/NV730	RC202	650p
TNQ1621	RC203	650p
PHILIPS		
RC5002,5154	RC134	650p
KT3 NON TEXT	RC135	650p
69117032	RC178	650p
69117194	RC180	650p
RC5991-UNIV	RC300	550p
RC38	RC301	650p
KT3 TEXT	RC5301	650p
RC5352	RC5352	650p
RC5375	RC5375	650p
RC5 STANDARD	RC300	550p
RC5903	RC5903	650p
SALORA		
SERIES L	RC190	650p
86173	RC882	650p
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RC218, RC222, RC228, RC238	RC140	650p
JXGE	RC878	650p
JXDE	RC884	650p
VHR2300	RC890	650p
RC628	RC865	650p
SHARP		
G0121CESA, 123CESA, 204, 251	RC140	650p
SONY		
RM604, RM605, RM606	RC140	650p
32 CHANNEL	RC140	650p
RM613	RC141	650p
RM632, RM636	RC160	600p
TATUNG		
FXA	RC877	650p
RC70	RC883	650p
FX70 FASTTEXT	RC894	650p
TELEFUNKEN		
FB632	RC632ST	650p
FB639	RC639	650p
THORN/FERGUSON		
3V35-42	RC342	600p
3V31-32	RC344	650p
3V57-58	RC628	650p
TX10 TEXT	RC732	575p
TX10 STEREO TEXT	RC738	575p
TC9-90-100	RC740	600p
3V55, FV11	RC783	650p
TX100 FASTTEXT	RC789	650p
TX100 ST, FASTTEXT	RC789	650p
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101-220005-03A	LOT72	1600p
D 050/37	LOT27	1450p
D 053/37	LOT207	1550p
D 056/37	LOT56	1650p
D 059/37	LOT200	1400p
D 069/37	LOT56	1650p
FCM 2015 AL	LOT78	1500p
FERGUSON		
00 D-3-508-001	LOT38	1250p
00 D-3-508-002	LOT38	1250p
00 D-3-508-003	LOT276	1400p
00 D-3-515-001 PL1	LOT276	1400p
00 D-4-208-001	LOT79	1600p
00 D-4-208-002	LOT79	1600p
00 D-4-235-002	LOT240	1250p
00 D-4-235-002 HTI	LOT81	1350p
00 D-4-235-00201G	LOT81	1350p
00 D-4-260-004 HTI	LOT38	1250p
00 H-0-701-2400	LOT182	1450p
06 D-3-083-001	LOT82	1250p
06 D-3-083-002	LOT82	1250p
06 D-3-084-001	LOT23	1400p
06 D-3-087-001	LOT23	1400p
06 D-3-088-001	LOT84	1450p
06 D-3-093-001	LOT204	1600p
06 D-3-095-001	LOT87	1000p
06 D-3-095-002	LOT87	1000p
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FETX 100 90 DEG	LOT04	1500p
FETX 90 WHITE	LOT06	1650p
FETX 100 100 DEG	LOT34	1500p
GRUNDIG		
29201.008.01	LOT153	1750p
29201.014.01	LOT140	1500p
29201.015.01	LOT149	1400p
29201.017.01	LOT60	1250p
29201.018.01	LOT163	1300p
29201.018.02	LOT61	1700p
29201.019.01	LOT62	1250p
29201.019.02	LOT62	1250p
29201.022.01	LOT63	1700p
29201.022.02	LOT166	1600p
29201.022.03	LOT165	1350p
29201.022.04	LOT165	1350p
29201.022.04A	LOT165	1350p
29201.024.01	LOT65	1500p
29201.024.04	LOT164	1400p
HINARI		
154 138 K	LOT24	1500p
51 13914 1	LOT24	1500p
51 14184 1	LOT24	1500p
CF 44 A	LOT24	1500p
HM51-1411834-1	LOT24	1500p
HITACHI		
2424593	LOT44	1050p
2432101	LOT79	1600p
2432461	LOT169	1500p
2432611	LOT80	1800p
2432651	LOT80	1800p
2432761	LOT169	1500p
2432981	LOT37	1200p
2432981	LOT37	1200p
2432982	LOT37	1200p
2433011	LOT171	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
PHILIPS		
4822 140 10142	LOT142	1800p
4822 140 101145	LOT134	1450p
4822 140 10146	LOT112	1700p
4822 140 10151	LOT102	1700p
4822 140 10161	LOT103	1250p
4822 140 10171	LOT104	1500p
4822 140 10176	LOT114	1150p
4822 140 10194	LOT105	1500p
4822 140 10198	LOT116	1600p
4822 140 10201	LOT104	1500p
4822 140 10236	LOT118	1550p
4822 140 10246	LOT111	1500p
4822 140 10247	LOT105	1500p
4822 140 10254	LOT107	1450p
4822 140 10263	LOT117	1550p
4822 140 10269	LOT210	1350p
4822 140 10271	LOT208	1650p
4822 140 10274	LOT123	1450p
4822 140 10282	LOT122	1300p
4822 140 10283	LOT104	1500p
4822 140 10294	LOT125	2150p
4822 140 10306	LOT110	1200p
4822 140 10325	LOT132	1500p
4822 140 10326	LOT122	1300p
4822 140 10328	LOT124	1450p
4822 140 10349	LOT106	1250p
4822 140 10353	LOT284	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
SONY		
3753100	LOT275	1500p
1-439-243-00	LOT91	1600p
1-439-243-11	LOT91	1600p
1-439-243-12	LOT91	1600p
1-439-243-31	LOT229	1700p
1-439-243-32	LOT229	1700p
1-439-243-41	LOT229	1700p
1-439-244-00	LOT48	1600p
1-439-244-11	LOT48	1600p
1-439-244-21	LOT48	1600p
1-439-244-31	LOT48	1600p
1-439-256-00	LOT45	1650p
1-439-256-11	LOT45	1650p
1-439--256-21	LOT45	1650p
1-439-256-22	LOT45	1650p
1-439-276-21	LOT230	1700p
1-439-280-00	LOT92	1600p
1-439-280-13	LOT92	1600p
1-439-286-00	LOT46	1300p
1-439-286-11	LOT46	1300p
1-439-286-12	LOT46	1300p
1-439-286-13	LOT46	1300p
1-439-286-21	LOT46	1300p
1-439-288-00	LOT228	1750p
1-439-288-12	LOT228	1750p
1-439-289-00	LOT47	1400p
1-439-289-21	LOT47	1400p
1-439-289-22	LOT47	1400p
1-439-289-31	LOT47	1400p
1-439-294-00	LOT93	1450p
1-439-294-11	LOT93	1450p
1-439-294-21	LOT269	1550p
1-439-303-00	LOT94	1300p
1-439-303-11	LOT94	1300p
1-439-303-31	LOT94	1300p
1-439-303-32	LOT94	1300p
1-439-311-00	LOT95	1550p
1-439-311-11	LOT95	1550p
1-439-311-13	LOT95	1550p
1-439-311-31	LOT95	1550p
1-439-311-32	LOT95	1550p
1-439-331-22	LOT96	1550p
1-439-331-41	LOT98	1550p
1-439-332-00	LOT99	1600p
1-439-332-11	LOT99	1600p
1-439-332-21	LOT99	1600p
1-439-332-41	LOT100	1500p
1-439-332-42	LOT101	1450p
1-439-332-52	LOT100	1500p
1-439-333-00	LOT270	1550p
1-439-333-11	LOT270	1550p
1-439-333-12	LOT270	1550p
1-439-363-11	LOT268	1400p
1-439-363-21	LOT268	1400p
1-439-387-11	LOT311	1450p
1-439-387-21	LOT311	1450p
1-439-416-11	LOT255	1600p
1-439-416-12	LOT255	1600p
1-439-416-21	LOT255	1600p
1-439-416-23	LOT255	1600p
1-439-416-41	LOT255	1600p
1-439-416-51	LOT255	1600p
1-439-430-21	LOT271	1550p
154125A	LOT275	1550p
TOSHIBA		
37010	LOT131	1450p
37011	LOT131	1450p
37012	LOT131	1450p
37013	LOT131	1450p
37014	LOT131	1450p
37015	LOT131	1450p
37016	LOT131	1450p
37017	LOT131	1450p
37018	LOT131	1450p
37019	LOT131	1450p
1810951	LOT55	1400p
2433751	LOT01	1300p
2433752	LOT250	1350p
23236023	LOT281	1300p
23236052	LOT131	1450p
23236098	LOT288	1400p
23236198	LOT288	1400p
23236255	LOT289	1500p
23236424	LOT129	1400p
23236425	LOT288	1400p
23236428	LOT289	1500p
3122113837011	LOT131	1450p
150F6D	LOT131	1450p
TFB 4039 AD	LOT293	1550p
TFB 4048 AD	LOT281	1300p
TFB 4048 BD	LOT281	1300p

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Sony	RCUNI02	Samsung	RCUNI07
Philips	RCUNI03	Toshiba	RCUNI08
Hitachi	RCUNI04	Ferguson	RCUNI09
Mitsubishi	RCUNI05	Grundig	RCUNI10

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UNIVERSAL REPLACEMENT SATELLITE REMOTE CONTROL
This unique remote control covers 11 brands including
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New Arrivals!!

FAST BLOW

RATING	ORDER CODE	PRICE
0.04A	FUSE53	60p
0.05A	FUSE54	35p
0.063A	FUSE55	35p
0.08A	FUSE56	35p
0.1A	FUSE57	30p
0.125A	FUSE58	30p
0.16A	FUSE59	30p
0.2A	FUSE60	30p
0.25A	FUSE61	30p
0.315A	FUSE62	30p
0.4A	FUSE63	30p
0.5A	FUSE64	30p
0.63A	FUSE65	30p
0.8A	FUSE66	30p
1A	FUSE67	30p
1.25A	FUSE68	30p
1.6A	FUSE69	30p
2A	FUSE70	30p
2.5A	FUSE71	30p
3.15A	FUSE72	30p
4A	FUSE73	30p

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This Kit consists of Assorted Wickman Fuses
both Slow & Fast Blow:
17 Different Types
10 of Each Type
170 Fuses in Total
Packed in a Plastic Storage Box
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RATING	ORDER CODE	PRICE
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0.063A	FUSE75	65p
0.08A	FUSE76	65p
0.1A	FUSE77	35p
0.125A	FUSE78	35p
0.16A	FUSE79	35p
0.2A	FUSE80	30p
0.25A	FUSE81	30p
0.315A	FUSE82	30p
0.4A	FUSE83	30p
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
4A	FUSE93	30p
5A	FUSE94	30p

★★★ PLEASE NOTE THAT ALL WICKMAN FUSE PRICES ARE FOR A QUANTITY OF 1 (ONE) – (EXCEPT FOR KIT) ★★★

HIGH VOLTAGE CERAMIC CAPACITORS

VALUE	VOLTAGE	ORDER CODE	PRICE	VALUE	VOLTAGE	ORDER CODE	PRICE
220 pF	2000v	CAP01	90p	1200 pF	3000v	CAP08	225p
330 pF	2000v	CAP02	90p	1500 pF	2000v	CAP09	130p
470 pF	2000v	CAP03	90p	1500 pF	3000v	CAP10	225p
680 pF	2000v	CAP04	95p	2200 pF	2000v	CAP11	130p
820 pF	3000v	CAP05	150p	3300 pF	2000v	CAP12	145p
1000 pF	2000v	CAP06	110p	4700 pF	2000v	CAP13	180p
1000 pF	3000v	CAP07	225p				

SMD ELECTROLYTIC 105° CAPACITORS

VALUE	VOLTAGE	ORDER CODE	PRICE	VALUE	VOLTAGE	ORDER CODE	PRICE
22 µF	6.3v	CAP14	110p	100 µF	25v	CAP22	300p
47 µF	6.3v	CAP15	110p	1 µF	50v	CAP23	110p
100 µF	6.3v	CAP16	130p	2.2 µF	50v	CAP24	110p
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
470 µF	16v	CAP20	320p	47 µF	50v	CAP28	300p
33 µF	25v	CAP21	130p				

★★★ PLEASE NOTE THAT ALL THE ABOVE CAPACITOR PRICES ARE FOR A PACKET OF 5 (FIVE) ★★★

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MITSUBISHI 21" & 25" TV's

To replace the TDA8178S fitted to the following MITSUBISHI 21" & 25" TV's:
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CT25A4STX, CT25A6TX, CT25B2STX, CT25B3STX

It comes with clear and concise instruction on how to carry out the work.

ORDER CODE: MITSKIT1
PRICE: 300p

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SUITABLE FOR
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Suitable for Samsung Winner 1 Chassis

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See Page 344 or more new arrivals

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PINCH ROLLER ASSEMBLY 948D020010
SUITABLE FOR:
AIWA
MITSUBISHI
ORDER CODE: PR205
PRICE: 750p

PINCH ROLLER ASSEMBLY X37277701
SUITABLE FOR:
SONY
SLV215, SLV216EE, SLV275, SLV282, SLV315, SLV325 etc
ORDER CODE: PR207
PRICE: 550p

PINCH ROLLER ASSEMBLY VXL 1858
SUITABLE FOR:
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PRICE: 300p

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PREPROGRAMMED TO COVER ALL MAJOR BRANDS OF TVS, VIDEOS, SATELLITES AND CD PLAYERS.

REPLACES UPTO 8 DIFFERENT REMOTE CONTROLS.

WITH TELETEXT & FASTEXT FUNCTIONS.

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FEATURES:
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- AUTO POWER OFF (APPROX 15 min)
- DIODE TEST FUNCTION
- ALL RANGES OVERLOAD PROTECTED
- SUPPLIED WITH TEST PROBES
- DC VOLTAGE: 200mV/2V/20V/200V/700V ACCURACY * 0.5%
- AC VOLTAGE: 200mV/2V/20V/200V/700V
- DC CURRENT A: 200µA/20mA/200mA/2A/20A
- AC CURRENT A: 200µA/20mA/200mA/2A/20A
- RESISTANCE Ω: 200Ω/2kΩ/200kΩ/2MΩ/20MΩ

ORDER CODE: CM3900A
PRICE: 2900p

CM3230 DIGITAL CAPACITANCE METER

FEATURES:
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- MAXIMUM READING 1999
- CAPACITANCE 9 RANGES FROM 200pF 20000*F
- MEASURING FROM 1pF-20000*F
- SINGLE MANUAL ROTARY SWITCH FOR FUNCTION AND RANGE OPERATION
- ZERO ADJUST KNOB

ORDER CODE: CM3230
PRICE: 3950p

CM3920 DIGITALMETER WITH TEMPERATURE MEASUREMENT

FEATURES:
- TEMPERATURE MEASUREMENT
- DIODE & TRANSISTOR HFE TEST
- LARGE LCD DISPLAY HEIGHT 18mm
- MAXIMUM READING 1999 + UNIT
- SINGLE MANUAL ROTARY SWITCH FOR FUNCTION AND RANGE OPERATION
- AUTO POWER OFF (APPROX 15 min)
- DIODE TEST FUNCTION
- ALL RANGES OVERLOAD PROTECTED
- SUPPLIED WITH TEST PROBES
- DC VOLTAGE: 200mV/2V/20V/200V/1000V ACCURACY * 0.5%
- 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
- CAPACITANCE: 2nF/20nF/200nF/2*F/20*F

ORDER CODE: CM3920
PRICE: 4100p

★★★ PLEASE NOTE THAT POSTAGE ON ALL THE ABOVE METERS IS CHARGED AT £3 ★★★

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: Teletext panel for the Beko 19321N TV series (AT-3 Siesta chassis). Need not be working but must be a complete PCB, preferably with plastic caddy and ribbon cable. Julian Salt. Phone 0958 559 970.

Wanted: Audio/control head and circuit diagram for the Fisher FVH-P716 VCR. Reg Oliver, 18B Rostrevor Road, Fulham, London SW6 5AD. 0171 731 5673.

Wanted: Power supply circuit diagram (photocopy OK) for the Panasonic NVJ30B VCR, with IC1102 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 5574.

Wanted: Scan coils for the Philips KT3 chassis. Robert J. Evans, Cemlyn, Nefyn, Pwllheli, Gwynedd LL53 6EG. 01758 720 748.

Wanted: LOPT type TBC70III for the Rigonda Fiesta 5·5in. mono portable. L. Symons, 14 Maidenwell Road, Plymouth, Devon PL7 1RB. 01752 343 074.

For disposal: Free low-band U-matics. Two JVCs with edit controller, one Sony with a few tapes. Probably working. Can deliver within a reasonable distance of Epsom. K.G. Palmer, 127 Ewell Bypass, Ewell, Surrey KT17 2PX. 0181 393 7442.

Wanted: Various parts for the reconstruction of a vandalised B&O 3802 TV set (3500 chassis): signals panels for left-hand 'door', 22in. tube (Mullard A56-510X?) and an ultrasonic RC handset. Also require Y-gain knob for the Tektronix T912 scope. David Barfoot, 65 Nortoft Road, Bournemouth BH8 8QB. 01202 291 698, fax 01202 467 327. E-mail david@einstein.demon.co.uk

Wanted: Service manuals for the Panasonic NV688 and Hitachi VT8300 VCRs, and for the Tatung 165 and Hitachi NP84 II TV chassis. Would copy and return by recorded delivery, or buy if inexpensive. Also *Television* back issues from 1975-85. Nicholas Arnold, 5 Vidler's Court, The Strand, Rye, E. Sussex TN31 7DB. 01797 225 747.

Wanted: Philips V2000 series VCRs, any model, preferably working but anything considered. Also N1500 or N1700 VCRs, dead or alive. Graham Bisset, 68 Ashwood Crescent, Bridge of Don, Aberdeen AB22 8XF. 01224 703 312.

Wanted: Connector WP01 with attached ribbon cable (on head preamplifier PCB), or complete PCB, for the Akai VS765EK. Also a capstan motor and BAA6871S drive/servo IC for the Panasonic NVHD90 (K mechanism). Kenneth G. Cargill, 1 Stradowen Drive, Strathfoyle, Londonderry BT47 6XN. 01504 861 268.

Wanted: Replacement or working original remote control unit (ultrasonic) for the Philips Model 674 (G11 chassis with teletext). V. Browning, 142 White Dirt Lane, Catherington, Portsmouth, Hants PO8 0TT. 01705 594 952.

Wanted: Scrap Sony SLV315UB VCR for spares, in particular the head motor. B.A. Wheler, BAW Electronic Services, 17 Highbury Terrace, Halstead, Essex CO9 2FB. 01787 474 820.

Wanted: Any service information (photocopy service manual/instruction sheet etc.) for the Orion SP/LP D1100 VCR. D. Lee, 16 Devonshire Place, Claughton, Birkenhead, Merseyside L43 1TU16.

Wanted: Circuit diagram/servicing information for the Philips D2-MAC decoder Model CTU900. A. Edwards, 20 Mulgrave Road, Whitby, N. Yorks YO21 3JS. 01947 603 729.

Wanted: Complete deck for the Amstrad VCR6000. Also instruction book for the Philips VR2020/21 VCR. Ron Bruce, 11 New Zealand Way, Rainham, Essex RM13 8JP.

Wanted: Complete working power supply for the Akai VS66EK, or would consider purchase of a faulty machine. John Martin, 161 Francis Close, Ewell, Epsom, Surrey KT19 0JT. 0181 224 8401.

Wanted: SD187R CRT, second-hand if possible, for the Sony VPH1031QM video projector, or any information on a possible source. K. Clark, 147 The Queensway, Hall Road, Hull, E. Yorks. 01482 801 822.

For disposal: Promax TA901 CRT rejuvenator with eight adaptors and all books/leads, little use, £200. Ten boxes and bags of TV spares, all very cheap because of close of business workshop clearout. For list phone 01752 670 803 (Plymouth) and leave message or e-mail either of the following:
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For disposal: Coherent call port noise-cancelling full-duplex audio unit (16-bit RISC-based audio unit for videoconferencing). Use with BT VC8000, IBM Screencall, ICL Teamvision, Olivetti PCC etc. Unused/boxed £50. Also National portable TV Model TR505GB, AC/DC, for spares/repair. £5. Julian Bohan, 01522 514 241 or mobile 0958 771 319.

Wanted: Main circuit board and service manual (photocopy will do) for the Hitachi Model C2114T. James Lowrey, 29 Scarborough Court, Byker, Newcastle-upon-Tyne NE6 2TG. 0191 265 3314.

Wanted/for disposal: Require late Sony Betamax VCRs and manuals (C9 onwards). Have for disposal the following VHS models: Philips VR6463, Samsung VI710 and Saisho VR3400 for parts/spares. Alan Stubbings, 7 Church Road, Saxilby, Lincoln LN1 2HH. 01522 583 373 (daytime), 01522 702 601 (evenings).

VCR Clinic

Reports from
Philip Blundell, AMIIEelec
Stephen Leatherbarrow
Eugene Trundle
Gerald Smith
Ronnie Boag
Brian Storm
Kevin J. Green, TMIIE
David A. Chaplin
Roger Burchett and
Pete Gurney, LCGI

Philips VR6490

This machine was dead. The power supply output voltages at plug J104 should be as follows: pin 4 –21·8V; pin 5 0V (chassis); pin 6 5·5V; pin 9 14·8V; pin 10 33·8V. In this case the voltage at pin 6 was low. C119 and C120 (1,000µF, 16V, 105°C) had dried up. **P.B.**

Daewoo V50

Failure to accept tapes was the complaint with this machine. I found that the deck was out of alignment because of a dirty mode switch. The cog that operates on both the supply and take-up loading arms was also damaged.

After attending to this the machine still refused to accept a tape. This time the cause was electronic: the 14V supply was missing because D62 was open-circuit. It provides the supply for the loading drive chip IC602. **S.L.**

Philips VR231

This Turbo-deck machine wouldn't load. The loading arms would cycle back and forth to the half-load position several times, then the tape would be ejected. Unfortunately the on-board diagnostic display only indicated that there was a loading fault – I was already painfully aware of that!

After much searching I discovered that one of the vanes (there are four) on the worm shaft was missing. This deck doesn't have a mode switch: the four vanes interrupt an optical link, which the microcontroller chip detects to get an indication of deck position. With one vane missing the chip was uncertain about the situation. **S.L.**

Sanyo VHR287

Powering down in the record mode only seems to be becoming a common fault with these machines. It happens when the 5V supply momentarily dips below its correct value. The cause is the relevant 'fuse' in the power supply – it goes high-resistance. The device is labelled 1A C/P and that's what we fit.

The same mechanism and power supply is used in many Sony models, with which you get the same fault.

The circuit reference no. is PR512. **S.L.**

Daewoo V435

We've now had this problem with two of these machines: intermittent recording in black-and-white, with E-E and playback of a good recording OK. In both cases the cause was the record chroma-signal coupling capacitor C402 (0·022µF). It was going open-circuit intermittently because of a crack at one end. **E.T.**

Akai VS204G

Like all the best ones, this fault was intermittent: on rare occasions there would be a 'hiccup' in record or play, with a momentary change of sound pitch and the picture moving fractionally sideways. The capstan motor was the cause. Presumably this could happen with other Akai models that use the same deck and motor. **E.T.**

Sony SLV6UV

We have now had two of these machines with the same fault. The symptoms are no E-E signals with just a blue screen, possibly intermittent. In both cases the cause was a dry-joint at the 9V feed choke L2 inside the IF module. **E.T.**

JVC HRJ410

This machine would intermittently return to standby in playback or record. The fault would occur more often the longer the machine had been on. I checked the usual circuit protectors, which were OK, then turned my attention to the reel FG pulses. The supply reel pulses were missing – replacing PS1 cured the fault. **G.S.**

Tatung TVR933

This machine wouldn't eject tapes. If you pressed stop while the machine was in the fast-forward mode tape would spill out as the supply reel continued to run. Checks showed that the reel brakes weren't triggering. A replacement mode switch cured both faults. **G.S.**

Sanyo VHR287

One row of segments in this machine's front display remained lit all the time. A replacement display made no difference. The cure was to replace D3120 in the display drive area. It was leaky. **G.S.**

JVC HRJ610

This machine was dead. The cure was to replace C12 (2·2µF, 50V) in the start circuit. **R.B.**

Nikkai J2

The E-E display was marred by a hum bar. This one was cured by replacing C803 (100µF, 50V). **R.B.**

Nokia VR3716

This machine left tape out of the spool when it ejected a cassette. A replacement back-tension band cured the problem. **R.B.**

Panasonic NVFS90

This machine's playback picture was unusual: there were just black horizontal lines displayed on a white

background. The fault is actually quite common with these machines, the cause being the 1H delay pack on the sub-luminance board. Inside this metal can you will find a CCD delay IC that likes to cook some of the adjacent capacitors slowly. It's usually C3501, C3506 and C3516 that give trouble, but this time the culprit was C3510, a miniature 3·3µF electrolytic capacitor. **B.S.**

Panasonic NVHD410

When a tape was presented to it the machine would revert to standby and display H01. This fault code usually means that the cause of the trouble is failure of the drum to rotate. When I removed the top I found that this was the case.

In many of these types of Panasonic VCR a stator PCB is mounted above the video head. It carries the drive coils for the drum and a magnetic resistor, part no. HW-300A-CF. A replacement resistor usually cures the fault. This item can also be the cause of drum servo instability if the output is slightly lower than normal. **B.S.**

Panasonic NVFS100

This machine's E-E picture was badly distorted. In fact it consisted of ragged verticals and bad smearing. The cause of the fault was traced to the Y-C separation board, where C3807 had gone low in value. **B.S.**

Toshiba V854B

The customer complained that there was no E-E or playback sound. This was confirmed, and we also found that there was no sound recording and the bar-graph on the front wouldn't work. The cause of the trouble was traced to C964 (330µF, 16V) in the audio section of the main PCB. It was leaky. **K.J.G.**

Hinari VXL6

E-E operation was OK but in the playback mode there was just a blank raster. I eventually found that the mute pin (26) of IC303 didn't drop to 0V. The cause of the problem was IC101. Pin 11 was static at 5V: it should produce a 5V vertical dummy pulse output. **K.J.G.**

Hinari VXL4

From the playback picture it looked as if this machine had one dirty video head. I cleaned the heads and obtained a good picture, but a few seconds later it was back to its initial state. This time cleaning made no difference. After a few seconds the picture cleared and was OK again.

The symptom came and went when the preamplifier can, which is mounted just behind the drum assembly, was waggled. When I looked inside the can I saw that there were dry-joints at the bottom plug assembly, which plugs into the main PCB socket. A good clean and resolder cleared the fault **D.A.C.**

Philips VR6291

There had been a local thunderstorm while this machine was recording. It was then found to be dead. Checks in the power supply failed to reveal any faulty components. When the machine was reconnected to the mains supply it worked normally but a strange, fizzing noise came from the power supply.

All functions worked correctly until a timed recording was attempted. At the preset start time the mechanism began to load then the machine went dead again. I decided to replace the CNX83A optocoupler. After that the machine ran quietly with no other problems. **D.A.C.**

Saisho VR705

There was no take-up as the reel idler was well past its 'sell-by' date. I fitted a new idler and replaced the nylon reel-motor pulley with the brass type, which provides a more positive drive. Then, after replacing the drive belts and cleaning the heads and tape path, I tested the machine.

Take-up was now good, but the capstan servo didn't lock. As the motor itself ran freely, I adjusted the capstan FR. A long soak test proved that everything was now in order. Maybe someone had had a twiddle!

The **Amstrad Model VCR7000** is similar. **D.A.C.**

Akai VSF11

This machine usually played all right but if cue or review was selected it would shut down with dashes in the display. It occasionally shut down when fast forward or rewind was selected. The cause of the trouble was C3 (2,200µF, 35V) in the power supply. The microcontroller chip was reacting to spurious power-down commands. **R.Bu.**

NEC N9077

In any mode except pause this machine would shut down almost immediately. So there was obviously a reel-rotation sensing fault. In fact there were no black segments on the reel, just reflective ones – hence a steady DC output from the sensor. As replacement reels are not available I painted the segments back in. **R.Bu.**

Orion D1094

The customer complained that this VCR had refused to eject the tape. He had then removed it himself. Fortunately the mechanism had not been damaged, and a quick set-up restored correct alignment. But at power up the machine did little: it refused to take a tape, and shut down after ten seconds or so.

A check on the outputs from the power supply showed that they were all OK. I felt that the basic problem was probably a loading fault, and found that the loading motor's supply was missing. The drive chip is mounted on the main PCB: as this is a centre-deck machine, the mechanism had to be removed to gain access. Once this had been done the cause of the fault was obvious. The BA6886 drive chip IC1004 had a small but visible crack in its case, and there was evidence that it had been running hot.

A replacement restored the drive voltage, but before refitting the deck I checked the loading motor's DC resistance. It was low at 8·5Ω – a check with a new one produced a reading of about 14Ω. So the motor had to be replaced as well.

This machine is electrically similar to the **Matsui VX1100**. **P.G.**

Toshiba V110B

Erratic behaviour was the problem with this machine. It might load a tape, refuse to give it back and shut down. I noticed that whatever deck function was selected it was carried out very slowly.

A check on the switched 12V output from the power supply showed that it was low at 1·5-6V depending on load. There were two causes. The crowbar zener diode DP08 was leaky, pulling down the supply. But the primary cause was the 6·8V zener diode DP07 in the 12V regulator circuit. Although it seemed to be OK when tested, it was the cause of the 12V supply being high at nearer 17V. Hence the failure of DP08.

I've had trouble with DP07 in a number of these machines. Even when this zener diode is working correctly the 12/14V supply tends to be high at about 15V, which is not far from the crowbar voltage (15·6V). The crowbar diode often presents evidence of having run hot. I usually fit a 6·2V zener diode in position DP07, as it produces an output that's closer to the specified 13·5-14V. **P.G.**

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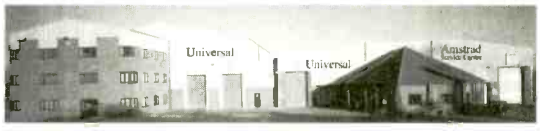

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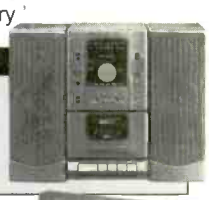

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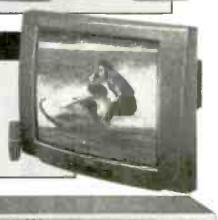

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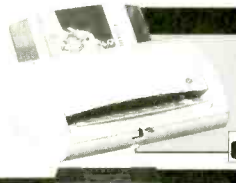

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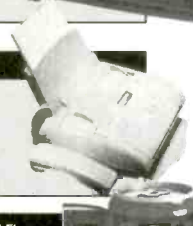

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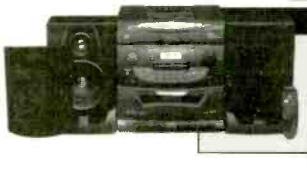

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Test Report

Steve Beeching describes and tries out a novel soldering station that's based on RF heating. It is ideal for use with current electronic assemblies that use surface-mounted technology

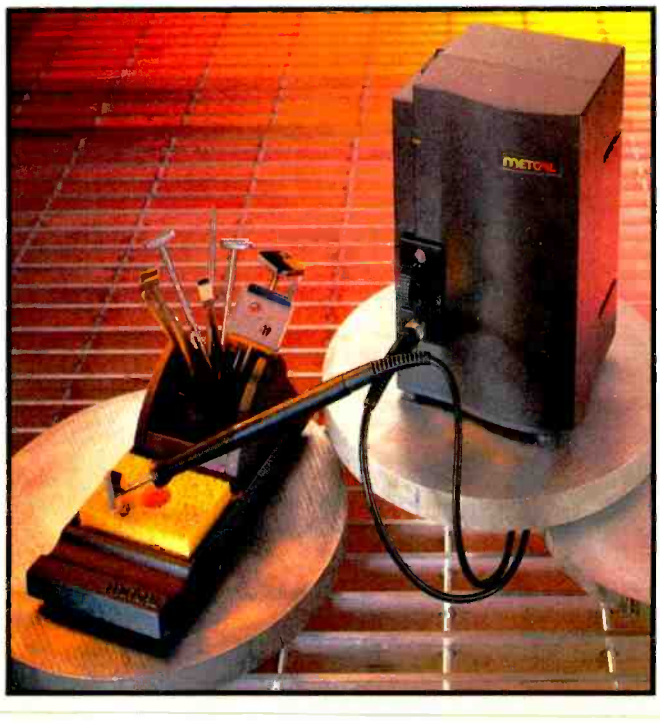
The Metcal MX500S Soldering Station

Our heading photograph shows the Metcal MX500 soldering pencil with quad flat-pack tip.

The Metcal MX500S soldering station is made by OK International and is available in the UK from SEME Ltd. It's just one of a wide range of products that OK International manufactures. They include fume extraction, rework and sophisticated production equipment. So the MX500S comes with a good pedigree. Its main feature is an RF heating/temperature control system called SmartHeat.

The soldering cartridge tip is of bimetallic construction. It consists of an inner core that's made of a material which has high thermal conductivity and low electrical resistance, and a ferromagnetic alloy outer layer which at normal temperatures has a high electrical resistance. To appreciate the significance of this, we must consider what is called the skin effect.

Consider a length of copper wire used as an electrical conductor. When a low-frequency AC voltage is applied, a current that's proportional to the electrical resistance of the wire flows. It passes through the whole cross-section of the wire, with even distribution. When a very high frequency voltage is applied however the current flow is concentrated in the outer layer of the wire. This is the skin effect.



SmartHeat Technology

The Metcal soldering system has a constant-current power supply that operates at a frequency of 13·5MHz. Its output is fed to the soldering pencil via a coaxial waveguide cable. To heat the tip, the current flows through its outer layer of high-resistance magnetic material. You thus get heating by means of the skin effect. Heat reaches the inner core of the tip by thermal conduction.

Once the outer layer of the tip has heated up, the material reaches its Curie Point, which means that the material ceases to be magnetic. At this point the material's resistance to the constant RF current falls, and in addition current starts to flow via the low-resistance inner core. As less power is being dissipated, the heating effect decreases.

As the tip's temperature falls, the outer-layer material returns to the state below its Curie Point. It becomes high-resistance again, and the heating effect increases.

Thus the tip's temperature is set by the Curie Point of the outer-layer material. As the Curie Point is well defined, temperature control is close – within 1°C. This is the Metcal SmartHeat technology.

Its advantages are: constant tip temperature; no need for calibration of temperature setting; high output at lower temperatures; easy to use; dual-port power supply.

In Use

It takes about fifteen-twenty seconds, depending on size, for a tip to heat up from cold. Thereafter the temperature remains stable. The iron is suitable for continuous or occasional use, heating up much more quickly than a conventional soldering iron. This was found to be an advantage in use.

As the reheat time is so quick, it's not necessary to leave the iron on all day. Switching it off doesn't cause any undue delays.

During the twenty-second heating period very high power, almost 40W, is applied to the tip. The power falls rapidly as, in the last few seconds, the Curie Point is reached. This was demonstrated to me by OK Industries, using an in-line power meter.

A small Allan key screw at the right-hand side of the power unit can be tightened to activate an idle timer, which turns the power off after an idle time of 25-30 minutes. This reduces the chance of a microfine tip being overheated and burnt.

Tips

The cartridge tip type sets the soldering temperature. With 500 series tips the temperature is 270°C (20W); with the 600 series it's 330°C (20W); and with the 700 series it's 395°C (30W). Tip types are identified by the first of the last three digits in the code. For example an STTC537 is a 500 series tip. A 0 in this position indicates a 600 series tip, 1 indicates a 700 series tip.

Tips can be changed 'on-the-fly' by using a heat-proof pad that's supplied. Once the cartridge tip has been removed from the pencil its lower stem will be very cool and can be handled. Insert the new tip in the pencil: it's safe to do this as the power supply will have shut off. Simply switch the power supply off and on again and you can continue after the brief heat-up time.

There are many tip shapes and sizes: surface-mounted component removal tips with different-sized slots for different-sized components; twin-sided, tunnel-shaped tips for dual in-line ICs; quad tips for PLCC, SQFP and PQFP surface-mounted ICs – in fact there are some 70-80 different tip sizes in each temperature range.

Standard soldering pencil tips range from 0·2mm to 1·6mm conical and 0·4mm to 5·2mm chisel plus various bevel- and bent-shaped tips, again in each temperature range. In addition there's a blade tip which can be used with DIL ICs or, more readily, to heat desoldering braid when cleaning a PCB up.

The microfine tips worked well, with imperceptible temperature changes, when used to resolder surface-mounted connectors and ICs in positions where leg-by-leg soldering was required because of high component density – in this respect the Metcal is similar to the JBC Advanced soldering iron (see pages 16-17, November 1998). I used slightly larger tips to wipe-solder surface-mounted ICs. Care is required to prevent burning when using microfine tips at 330°C, and as a precaution the unit was switched off between jobs rather than leaving it to the idle timer.

The 600 series is suitable for most surface-mount working with a microfine tip. Series 700 tips would be better for general TV/VCR work with through-hole components.

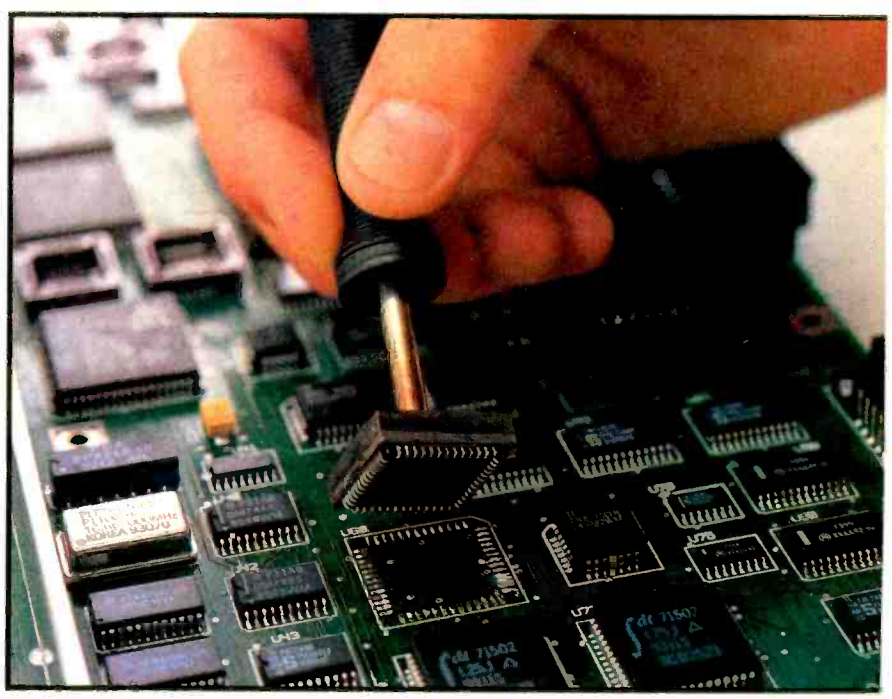
Because of their thermal capacity, larger tips are better for some tasks such as soldering tuner tags: you can change quickly to a smaller tip for the tuner connections, to prevent print damage due to overheating.

The Talon tweezers (left), Metcal soldering pencil (centre) and a selection of cartridge tips.

Talon Tweezers

A considerable benefit is the Talon handpiece that can be used with the system. This is in effect a pair of heated tweezers whose matched tips are controlled by the SmartHeat system. Tip temperature is regulated to within a few degrees in the idle mode, ready for use. As the correct temperature is reached within a few seconds, once again the power doesn't have to be left on.

For test purposes two sample tips came with the Talon handpiece, one 0·4mm wide and the other a 15·8mm width blade with small chamfers at each corner. There are blade tips 6·4mm wide, but not a more usable 10mm wide (I was quoted a vast sum of money to make a 10mm pair). Talon tips can be mounted either way round in the handpiece, giving three ways to grip a component (see Fig. 1).



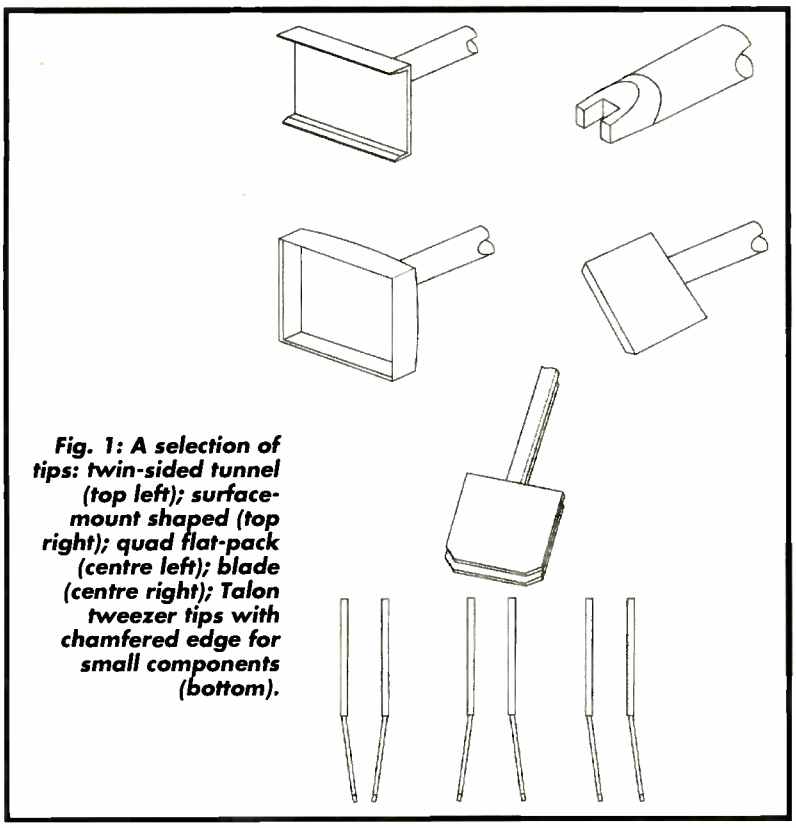


Fig. 1: A selection of tips: twin-sided tunnel (top left); surface-mount shaped (top right); quad flat-pack (centre left); blade (centre right); Talon tweezer tips with chamfered edge for small components (bottom).

I've always found one particular component in a digital camcorder, a small, soft flexible surface-mounted fuse on large PCB lands, to be difficult to remove, even with Pace tweezers. The Talon tweezers made its removal an easy matter, without any component damage, because of the rapid heat regulation.

As with most desoldering equipment, if it's good I have to have it. After using the OK Industries sample Metcal MX500S system for a month or so I found that I couldn't live without it. Nor can you if you are serious about replacing surface-mounted components.

Availability

The Metcal MX500S soldering station is available from SEME Ltd., Unit 2, Saxby Road Industrial Estate, Melton Mowbray, Leics LE13 1BS (phone 01664 481 818, fax 01664 563 976) at £475. Tips cost between £15.95 and £36.25. The Talon tweezers cost £232.50. Talon tips come at £72.60 a pair. These are trade prices, exclusive of VAT. Check them before ordering.

Metcal products have a four-year warranty.

SEME can supply the Metcal brochure and price list to customers who are interested in the range. All you have to do is to phone the new sales hot line on 01664 484 000 and quote order code LEAF116 for a free copy.

SEME is willing to visit a customer's premises and demonstrate the product or, if preferred, a demostration can be arranged in-house at SEME. To make arrangements, phone 01664 484 000.

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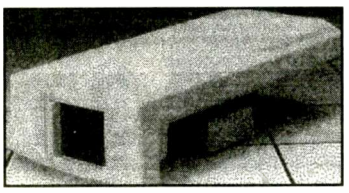

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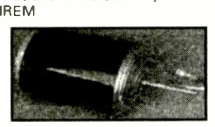

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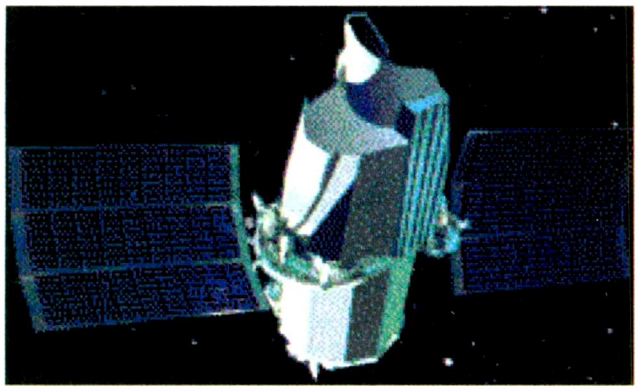
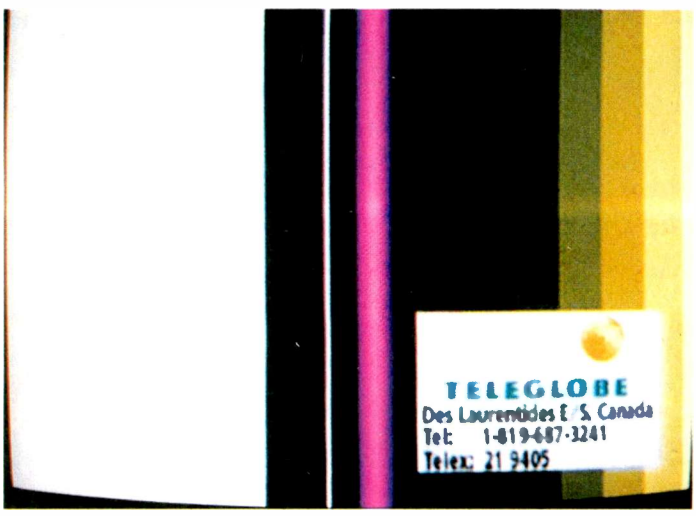


DX and Satellite Reception

Terrestrial DX and satellite TV reception. News from abroad and from the satellite belt. Archive material – a remarkable tape of transatlantic TV reception in 1938 has recently been made available. Review of a handy standards converter that provides excellent results. Roger Bunney reports

December produced little by way of terrestrial DX-TV reception, with the Geminids meteor shower early in the month a rather unexciting event. During the 16th/17th there was a minor Troposhperic lift, which provided Band III/UHF reception from the Benelux countries and France across eastern and southern areas of the UK. Here in south Hampshire signals from the Dutch ch. E4 transmitter at Lopik were fluttering about all day above the noise level, and there were also French Band III signals. There have still been no reports of DX reception of the Isle of Wight TV 12 RSL station on ch. 54 (horizontal)!

The ITC has released details of more RSL-TV stations that have been awarded transmitting licenses in areas where there were several applicants. They include Solent City TV (Southampton), Grimsby/Cleethorpes and Birmingham. There is also to be an RSL station in Bournemouth, though there is at present no channel/power/polarision information.



A recent test pattern received from the Canadian TeleGlobe network via Intelsat K digital.

Solar Cycle 23

We are now on the ascending slope towards the next sunspot maximum – in solar cycle 23. Check out the LF end of Band I for signs of any increasing activity, in the hope that something might be seen – or possibly a 50Hz video buzz heard on your scanner. The MUF might rise to the New Zealand channel 1 (45·25MHz video) or the Australian channel 0 (46·25MHz video). In the UK, the best time for Australasian reception via the F2 layer is 0830-1000 GMT.

If you are lucky enough to have ch. E2/R1 clear at your location, check at such times for distant TV from the NE/E (this is quite common at sunspot peaks). You need solar noon half way along the signal path for the MUF to provide long single-/multiple-hop reception. If the signal produces "ghosty" reception, it's F2!

During the late afternoon through to 1930 GMT check towards the south for TE (transequatorial) signals from Africa. If you have a scanner or a VHF radio that tunes above 30MHz, check for distant communications signals – taxis, military, police etc. – which can be heard well into the 40MHz region. When the band is open, you will find that there are many interesting signals. It has been open during the past two months.

I might, say at around 0815, tune to ch. R1 (49·75MHz video) and suddenly, over a period of a minute or less, signals would just appear out of the noise, becoming very strong as the en-route MUF lifted to reflect them to the UK. Such reception is very height-conscious: a four-element Band I array at 17m would pick up such signals first, followed a minute or so later by reception using an array at 10m.

During past sunspot peaks I've received New Zealand ch. 1 and the Australian ch. 0 (several signals) here at my valley location at Romsey, using just crossed wideband dipoles mounted only 12m high – next to a main road! So it's definitely worth a try.

Satellite Sightings

The Operation Desert Fox Iraq bombing campaign started on December 16th. As with the earlier Desert Storm conflict, the satellite waves came alive with news feeds and reports. The difference this time was digital transmission, the majority of Baghdad terminals using MPEG – though in the clear. I ran into difficulties with the primary hop via Eutelsat W2 (16°E). Fortunately several live feeds were carried via New Skies (see later)/Intelsat K at 21·5°W, a secondary hop: on the first night's bombing there were five simultaneous analogue feeds and three digital ones. Most were scrambled, but the Reuters feed went clear and the full

scale of the bombing could be seen as the signals were fed to the US networks.

Jim Scofield, using his Nokia 9600 for reception via Eutelsat W2, noted eleven different digital frequencies in use between 12·505-12·558GHz, all with horizontal polarisation. Some operated intermittently, but about six were continuously on air. The most consistent feed was the CBS one at 12·558GHz, fronted by Mark Phillips. An Arabic-crew manned uplink for Jazeera Channel at 12·534GHz, in operation on the banks of the River Tigris, was always first on the spot with damage reports – the BBC's pictures were taken an hour later. Jim comments that the digital news feeds usually provide pin-sharp quality pictures – it's either good quality or no signal.

The evening of the 25th brought reports of the end of Richard Branson's balloon flight. Live pictures from KHNL-Hawaii, at the Barbers Point air terminal, were seen from about 2000 hours via the regular Intelsat K 11·566GHz vertical digital feed (5632 SR; FEC 3/4) as helicopters brought the balloon crew back after being snatched from the rough Pacific sea. A CBS reporter at the airstrip eventually obtained an interview with Richard himself. This and other interviews were seen via CNNI.

Christmas has usually produced a varied selection of seasonal graphics via the regular news bureau circuits. Very few displayed the Christmas spirit this year – PanAm 3R/6 at 43°W provided a basic greeting on colour bars and that seemed to be it. The EBU and its members have in the past offered a variety of greetings from 7°E: this year the offerings were in MPEG 4:2:2 digital and were invisible to analogue and most digital operators. A great loss. The Landscape Channel via Orion at 37·5°W (11·622GHz vertical, 18900 SR, FEC 7/8) provided a moving picture of a burning log fire with appropriate music, which was at least soothing.

The BBC UKI-234 SNG truck was seen reporting on the floods and high winds across Scotland: there were live news inserts via Telecom 2C (3°E) at 12·604GHz vertical. This was on December 28th. Three days later UKI-234 was at Edinburgh for the New Year celebrations, with live interviews and spectacular shots of the fireworks. Just up the dial, Reuters provided video inserts of Paris street celebrations and German financial suits toasting the Euro!

I was surprised to see an Italian OB feed via 2C on New Year's morning – the ITA-57 Napoli truck provided a live analogue insert from the streets of Naples (Italian OB circuits usually come via 18°W).

If you missed the original and repeats of Treasure Hunt, check Saudi Channel-2 via Arabsat 2A (26°E): the programme is being shown on Sundays from 2200 hours GMT with the original English sound track, using the 3·968GHz (C band) RHC-polarised transponder.

Bob French has found many clear MPEG-2 channels in Band C via the new Intelsat 806 bird at 40·5°W, using a Nokia 9600 receiver. They include transmissions from Argentina, Chile, Bolivia, Brazil and Florida. Hugh Cocks has noted a digital channel (6110 SR, FEC 3/4), International MPI, via the 4·187GHz transponder aboard PAS 3R/6 (43°W): it's a private Nigerian-Minaj broadcaster that uses Band C for regional feeds and transmitter links. Other new sightings are Jordan TV via the Arabsat package from Hot Bird (13°E) and Palestine Satellite Channel on test card via Nilesat (7°W) – check the Horas-2 digital frequency at 11·823GHz (vertical).

Though there's not much by way of terrestrial DX-TV at present, there's lots happening in the skies!

Terrestrial News

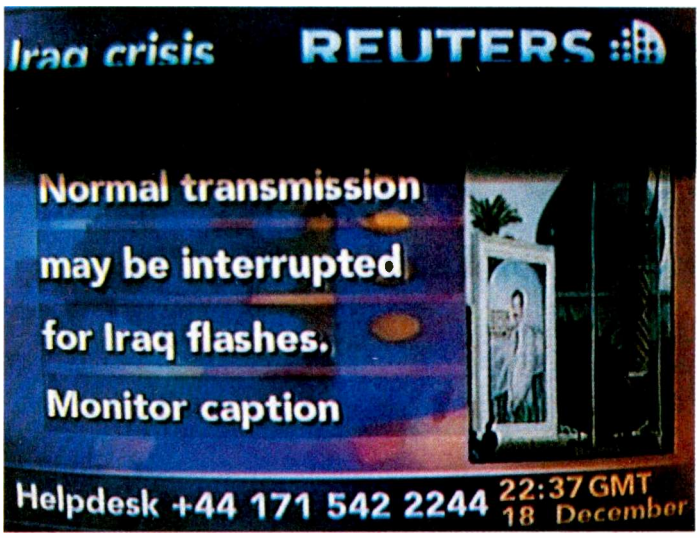
This time it's all digital TV!

Denmark: A listing of future DTT transmitter allocations has been published. All but one are in the UHF bands. The exception is Thisted ch. E3. I wonder what digital TV via SpE looks like?!

USA: On November 1st 1998 42 TV stations transmitted their first digital TV programming, ahead of the FCC's timetable for a May 1st 1999 start up. US broadcasters seem to be enthusiastic about DTT: several transmitters are operating at the maximum authorised ERP of 1MW. Stations are anxious to be first in their area, to gain early digital viewers and prestige.

Because of lack of mast space, several main stations in New York, Detroit and Chicago were unable to start digital transmissions on November 1st as hoped. They are expected to be on-air by May 1st. Commercial stations have to apply for a digital licence by this date, and should be on-air dual-casting with digital/analogue transmissions within three years. Non-commercial stations have a one-year extension.

The FCC is to start selling off the present analogue TV spectrum to communications and data servicing groups by mid-2002. By May 1st 2003 all stations should be dual-



A digital feed from the Reuters Washington news bureau. The black bar is caused by incorrect camera shutter speed (1/60th instead of 1/15th sec.).

The SISLink satellite news gathering (SNG) truck at Poole Quay, Dorset.

casting (analogue/digital). The planned date for the end of analogue NTSC transmissions is May 1st 2005.

Sweden: Terracom AB has been on-air with experimental digital TV for six years. A full DTT service came into operation on January 1st, running in parallel with analogue TV and including various data and interactive services and facilities. Two further networks are to start this spring. Each network will carry four channels. All the main terrestrial TV broadcasters are involved, plus several local stations. A fourth network should be in operation by the end of the year. The long-term plan is for six networks. Analogue services are to be phased out some time around 2010.

Satellite News

A number of satellite launches are due, the most important being W3, the new Eutelsat bird at 7°E. It will replace Eutelsat II F4, and the EBU has confirmed that it will lease four 72MHz transponders for European/African/Middle Eastern coverage. At present the EBU uses twenty channels in a four leased-transponder package at 7°E for digital distribution of TV and radio services.

Arabsat 3A is due to join 2A at 26°E after its February 16th launch, providing coverage from the Middle East through Europe with a total Ku-band payload of some twenty transponders. Using digital compression, it will be possible to downlink eight TV channels via each transponder. 26°E could become another programme hot spot, with the advantage of easy reception using a second LNB on a dish aligned for Astra reception from 28·2°E

AsiaSat-3S is to be launched in March as a replacement for the ageing AsiaSat-1 at 105·5°E. The new satellite will carry sixteen 54MHz transponders, doubling AsiaSat's Ku-band transponder count. Because of the financial problems in SE Asia, the launch of AsiaSat-4 has been postoned until 2000 or after. Television Corporation of Singapore is about to open a satellite news service called Channel News Asia.

Several Intelsat craft have been transferred to a new independent company, New Skies Satellites NV, based in Amsterdam. New Skies currently has Intelsat 513 at 177°W, Intelsat 806 at 41·5°W, Intelsat 803 and K at 21·5°W and Intelsat 703 at 57°E. The all Ku-band satellite K-TV, now being built, will go into orbit at 95°E and be added to the New Skies fleet. Intelsat has confirmed its order for a new satellite, 905, to be launched in spring 2002 for location either over the Atlantic or the Indian Ocean.

BT Broadcast Services has installed a new satellite uplink for the BBC at its Moscow site.

Rupert Murdoch has signed up with TF1 (France) to provide a new children's channel, TFX, to be launched in 2001 for digital transmission as part of the Television par Satellite service. This has upset channel M6, which is threatening to pull out of TPS if TFX goes ahead as part of the package.

American Echostar, which operates the Digital Satellite TV (DST) service, has bought News Corporation/MCI's American Sky Broadcasting (ASkyB), including the programming, two satellites and the Arizona uplink centre. As part of the deal DST will broadcast several Fox Network programme feeds for various local stations, plus the Fox News channel, as part of its DST service until 2002. News Corporation/MCI will receive shares that give them 37 per cent ownership of DST. Echostar will now offer over 500 channels of programming, also various data/internet services.

There will be more regional feeds in the UK now that ITN has expanded its SNG fleet to collect news for regional TV, Channel 4 and 5. ITN ordered ten new trucks last March. Five became operational in December, two in January and the other three are to go into service in March.

After considerable debate, RAI (Italy) has taken a ten per cent interest in the Canal+ digital service Telepiu.

From the Archives

"'Twas the night before Christmas and nothing stirred, not even a mouse." As I opened a jiffy bag the night before Christmas, something fell out. Not a mouse but a VHS tape, with the compliments of Andy Emmerson! Its contents are quite dramatic in TV terms.

Some sixty years ago, in the autumn of 1938, the F2 layer was riding high with the MUF reaching into the low VHF band. Engineers at the RCA research establishment, River Head, Staten Island, New York were excited. They had installed a 405-line system A receiver tuned to the UK's then only TV channel, from Alexandra Palace with the vision carrier at 45MHz, and had calculated that flickering images might appear from across the Atlantic – programmes and test patterns from the only regular TV service then operational in the World, BBC ch. B1.

Images duly appeared, and the pictures taken of them were the first ever of DX-TV with an all-electronic transmission (several years earlier there were reports of Baird mechanically-scanned pictures being received at distant locations, but these were transmitted in the medium-wave band – the late Charles Rafarel, who wrote this column from 1963-1971, received 30-line transmissions at Leeds in 1933, some 300 miles from London).

Andy Emmerson's VHS tape shows a copy of the only surviving film of live, pre-war TV. The RCA engineers filmed the TV screen displaying BBC reception over four minutes. Picture quality is naturally poor – typical F2, with smeary, multipath images and deep fading. But those with long memories will recognise announcer Jasmine Bligh and see a Disney cartoon.

A copy of the tape sent to the National Film and Television Archive produced the comment that it is "the most significant find of 'lost' TV yet made". A couple of stills from the video are reproduced nearby, showing the general quality of the 60-year old DX-TV reception. Andy includes some RCA Victor filmed commercials on the tape, showing several post-war domestic receivers – one is a small, bedroom set that's displaying the RETMA test card.

Andrew Emmerson can supply copies of this historial video. Any reader interested should write to him, enclosing an SAE, at 71 Falcutt Way, Northampton NN2

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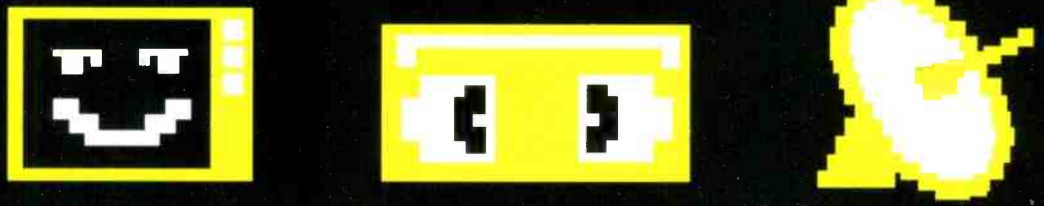

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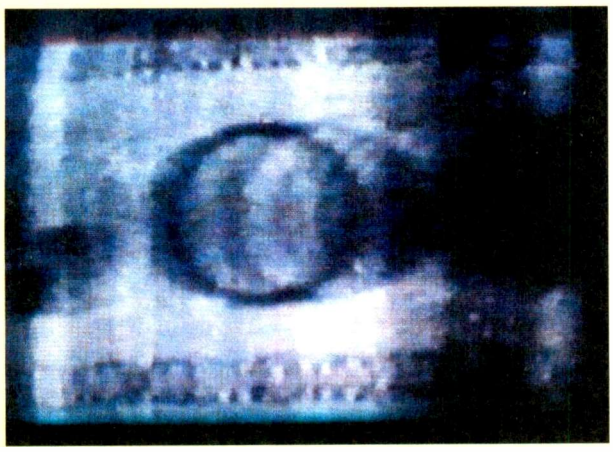


A BBC TV tuning caption received by RCA in New York in 1938. The smudgy, multiple images are the result of the reception mode – F2 layer reflection.

Another still from the RCA film recorded on Andrew Emerson's VHS tape. The 1/60th bar is the result of my camera setting error.

8PH. Remember that this is a pre-war film of multipath F2 reception, so the quality is poor.

Equipment Review – the Universal Video Format Converter Model CDM630

Back in the Sixties I worked at Southern Television, based at the converted Plaza Cinema, Northam, Southampton. This was in the pre-colour, pre-625-line era. Eventually Southern went out from Rowridge with 625 lines, but all Plaza programming originated with 405 lines and had to be standards-converted to 625 for UHF transmission – the 405-line material continued to be transmitted at VHF (ch. 11) from Chillerton Down. Several 19in. racks of equipment some 6ft high carried out the 405-625 conversion magic. Later, when a colour studio centre was built alongside the Plaza, all programming originated as 625-line PAL – Chillerton then down-converted to 405-lines mono. The studio centre was taken over by TVS in the early Eighties, and is now Meridian.

Two years ago Aerial Techniques lent me a systems converter that would convert from 525 to 625 and vice versa, also converting between PAL, NTSC and SECAM as required. I checked the converter with an incoming 525-line NTSC sports feed for CNN via Intelsat K, converting to 625-line PAL. The results were startling. Apart from a slight 'sticking' with fast-moving objects, e.g. a football, the quality was excellent – both the colour and the frequency response, with no smearing. A display of LEDS indicated the incoming signal standard, the user selecting the output standard. The converter was housed in a small plastic box that could be held in the palm of your hand, and took about 200mA at 12V. Compare with the massive 19in. racks previously mentioned!

Aerial Techniques has recently taken delivery of a much more up-to-date version that should be of interest to enthusiasts who are into satellite feeds, and also to dealers who get those awkward "aunty brought this VHS back from her holiday in America but it won't play on our video" laments. The new unit, Model CDM630, provides manual or auto selection of the following input standards: NTSC 3·58 or 4·43MHz; PAL B/D/G/I/K; PAL-M and -N; SECAM. The output standards available are similar, except that SECAM is not available.

All input/output standards can be preset, or can be set to auto. A front-panel LED display provides confirmation of the input/output settings. Line conversion 525/625 or 625/525 and field conversion 60/50 or 50/60 is done digitally, a built-in timebase corrector providing correct line and field pulse shaping and syncing. This, coupled with the 4Mbits field memory, ensures a smooth video transition without sticking when fast-moving objects are present.

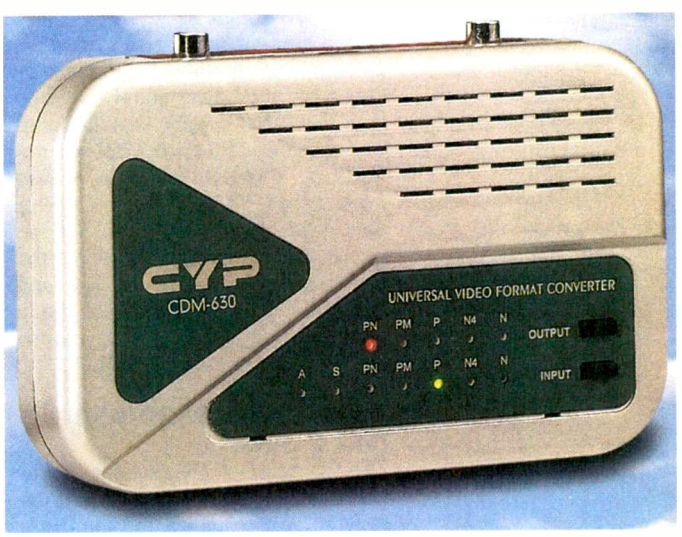
An AGC system maintains the output at 1V peak-to-peak with inputs varying from 0·5V to 2V peak-to-peak. If there is no signal present or the input signal fails, the converter produces a colour-bar video output.

Input standard selection can be either left on auto or manually preset by means of a row of small buttons. The output standard is similarly selected.

The unit draws 450mA at 15V. It uses a sampling frequency of 13·5MHz for the luminance signal and 6·75MHz for the two colour-difference signals B – Y and R – Y. For these parameters the signal is 8-bit coded.

The unit weighs only 1kg and measures 145 x 95 x 34mm. Apart from the video-standard setting buttons there are only input and output video phono sockets and the 15V power input socket. A separate 230V mains unit and various cables are supplied with the converter.

The performance of this unit is very impressive, especially when you consider the amount of technology in such a small plastic box. I'm told that the Universal Video Format Converter is available at £399 including VAT. For more information phone Aerial Techniques on 01202 738 232 or write with an SAE to Aerial Techniques, 11 Kent Road, Parkstone, Poole, Dorset BH12 2EH.



The Universal Video Format Converter Model CDM630, which is available from Aerial Techniques.

TV Fault Finding

Reports from
Philip Blundell, AMIIEelec
Pete Gurney, LCGI
Chris Watton
Michael Dranfield
Stephen Corcoran
Denis Foley
Jim Kirkman
Colin J. Guy and
Michael Maurice

Philips 32PW9631/25 (5GFL2.30 E AA chassis)

This widescreen was dead with a whistling noise that came from the power supply. Checks revealed that the line switch FET was short-circuit and that there was a low resistance across the line output transistor – C2433 (510nF in this model) was short-circuit. Normal results were obtained once a new FET and capacitor had been fitted. **P.B.**

Sharp DV5131H (S3B chassis)

The fault report said "dead". But I had a surprise when I switched the set on. Although there was no picture, a rushing noise came from the speaker! Voltage checks on the outputs from the power supply showed that the 9·5V supply was missing. The cause was R745 (0·33Ω, part no. VRN-V V3ABR33J), which was open-circuit. When a replacement was fitted the set came on but the picture was flickering. This time the 9·5V supply proved to be low and varying. The BY299 rectifier diode for the supply, D713, had developed high forward resistance. **P.B.**

Philips 28ML8800/05B (FL1.6 chassis)

The FL range of TV sets has an on-board diagnostic mode that can be very helpful when tracing the cause of some faults but a distraction with others. After half an hour this particular set would shut down and flash its mute, stereo and standby LEDs. This, along with the error code 99 stored in the memory, showed that the protection line was in operation. Other fault codes were logged after 99 but turned out to be distractions.

I used the magnifier to check the large signal panel and found a few suspect solder joints, but after attending to these the fault was still present. On one occasion I happened to be looking at the screen just as the set shut down and saw that the vertical lines in the picture appeared to go ragged just before the switch off. The blue 'box' capacitors are suspect if you think that there is arcing in the line output or line scan coil feed circuits. The cause of the trouble was C2523 (8·2nF, 2kV) which was arcing internally. **P.B.**

Grundig CUC7350 Chassis

If the mains fuse Si60001 has blown, check whether the BUZ90 chopper transistor T60020 is short-circuit. If so look for a dry-joint at C60029 (470pF, 1·6kV): this could well be the cause of the transistor's failure. Before powering the set, check the mains rectifier diodes D60011-14 and D60023-24 which are in series with T60020. **P.B.**

Ferguson 59M5 (ICC5 IMC chassis)

"Smoked then went off" it said on the job card. A dry-joint had damaged CL48 (12·4nF) in the EW diode modulator circuit and the TDA4950 EW correction chip IG01, but when these items had been replaced the set tripped three times then died. Voltage checks around the BC548B protection transistor TL17 produced some very odd readings. All became clear when the transistor was checked out of circuit – it was open-circuit base-to-emitter. **P.B.**

Dynatron 256289IR/25R (Philips G110-SVHS + Black line chassis)

This set has been the workshop hobby for the past twelve months. First the power supply blew up, so a kit had to be fitted. Then the teletext panel developed dry-joints. After this the line output transformer failed.

We now had a sync fault – the set kept losing line lock and the video input at pin 5 of the TDA2579A timebase generator chip was low. This led us to transistor Tr7364 (BC858), which was open-circuit base-to-emitter. A replacement lasted for only about five minutes. As the output from Tr7364 goes to the teletext panel, which had given trouble before, we fitted another transistor then tried the set with the teletext panel removed. This time the transistor didn't fail. A few minutes spent with the continuity tester revealed the cause of the trouble. The video input track on the teletext panel runs round the outside and comes very close to the hole where the screening can fits. The track was intermittently shorting to the screening can's fixing leg. A piece of heatshrink sleeving ensured that they didn't short again. **P.B.**

Grundig CUC2000/3000 Chassis

With conventional TV sets line collapse when hot is usually a straightforward dry-joint type of fault. With this range of chassis however one possibility is an intermittently open-circuit winding on the combi (Ipsalo) transformer. When the winding between connections N and L of the

transformer is open-circuit the symptom is line collapse with the EHT still present. **P.B.**

Ferguson ICC7 Chassis

The complaint with one of these sets was intermittent black-and-white lines, usually at switch on or when the set was very hot. The fault would sometimes occur daily, then not for weeks. Severe patterning that originated in the IF module was eventually found to be the cause. Most of the soldered connections to the non surface-mounted components showed signs of breakdown. This was particularly the case with CS25 (1µF), which had nearly departed from the board. Resoldering cured the problem.

Note that the fault was not sensitive to vibration. Only removal of the unit and close visual inspection revealed the cause. **P.G.**

Grundig GT2103 (G1000 chassis)

I've had several of these sets in which R316 (10Ω) in the HT supply to the RGB output stages has failed for no apparent reason. The symptoms are a bright raster with the sound OK. In all cases I replaced the associated rectifier diode and reservoir capacitor to be on the safe side. **P.G.**

Matsui 209T

There was severe field foldover at the top of the screen. The chassis uses a fairly conventional discrete transistor field output stage, and in this case the cause of the fault was C303 (3·3µF, 160V) which is connected to the collector of the upper transistor Q302.

With this chassis I normally replace the chopper transistor's base drive coupling capacitor C607 and resolder the line driver transformer as a matter of course. **P.G.**

Mitsubishi CT25A5STX (Euro 14SF chassis)

The job card said that this set was dead. On test it seemed to function, but after several minutes the HT became unstable. Problems with this power supply are usually caused by the electrolytic capacitors. The chopper transistor's base drive coupling capacitor C914 (47µF, 35V) was replaced as a matter of course, using a high-temperature type. The culprit was C905 (470µF, 25V) however. It's the reservoir capacitor for the LT supply on the primary side of the circuit. When it had been removed there were signs of electrolyte leakage on the board.

As a precaution I usually replace the electrolytics on the secondary side of the circuit. They too can give troubles because of leakage. **P.G.**

Philips 28ML8770/05 (FL1.1AB chassis)

This set was dead with a blackened mains fuse and the chopper transistor short-circuit. In cases like this the recommended procedure is to fit the Philips kit 4822 310 31919, which includes all the items required for a reliable repair and a new power supply subpanel.

After fitting the kit components I checked the two line output switching transistors Tr9544/9545 (both type ON4673) before switching on. They were both short-circuit. When this has happened I check the tuning capacitor C2504 (1·5nF, 2kV), which on this occasion was leaky with a crack across its surface. I fitted a replacement rated at 3kV and replaced the ON4673 transistors. At switch on everything worked normally. **P.G.**

Toshiba 2102TB

The field scanning was extremely distorted, with the top half virtually missing. As the condition improved when the set had been running for several minutes I assumed that the cause was dried up electrolytics. Correct scanning was obtained when the 100µF, 35V flyback boost capacitor C313 and the 2·2µF feedback capacitor C317 had been replaced. **P.G.**

Hitachi C2514T

If the power supply has blown up, with the BUT12AF chopper transistor and ZD952 short-circuit and the optocoupler IC901 faulty, also the line output transistor short-circuit, make sure that you check the value of R951 (82kΩ, 0·5W) in the HT sensing circuit. Otherwise you may have to replace them all again. **C.W.**

Philips G90AE Chassis

This set would start to trip a few minutes after coming on. The tripping would gradually speed up until the set popped about twice a second. The culprit was Tr7652 (BC557C) on the secondary side of the power supply. **C.W.**

Hitachi CPT2158

This set came on with a blank raster and maximum sound that couldn't be turned down. Nor would it go into standby when plugged in and switched on. There was no 5V supply to the microcontroller chip as D911 in the power supply was dry-jointed. **C.W.**

Finlux 1000 Series

This set would go into standby intermittently. Simple this time: on investigation I found that there was a tiny hole in the line output transformer. **C.W.**

Nikkai Baby 10

If the problem you have is tuning drift when changing channels, don't immediately suspect the tuner. The cause of the trouble is more likely to be the integrator capacitors in the tuning voltage generator circuit – C103, C104 (both 0·22µF) and C105 (0·47µF). Don't replace them with ordinary capacitors. Only high-stability tantalum ones are suitable. **M.Dr.**

Matsui 1482

This set would intermittently return to standby after about ten minutes. Someone else had resoldered many joints. A few weeks later the set went dead completely, with the standby LED out. This time there was no output from the standby transformer, whose primary winding was open-circuit. An ideal substitute is available from Farnell Electronic Components, part no. 926-280, at less than £4 – the original type costs about £14. **M.Dr.**

Goodmans 2575

The complaint with this set was no results. When I switched it on the 10Ω, 5W resistor that feeds the line output stage became red hot. The cause of this was the line output transistor, which was leaky. As no obvious dry-joints could be seen in the area I fitted a replacement. At switch on the EHT went sky high and the new transistor failed. The line flyback tuning capacitor C134 had fallen in value from 10nF to 3·3nF. **M.Dr.**

Ferguson D14R (TX805 chassis)

This set had a bright white picture with flyback lines. The obvious thing to check was the 150V supply for the RGB output transistors. I found that the 10Ω safety resistor was open-circuit while the 22µF, 100V reservoir capacitor CP22 had dried up. In case you are wondering about the capacitor's voltage rating, its negative plate is connected to the 103V HT line. **M.Dr.**

Sharp 37AM-23H

The complaint with this newish colour portable was poor picture/

sound and a blue screen. In fact the blue mute was cutting in because the set was slightly off tune. When the set had been retuned I found that the AFC was detuning it. In an older set a slight tweak of the AFC coil would probably have cured the fault, but in this set the AFC is bus-controlled.

The AFC is set by the microcontroller chip, which applies a voltage to the varicap diode at pins 5 and 6 of the IF chip to alter the frequency of the VCO. I cleared the fault by entering the service mode, accessing the non-volatile memory's hex program, going to location OD and changing the data here to 9F. All that remained to be done was to retune the set again. **M.Dr.**

Sony SX Chassis

At switch-on the EHT appeared for about half a second then the power supply gave up. There was no overcurrent trip indication (flashing standby LED). When the feed to the 2SD1497 line output transistor Q804 was disconnected the power supply worked normally. The line drive was present and correct. So I replaced the 2SD1497 transistor. This proved to be ineffective, and there was nothing else obviously amiss in the line output stage. The transformer passed a simple resistance check, but was nevertheless faulty. A replacement restored normal operation. **S.C.**

Sony KV2052

Another engineer had quoted "about £100" to fit a a new tube in this set. When I switched it on I found that the set was dead apart from a squealing power supply. HT was present when the feed to the line output stage was disconnected, so I checked the BU208A line output transistor, which was short-circuit. A replacement restored the set to life with a very high-quality picture. **S.C.**

Mitsubishi EE3 Chassis

This set took a long time to come on: during this time there was a fluttering noise from the speakers and the standby LED showed red. C955, the 2,200µF reservoir capacitor for the 11·5V supply, had fallen in value to about 400µF. I fitted a replacement rated at 105°C. **D.F.**

Sony AE1 Chassis

The set would work normally for about twenty minutes then shut down with the standby light flickering rapidly. The fault could be instigated earlier by channel changing. In the fault condition there was no remote control.

This suggested that the cause of the trouble was in the microcontroller chip area, where the 5V supply was found to be low at 4·3V. The supply is regulated by transistor Q604, which is type 2SD789-3. When a replacement had been fitted the supply was correct and the problem had been cured. **D.F.**

GoldStar CF25C22F etc (PC33J chassis)

The cause of field collapse was failure of the TDA8350Q field output chip IC301. LG Electronics' helpful technical department told me to obtain a kit of components from CPC, part no. KITPC33J. It contains RU4DS diodes, a TDA8350Q IC, a power transistor and other components, plus full instructions for the factory-approved modification. This was 100 per cent successful. **J.K.**

Sony KVM2120U (BE1 chassis)

There was a faint, greenish picture with flyback lines. No faults could be found on the tube's base panel, so I moved back to the TDA3505 video control chip IC302 on the colour decoder subpanel. A scope check at pins 1, 3 and 5 showed that the RGB outputs were very low. The inputs at pins 12, 13 and 14 were satisfactory. Was it the chip or was it something else? In standby the outputs are taken to chassis via the DTC114ES digital transistor Q308, which was leaky (220Ω) collector-to-emitter. When it was removed the picture reappeared! **J.K.**

B&O LX2802 etc

There was no raster. When the setting of the first anode control was advanced the cause of the problem was seen to be field collapse. The supply and drive to the TDA2170 field output chip were OK, so it seemed that a new IC was needed. Problem: the TDA2170 is no longer available! B&O have a solution however. I was supplied with a TDA8172 chip and an adaptor PCB. Change 4R78 to 3·3kΩ and 4R85 to 0·56Ω (both 0·25W) and all is well. **J.K.**

Philips G110 Chassis

This set had no teletext. The cause was found to be a dry-joint at a surface-mounted link in the 12V supply line on the text panel. Resoldering it restored the teletext, but the top of the display wavered from side to side – just as prerecorded VCR pictures do when played back via a non-VCR channel. The cause of this was C2829 (47µF) on the text panel. **C.J.G.**

Beko 16328

This set was dead with a shorted line output transformer. The Termal LOPTs used in these sets don't seem to be very reliable. They often arc from the side, destroying the adjacent BY299 video output stage supply rectifier. This produces the same symptoms as a shorted LOPT. The HR7218 transformer available from SEME and others is a cheaper and probably more reliable replacement. **C.J.G.**

Sony KVM2131U (BE1 chassis)

There was no line or field sync. When the teletext panel was removed however there was a normal picture. The 12V and 5V lines on the teletext panel were both low, the cause being an open-circuit track to the collector of the surface-mounted regulator transistor Q02. This whole area was black: it obviously runs very hot. **C.J.G.**

Mitsubishi CT2227BM

These old Blue Diamond tube sets seem to go on for ever. This one had field collapse however, with a smell of burning. The smell came from the 330µF field scan coupling capacitor C412, which was desperately trying to ease itself out of its can – and would have done had I not switched off rapidly. Replacement of this capacitor and its companion C413, which was dead short, restored an excellent picture. C412 and C413 are connected in series. **C.J.G.**

JVC C14ET1K (Onwa chassis)

Words failed me when I removed the back of this set and found one of those awful Onwa chassis. Another 'repairer' had been at it as well. After rebuilding the primary side of the power supply and replacing the 12V zener diode ZD402 and its feed resistor R425 (5·6Ω) I had a picture with reduced height and no colour. The 12V supply was slightly low and varied with picture content. Fusible resistor R434 in this supply had risen in value to about 15Ω instead of 6·8Ω. **C.J.G.**

Toshiba 256T9B

"Loses memory" the report said, but when I tried the set all the local stations were tuned in. So on to the test bench it went, remaining there for most of the afternoon and the next morning. Later, while trying to find

something tolerable to watch amongst the dross of what's called daytime TV, I discovered that with repeated channel changing all the stations would be lost. They would come back if the set was left off for a few minutes. So the set was not actually losing its memory.

Close examination in the area of the microcontroller and EEPROM chips, using a magnifier, revealed a multitude of dry-joints. Thorough resoldering cured the fault. **C.J.G.**

Matsui 1455

The sound was accompanied by a whistle that changed pitch as the volume was adjusted. The cause was traced to the two electrolytic capacitors in the DC volume control circuit, C429 (2·2µF) which is in the microcontroller department and C130 (1µF) which is in the IF section.

Whenever one of these Onwa sets comes in for repair it's prudent to replace the two small electrolytics on the primary side of the chopper power supply circuit. **C.J.G.**

Philips G90B Chassis

There were two faults with this set. The first was no text and the sound taking a long time to come on from cold. This was cured by replacing C2846 (220µF) on the text panel. The second fault was no text when the set was warm. It was cured by replacing the SAA5243P/E text processing chip. **M.M.**

Ferguson TX98 Chassis

The fault was partial field collapse. I found that the 50V supply to the field output stage was very low at only 12V. The rectifier diode for this supply, D16 (RGP30D), had gone high-resistance. **M.M.**

Philips G110 Chassis

One of these sets suffered from a very intermittent fault – it would just go dead, with no LED indication at the front. I resoldered a number of suspect dry-joints, and of course with the back off and the chassis in the service position the fault would not show up. Finally, on the third visit and after very close inspection, I spotted what appeared to be a poor connection between the rivet and the PCB land at pin 18 of the LOPT. Observation in darkness then revealed some arcing. Resoldering provided a complete cure – pin 18 is the connection to the line output transistor. **M.M.**

Sony AE1C Chassis

There was sound but no raster. Checks showed that the resistor and rectifier diode in the tube's first anode (G2) supply were OK, and when the control was advanced a raster with green channel information appeared. Scope checks confirmed that video was reaching the TDA4580 colour signal processor chip IC301, so I fitted a replacement. Fortunately this cured the fault – after resetting the A1 control. **M.M.**

Matsui 2050

This old set is a Toshiba clone. The complaint was very poor, distorted sound. Some improvement was obtained by replacing the TDA1015 audio output chip, but the real cause of the trouble was the loudspeaker, which is no longer available. A friend was able to supply a suitable replacement that came from a Bang and Olufsen set. One could even say that the results obtained were better than new! **M.M.**

AN240 = 150
AN316 = 390
AN3301K = 350
AN5015 = 250
AN5256 = 150
AN5512 = 100
AN5515 = 160
AN5321 = 100
AN5615 = 300
AN5701 = 150
AN5900 = 130
AN6612 = 080
AN7178 = 180
AN8377 = 400
BA3812 = 080
BA5115 = 075
BA5402 = 180
BA5406 = 180
BA6222 = 100
BA6235 = 050
BA6247 = 130
BA6248 = 150
BA7258 = 300
BA7751 = 125
BA2751S = 1450
CNX62A = 080
CNX82A = 060
CNX83A = 080
CNYIT = 225
DPY2540 =
HA1137 = 150
HA1199 = 130
HA1377 = 140
HA11215 = 299
HA11847 = 700
HA11351 = 765
HA11412 = 600
HA11702 = 300
HA11720 = 650
HA11744 = 330
HA12005 = 180
HA12411 = 575
HA13002 = 200
HA13118 = 140
HA13119 = 140
HA13151 = 800
HA13155 = 900
HA17384 = 200
KA2206 = 150
KA9257 = 120
KIA6210 = 400
KIA6281 = 250
LA 1180 = 075
LA1235 = 130
LA1260 = 075
LA1369 = 200
LA3155 = 175
LA3241 = 105
LA3400 = 250
LA4108 = 125
LA4178 = 150
LA4200 = 350
LA4275 = 200
LA4280 = 250
LA4282 = 350
LA4440 = 200
LA4445 = 200
LA4446 = 170
LA4498 = 275
LA4557 = 150
LA4700 = 350
LA5601 = 110
LA5700 = 300
LA6510 = 150
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STA901M = 310
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STK011 = 895
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STK441 = 650
STK457 = 470
STK463 = 750
STK561 = 450
STK563 = 415
STK583 = 500
STK2125 = 575
STK2240 = 700
STK3082 = 550
STK4017 = 400
STK4060 = 1510
STK4211/2 = 600
STK4211/V = 800
STK4362 = 450
STK4392 = 500
STK4773 = 820
STK4833 = 650
STK5324 = 450
STK5335 = 750
STK5337 = 500
STK5361 = 375
STK5431 = 1250
STK5441 = 400
STK5461 = 500
STK5466 = 500
STK5471 = 630
STK5478 = 380
STK5481 = 470
STK5725 = 450
STK6932 = 725
STK730-060 = 645
STK73907 = 599
STR450 = 700
STR1195 = 350
STR2105 = 550
STR3215 = 275
STR6020 = 270
STR10006 = 450
STR11006 = 325
STR20015 = 450
STR40090 = 350
STR44115 = 475
STR50020 = 350
STR50092 = 260
STR50103A = 260
STR50115 = 500
STR53041 = 400
STR54041 = 320
STR56041 = 850
STR58041 = 250
STR81159 = 400
STRD1806 = 360
STRD4412 = 400
STRD4420 = 550
STRD5441 = 400
STRD6001 = 515
STRD6108 = 450
STRD6602 = 400
STRD6802 = 375
STRM6545 = 775
STRM6546 = 795
STRM6549 = 725
STRM6559 = 900
STRS5701 = 1700
STRS5717 = 500
STRS5741 = 600
STRS5942 = 700
STRS6307 = 450
STRS6309 = 550
STRS6525 = 1350
STRS6545 = 725
STRS6707 = 800
STRS6708 = 550
STRS6909 = 550
STRZ2152 = 1000
STV2110B = 685
STV9379 = 400
STV9379F = 415
TA7075 = 300
TA7145P = 400
TA7210P = 200
TA7248P = 575
TA7271P = 220
TA7299P = 200
TA7318P = 490
TA7324P = 050
TA7401P = 250
TA7609AP = 170
TA7616P = 300
TA7636P = 400
TA7658P = 100
TA7680AP = 275
TA7691P = 165
TA7698AP = 400
TA7719P = 200
TA7743P = 600
TA7772P = 140
TA8111AP = 210
TA8200AH = 325
TA8210AK = 275
TA8205AH = 220
TA8210AH = 265
TA8211AH = 200
TA8215AH = 300
TA8220H = 500
TA8227P = 215
TA8238K = 200
TA8403K = 250
TA8427K = 350
TA8449P = 375
TA8611AN = 025
TA8631N = 415
TA8690AN = 700
TBA120T = 030
TBA130-2 = 1299
TBA750C = 150
TBA820M = 035
TBA990Q = 200
TCA650 = 250
TD6359P = 600
TDA1012 = 120
TDA1013A = 110
TDA1022P = 330
TDA1035 = 799
TDA1044 = 110
TDA1054 = 180
TDA1062 = 140
TDA1085C = 270
TDA1170N = 135
TDA1170N-TFK = 850
TDA1170S = 135
TDA1220A = 550
TDA1327 = 200
TDA1412 = 085
TDA1589 = 275
TDA1771 = 200
TDA1904 = 199
TDA1908 = 299
TDA1905 = 080
TDA1950 = 175
TDA2004 = 150
TDA2008 = 100
TDA2161 = 590
TDA2504 = 200
TDA2530 = 300
TDA2542 = 215
TDA2546A = 950
TDA2556 = 230
TDA2560 = 899
TDA2577A = 200
TDA2578A = 225
TDA2579A = 210
TDA2581 = 100
TDA2600 = 400
TDA2611A = 100
TDA2640 = 350
TDA2680 = 1299
TDA2700 = 550
TDA2790 = 400
TDA2820M = 100
TDA3190 = 375
TDA3500 = 525
TDA3505 = 275
TDA3530 = 365
TDA3562A-ST = 525
TDA3562A-PHI = 525
TDA3565 = 220
TDA3566 = 300
TDA3580 = 499
TDA3645 = 385
TDA3653B = 250
TDA3654 = 080
TDA3654Q = 080
TDA3827 = 200
TDA3858 = 500
TDA4050 = 145
TDA4228T = 360
TDA4420 = 120
TDA4439 = 220
TDA4442 = 240
TDA4427 = 899
TDA4443 = 250
TDA4480 = 280
TDA4500 = 300
TDA4503 = 250
TDA4505A = 300
TDA4505E = 400
TDA4505K = 450
TDA4556 = 370
TDA4560 = 270
TDA4568 = 300
TDA4600-2 = 160
TDA4600-2D = 260
TDA4601 = 120
TDA4605 = 190
TDA4605-2 = 395
TDA4605-3 = 395
TDA4610 = 685
TDA5660 = 250
TDA5820 = 400
TDA6101Q = 215
TDA7000 = 170
TDA7056 = 200
TDA7222 = 100
TDA7245 = 350
TDA7250 = 400
TDA7251 = 400
TDA7255 = 400
TDA7273 = 080
TDA7350 = 300
TDA7385 = 900
TDA8138 = 200
TDA8140 = 200
TDA8145 = 120
TDA8171 = 200
TDA8175 = 450
TDA8177 = 215
TDA8190 = 299
TDA8215B = 225
TDA8304 = 400
TDA8349 = 350
TDA8350Q = 399
TDA8351 = 200
TDA8370 = 1125
TDA8376 = 1200
TDA8380 = 200
TDA8391 = 675
TDA8421 = 500
TDA8443 = 295
TDA8540 = 215
TDA8568Q = 695
TDA8709 = 600
TDA9045 = 1350
TDA 9102C = 250
TDA9610H = 1185
TDA9860 = 500
TEA1002 = 650
TEA1015 = 300
TEA1035 = 200
TEA1061 = 250
TEA2014 = 080
TEA2018A = 110
TEA2019 = 1550
TEA2026CV = 650
TEA2029CV = 400
TEA2031A = 125
TEA2164 = 160
TEA2260 = 225
TEA2261 = 345
TEA2262 = 350
TEA5170 = 140
TEA5581 = 200
TEA5701 = 650
TEA6101 = 550
TEA6417 = 600
TEA8170 = 240
TFMS1380 = 085
TFMS5300 = 170
TFMS5360 = 170

Answer to Test Case 435

– see page 323 –

Two faults for the price of one this month. It's quite a common situation in the service trade these days!

The first fault, no-go, occurred when the HT voltage rose excessively, reaching the breakdown voltage of the 130V avalanche diode ZD952. At this point the set tripped back to standby. The two faulty components were in the error detector circuit: the 1kΩ skeleton potentiometer VR951 (HT preset) and the 6·8V reference zener diode ZD951. Standard stuff. With earlier Hitachi sets that use this circuit the 39kΩ fixed resistor in series with the preset usually causes the trouble, but in this particular version it's the preset itself that causes problems.

The second problem was a quite different kettle of fish, to do with the user software. Perhaps a bit more thought, together with a knowledge of the set's features and its previous location (at a bankrupt bed-and-breakfast in Walmington-on-Sea), might have produced the answer. But it didn't occur to TechnoCrat – nor to Sage, Television Ted, Service Manager or the others. Why would you want to restrict the maximum volume setting and prevent the user messing about with the tuning? In a hotel situation, perhaps?

And that was it: the set was in the hotel mode. The problem was solved once we had the comprehensive service-mode instructions that Hitachi faxed to us.

NEXT MONTH IN TELEVISION

PC Operation and Repair
The hundreds of thousands of PCs in offices, homes and elsewhere represent a substantial source of servicing and repair business. You need to know how a computer's hardware and software operate, what can go wrong, and how to go about testing. K.F. Ibrahim starts a new series that provides practical guidance.

Short Locator
A short locator is particularly useful when dealing with bussed-IC failure. Adrian Spriddell has devised a simple tester circuit that works well.

Setting up as an ASC
As a manufacturer's Authorised Service Centre you will recieve a steady work flow. This calls for investment and careful planning. Cliff Martin describes what's involved.

Servicing Hitachi 46TN Series TVs
John Coombes provides a fault-finding guide for the Hitachi Models C2146TN, C2546TN and C2846TN, which first appeared in 1995.

Toshiba Service Briefs
More know-how from Toshiba Technical.

Plus all the regular features

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Digital TV

According to GfK Marketing Services 170,000 digital satellite set-top boxes (SkyDigital and ON digital) were sold through retail outlets during the period October 1st-December 26th. Only 14,000 analogue satellite seceivers were sold during the period. Pace, which has returned to profitability, has announced that it expects to cease production of analogue receivers very shortly. Pace, Amstrad, Grundig and Panasonic are now producing Sky digiboxes while Pace and Philips have ON digital STBs in production.

There is some confusion over the compatibility status of the IDTV sets launched by Hitachi and Sony. It relates to the smart-card reader that will enable the sets to receive ON digital's subscription service. Philips has launched an IDTV receiver with a built-in ON digital smart-card reader, but the Hitachi and Sony sets were launched without the readers, which are not required for free-to-air reception. Card readers are expected to become available mid-year. ON digital says there is no guarantee that when they arrive they will be compatible. Hitachi says they will be.

ON digital has been warned by the ITC about its lack of teletext services. The problem relates to the software required to deliver teletext and is expected to be resolved shortly. SkyDigital transmits teletext alongside the MPEG video and sound, the STB converting it to conventional vertical blanking interval teletext for decoding in the normal way. ON digital's system will provide much higher-quality graphics, but requires a separate dedicated channel.

Interactive TV

NTL has launched its Internet-TV service, which enables viewers to explore the internet via their TV sets. The new £15 a month service is provided via a rented set-top box manufactured by the Taiwanese computer company Acer. It provides internet access plus e-mail and telephony facilities. The service will subsequently be upgraded to provide digital terrestrial TV channels and interactive operation. Telephone charges are extra. The system is based on the TV Navigator software developed by Network Computer Inc., a Californian company whose investors include Oracle, Netscape Communications, Acer, NEC, Nintendo, Sega and Sony.

Microsoft is to invest some £300m in NTL to accelerate the use of high-speed voice, data and video services in the UK. Microsoft has also bought a stake in United Pan-European Communications (UPC), Europe's largest private cable TV operator.

Front Row, the pay-per-view service established by UK cable companies NTL, Telewest and Diamond Communications, has launched a pay-per-view boxing service as a follow-up to its PPV movie service. Front Row is available to about 1·5m cable subscribers.

Berlin Radio Show

This year's Berlin Radio Show, more correctly known as Internationale Funkausstellung '99, will be held at the Berlin Exhibition Grounds from August 28th to September 5th.

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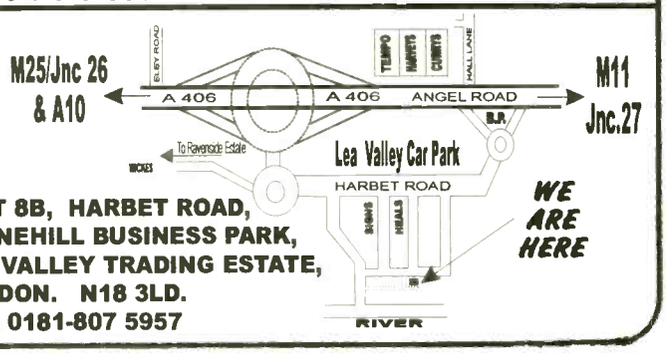

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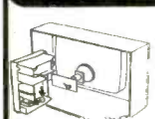

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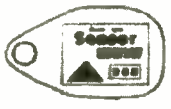

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You should have a basic knowledge of electrical wiring and experience in the installation of audio-visual products.

Service experience would be an asset but not essential.

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You should have a wide experience of servicing audio/visual equipment. Qualification required City and Guilds 224 or equivalent.

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MISC

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I enclose herewith cheque/PO for

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Please debit my Access, Visa or Switch account as below:

Card Number

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Melton Mowbray
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