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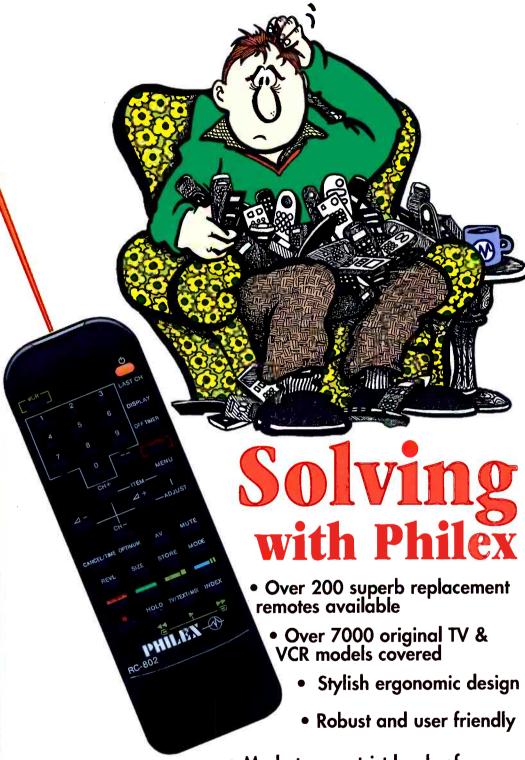
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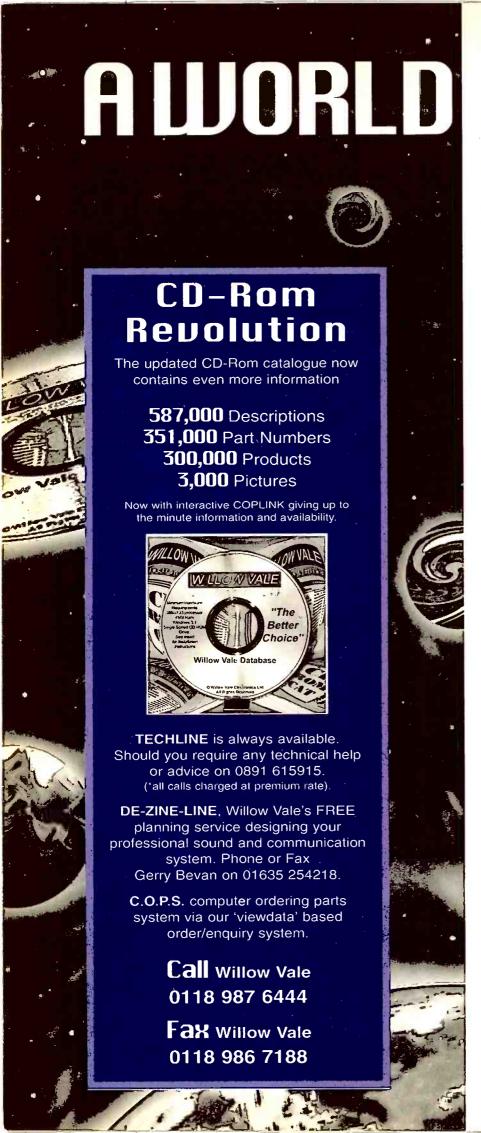
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If it takes three men four days . . .

Maths has never been my strong point, to put it mildly. It all started at school, when I was presented with this book which had rows of apples, green ones. You had to count them and enter the total at the right-hand side. This was soon mastered. Then subtraction came. How can you take one apple from another? Are there negative apples, sort of anti-apples, and what do they do to your everyday ones? One had to think of them as being in a basket, with some being removed and set aside. This approach is of limited usefulness however. Multiplication and division followed, which meant further problems.

Then, one day, a maths master presented us with a problem we were supposed to be able to answer. If it took three men four days to dig a trench 200 yards long, how long would it take seven men to dig a trench 350 yards long? Or something like that. A dirty, underhand question to ask I'd say. Anyway I sat there, puzzled. I had this picture of the three men, in their cloth caps etc. One was resting on his shovel, lighting a fag. Another was rummaging around looking for something he'd dropped. The third, if I recall correctly, was opening his sandwiches and pouring a mug of tea (not at the same time, you understand). How was I supposed to know how long it would take them or the other lot to do anything at all?

After a while there were stirrings in the class. Someone had an answer! Then others. Some were actually correct. Meanwhile I sat there flummoxed. A vital piece of information was missing. Did the diggers all put in the same amount of work? We'd not been told that. Some must have inferred that they did, which is illogical, since it was not implicit in the question as

asked. So what we should have been asked is "given that a digger removes a set amount of earth a day . . ." But that was not the end of the matter. Oh no.

While excavating a trench, you might well come across an obstacle which would involve digging beneath or around it. That would take extra time. And you couldn't assume that the length of the trench to be dug would consist of the same type of material throughout. Some sections would probably be harder to dig than others. So the question should have been "given that a digger removes a set amount of earth a day, and that the earth is of given consistency and there are no unforeseen obstacles . . ."

What about the weather? Trenches are generally dug outdoors. Suppose there was a downpour? You'd have to stop digging, then maybe take steps to remove the water from the trench. Get buckets and so on. After all you are digging a trench, not a canal or a river. I had assumed that pipelaying was the object of the exercise, or maybe digging foundations. You don't dig a trench for the sake of it, unless, perhaps, you are a maths master.

Suppose one of our diggers broke his spade? It happens. He might have had to wait a day for a replacement. Done a bit of tidying up perhaps. This would have affected the outcome.

There are possibly other factors that might have affected how things went, making a comparison between our first gang of three diggers and the second of seven difficult to assess. But of course you weren't supposed to be looking at things in this sort of way in a maths class.

There is a little moral in this: that there are different ways of doing things and

different types of learning. In electronics for example you could concentrate on network calculations and other such delights, or perhaps on component failure mechanisms say. Quite different matters. To be competent in the electronics field you need to know a bit about both of course. But there is learning to pass exams, which is based on the theory that someone at some time thought relevant to the curriculum concerned. And there's learning how to cope with everyday problems, which is what our NVQs are supposed to be all about. In both cases it's difficult for education authorities to get the right balance of what to include.

It is also difficult to know what to keep in a syllabus. We don't need to know much about valves now, except for the CRT. What about tuned circuits, which could once occupy a lot of time? Since little bits of resonant ceramic or a surface-wave acoustic filter will do most of what we might want, it is hardly necessary to have a detailed knowledge of resonant circuit theory. But at least, in electronics, we don't have to worry about men digging trenches!

If you want to know in which way your mind tends to work, try the famous butter test. The question is: how many sides are there to a pack of butter? Some of us will concentrate on the butter, thinking of a yellow pack, then counting the sides. Or maybe we'd see a silver or gold pack, with Wheelbarrow or something written on it. Others realise straight away that the butter is irrelevant. The pack is a cube, and a cube has six sides. Forget the butter! For those of us who can't, life can be perplexing. I wonder who makes the better diagnostician?

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2SB1143	0.77	2SD1651	2.38	BC212B	0.19	BD902	0.60	BY133	0.08	FXT749	0.43		10.70	TDA2005 TDA2006	1.83 1.06	TIP120 TIP122	0.40 0.40
2SB1243	0.60	2SD1858	0.43	BC212L	0.18	BD911	0.52	BY206	0.20	HA13001	3.85	SL1430	1.92	TDA2006	0.91	TIP2955	0.40
2SB560 2SB643	0.43 0.29	2SD1877	2.14	BC237	0.12	BDT64C	1.18	BY227	0.13	HA13119	2.05	SL1431	2.82	TDA2030V	1.46	TIP29E	0.77
2SB647	0.29	2SD1878 2SD1879	2.63 3.16	BC237B BC238	0.19 0.11	BDT65C BF194	1.68 0.22	BY228 BY2291000	0.26 1.31	HA13151 HA51338SP3	13.20 3 7.69	SN74141N STK4132II	0.17 10.00	TDA2050	4.56	TIP3055	1.08
2SB649A *	0.77	2SD1884	3.35	BC238B	0.16	BF195	0.07	BY255	0.14	HM6251	14.32		10.23	TDA2270	12.08	TIP31A	0.36
2SB688	1.61	2SD1887	3.56	BC307	0.06	BF197	0.18	BY299	0.18	ICH28I	0.26	STK4142II	9.40	TDA2540 TDA2541	1.29 1.12	TIP32C TIP35C	0.40 1.82
2SB698	0.35	2SD288	0.85	BC307B	0.15	BF199	0.18	BY397	0.20	IR9594	15.79		10.95	TDA2577A	3.45	TIP41C	0.65
2SB716 2SB772	0.43 0.50	2SD350A	1.97	BC308	0.09	BF258	0.04	BY398	0.16	IRFBC40	5.98		14.64	TDA2578A	3.20	TIP42C	0.52
2SB774	1.61	2SD381 2SD400	1.66 0.34	BC308A BC308C	0. 09 0.26	BF420 BF421	0.21 0.24	BY399 - BY448	0.12 0.30	KIA6210AH LA4270	6,15 2.73	STK5332 STK5342	2.82 4.07	TDA2579A	4.91	TIPL761A	1.85
2SB891	0.60	2SD401A	0.77	BC309B	0.10	BF422	0.19	BYD14J	0.35	LA4280	3.12	STK5372H	6.84	TDA2581Q TDA2582	2.57 3.85	TiPL791A TL072CP	1.25 1.03
2SB892	0.35	2SD468	0.28	BC327	0.10	BF423	0.14	BYD33D	0.12	LA4282	5.11	STK5421	9,52	TDA2593	1,12	TMP47C432	
2SC1008	0.24	2SD667	0.38	BC328	0.14	BF459	0.43	BYD33J	0.16	LA4445	3.45	STK5481	8.12	TDA2600	7.69	1111 470432	15.19
2SC124	0.48	2SD669A	0.64	BC337	0.14	BF471	0.37	BYD33M	0.26	LA4460	2.50	STK7253	7.69	TDA2611A	0.64	TMP47C434	IN3537
2SC1318 2SC1473	0.19 0.21	2SD718 2SD756	1.90 0.47	BC338 BC368	0.06 0.18	BF487 BF491	0.57 0.41	BYV10-40 BYV95B	2.55 0.21	LA4700 LA6324	4.27 2.05	STK7308 STK7348	6.41 5.74	TDA2611AQ	1.32		15.22
2SC1573	0.52	2SD837B	1.12	BC369	0.18	BF494	0.12	BYV95C	0.21	LA6510	2.94	STR11006	7.37	TDA2653A TDA3190	4.70 2.05	TMP47C434	N3555 16.63
2SC1675	0.14	2SD856	0.79	BC372	0.53	BF759	0.38	BYV96D	0.27	LA7830	1.88	STR4211	9.40	TDA3190	14.21	TPU2732	10.05
2SC1685	0.21	2SD882	0.43	BC546A	0.11	BF869	0.38	BYV96E	0.53	LA7832	2.40	STR50020	9.38	TDA3505	2.40	U2829B	3.40
2SC1740	0.16	2SD898B	6.41	BC546B	0.12	BF871	0.41	BYW56	0.31	LA7835	2.99	STR50103	4.48	TDA3560	6.13	UC3842	1.46
2SC1815Y 2SC2001	0.11 0.23	2SD965 2SD965R	0.67 1.05	BC547 BC547A	0.11 0.04	BF959 BF960	0.18 0.30	BYW95C BYW96E	0.21 0.50	LA7837 LC7132	4.19 4.70	STR50103A STR54041	5.56 5.15	TDA3561A	3.85	UC3844	1.20
2SC2023	3.18	2SK1117	3.40	BC547B	0.11	BF970	0.43	BYX55600	0.30	LED3G	0.10	STR54041	4.02	TDA3562A TDA3565	4.62 2.74	UC3844N UPC1318AV	1.91 3.85
2SC2073	1.03	2SK1118	3.40	BC548	0.11	BFR90A	0.68	BZV10	1.34	LED3R	0.10	STR58041	3.42	TDA3566	6.41	UPC1365C	1.70
2SC2078	1.00	2SK30A	0.35	BC548A	0.11	BFY51	0.39	BZV85C5V1	0.15	LED3Y	0.10	STR59041	8.11	TDA3576B	10.31	UPC1378H	1.71
2SC2120 2SC2229	0.23 0.31	7407 74HC04	0.69 0.88	BC548B BC548C	0.06	BR100	0.18	BZX6110	0.16	LM317T	1.29	STR6020	6.07	TDA3592A	4.60	UPC1394C	1.92
2SC2229 2SC2230	0.31	74HC04 7805	0.88	BC548C BC549B	0.14 0.11	BR103 BRX44	0.62 1.02	BZX6111 BZX6112	0.10 0.13	LM324N LM339N	1.48 0.50	STRD1816 STRD4420	7.69 10.64	TDA3640 TDA3650	5.98 11.04	UPC1488H UPC1498H	2.99 2.31
2SC2235	0.36	7806	0.60	BC550B	0.16	BRX49	0.43	BZX61120	0.13	M494B1	11.85	T9053V	1.35	TDA3653B	1.54	UPC574J	0.86
2SC2236	0.36	7809	0.69	BC550C	0.09	BRY55	0.28	BZX6113	0.11	M5218L	0.69	T9064V	1.87	TDA3653C	2.82	X2402P	5.78
2SC2240	0.21	7812	0.52	BC556A	0.11	BSX20	0.35	BZX6116	0.19	M54544L	2.04	TA7120P	0.66	TDA3653CQ	2.57	ZTK33B	0.28
2SC2271	0.67	78L05	0.35	BC556B	0.14	BT139600	1.29	BZX6120	0.19	M58655P	4.96	TA7280P	2.74	TDA3654	1.44	ZTX650	0.51

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TELETOPICS

The Analogue TV Switch Off

Details of a report being prepared for the Department of Culture, Media and Sport by research consultancy Nera on the costs involved in an analogue TV signal switch off in either five, ten or fifteen years are expected to be published shortly. A consultation paper will be published at the same time, to enable consumer groups and industry bodies to contribute to the discussion on when to switch the signals off.

Television companies involved in the launch of digital terrestrial TV (DTT) next year would like the government to announce a firm date for the end of analogue TV as soon as possible. When the switch off occurs, viewers will have to buy a digital TV set or a

digital set-top adaptor – the government does not want to get involved in any sort of digital TV equipment subsidy. It is hoped that the announcement of a firm date will encourage viewers to buy more expensive digital TV sets when their present analogue ones need replacement. Public uncertainty could have an adverse effect on trade by postponing buying decisions.

The start of DTT next year has already been delayed as a result of the ITV deferring the award of licences. Instead of a July launch, in time for the 1998 World Cup, October is now the most likely date for the start of DTT. British Digital Broadcasting is still drawing up digital receiver/set-top

box specifications for manufacturers. Meanwhile European broadcasters, technology groups and regulators have agreed to work on a single set-top box standard that will cover the TV signal, interactive multimedia services and the internet. The aim is to produce a reference design with a common application programming interface (API), electronic programme guide (EPG) and a common interface for conditional access (CA).

The US government announced earlier this year that analogue TV transmissions would end in nine years' time. Since then however Congress has attached a number of conditions that could delay the switch off.

Flat-screen Displays

There have been a number of flat-screen display developments recently. Sony, Philips and Sharp have jointly developed a 42in., wideviewing angle, flat-panel display that uses Plasma Addressed Liquid Crystal (PALC) technology. It has an active-matrix LCD with Axially Symmetric-aligned Microcell mode (ASM) technology. The latter increases the viewing angle without affecting the contrast – by aligning the liquid-crystal material to each pixel in an axially-symmetrical

manner. The display has 16-bit colour resolution (16.77 million colours), a 16:9 aspect ratio, a contrast ratio of 100:1 and a viewing angle of 140°. There is no information yet on when a commercial version of the display will become available.

NEC has brought into production a 50in. plasma display (see picture) that's intended for the highdefinition TV market. The Hi-Vision PlasmaX panel, which has a onemillion pixel capability, will go on sale in Japan next February to coincide with the HDTV coverage of the Nagano Winter Olympic Games. Sets that use the display are likely to cost around 2.7m yen (some £13,000).

Hitachi has developed a 41in. colour plasma display that's aimed at the business market. It has a contrast ratio of 300:1 and a viewing angle of 160°. Weight is 37kg, with a built in power supply but not including the stand. There are no price details.

Toshiba has announced the world's first 12·1in. thin-film transistor (TFT) LCD panel that uses low-temperature polysilicon technology. This enables the drivers to be formed directly on the LCD substrate, reducing the component count by up to 40 per cent in comparison with a typical amorphous silicon TFT LCD. Production of the new display is likely to start towards the end of 1998.

Samsung has produced the world's first 30in. single-glass UXGA TFT LCD panel. Its UXGA resolution is 1,600 x 1,200 (red, green, blue). Weight is 4-5kg, thickness 4-5cm, power consumption 45W. Samsung sees it as a competitor to large plasma displays and says that the technology could stretch to 40in.



Designed by renowned Japanese interior designer Motomi Kawakami, the first "Hi-Vision" high-definition PlasmaX television is also the world's slimmest. Pixel pitch has been reduced from 1.08 to 0.81mm: over a million pixels are displayed. Compared to the previous PlasmaX, which was announced last February, this latest model is 10mm slimmer at 89mm.

DVD Technology

The DVD Forum, led by Toshiba, Matsushita and Hitachi, has demonstrated DVD-R (write once) and DVD-RAM (rewritable) discs and drives and published fresh specifications. The DVD-R disc, which is intended mainly for data archiving, has a capacity of 3.9Gbytes – a 4.7Gbyte version is under development however. While the DVD-RAM version 1.0 has a capacity of 2.6Gbytes per side, a prototype 4.7Gbyte version was demonstrated at the DVD conference in Berlin last October.

Phase-change technology is used to write and erase data with a DVD-RAM. The read/write laser light has a wavelength of 650nm, a lens with a numerical aperture of 0.6 being used. The data bit length is 0.41-0.43 microns, the track pitch being 0.74 microns. Draft approval of the DVD-RAM specification by the European Computer Manufacturers Association is expected next summer.

Toshiba points out that the longer-recording DVD-RAM disc will be able to store two hours of MPEG-2 video per side. With the development of low-cost, one-chip

encoders, expected to be available by 1999, this would lead the way to DVD home video recorders.

Cirrus Logic has launched what it claims is the first multi-standard, multi-channel audio decoder for consumer DVD players. Known as the CS4925, the decoder provides both Dolby Digital (AC-3) and MPEG-2 5.1-channel sound. It will sell to manufacturers at approximately \$15 in lots of 100,000.

Matsushita has revised downwards its forecast for first-year total worldwide DVD player sales. Initially sales were expected to be around two million units. The revised forecast is below one million units.

Six of the ten companies that hold patents on the initial DVD technology are to start a joint licensing operation, providing new entrants to the field with a one-stop shop for DVD technology. It's being run by Toshiba. The royalties are expected to amount to some four per cent of the cost of a DVD player and seven and a half per cent of the cost of a disc.

Willow Vale Electronics has been appointed national distributor of Wallis Universal CTV remote control units to the independent retail trade. These new handsets incorporate a microchip that gives operation with most well-known brand TV sets with no need for coding or programming - they are brand matched rather than being matched to particular model numbers. Thus one unit covers one brand, with no need to search for codes.

The Wallis range being handled by Willow Vale provides low-cost replacements for Blaupunkt, Hitachi, Panasonic, Philips, Sony, Grundig, Nokia, Mitsubishi, Samsung, Sanyo, Toshiba and many other premium brands.



Parts Ordering Technology

A survey of more than 2,000 independent electrical retailers across the country has shown that while most of them are aware of the benefits that can be obtained from the use of a professionally produced CD-ROM catalogue only a tiny majority have ever used the internet or bothered with e-mail facilities.

The survey was undertaken independently by Marvyn Hamlyn Reasearch of Peacehaven, Sussex (phone 01825 768 876) and came up with many interesting facts,

including the following. While more than 60 per cent of dealers use a PC, more than half of them don't have a call-based management system. 75 per cent of dealers prefer traditional accounts with distributors or manufacturers. More than 50 per cent prefer to use the phone for ordering: 24 per cent use viewdata, 23 per cent use faxes and two per cent use e-mail. Only one per cent had ever used the internet.

There was a 50:50 split on the acceptability of pattern parts: more than one in four said they would buy

pattern parts if the original ones were not available, while half said they could never buy pattern parts under any circumstances. On service back up, more than 40 per cent said telephone advice was vital and 30 per cent said that a catalogue was indispensible.

And their preferred trade magazine? Well *Television* of course! Over 50 per cent said that they read *Television*, higher than any other title. Good going, especially as the survey covered white goods, brown goods and mixed dealerships.

Community TV

A number of local TV companies have shown keen interest in setting up broadcasting services within cities, using a sixth terrestrial channel. The ITC has received 31 applications for two-year franchises to run such local community services. Those awarded a franchise will pay £4,200 for the use of a frequency not assigned to one of the main broadcasters in the area, plus the full transmission costs.

ITC's chief executive Peter Rodgers says that the commission

is "greatly encouraged by the number of applicants for this new and as yet untried form of television".

Correction

According to VideoPlus maker Gemstar, 80 per cent of all VCRs sold now include VideoPlus as a built-in feature. By the end of the year, two million more households in the UK will have VideoPlus technology available – the total number of UK households with VideoPlus will then be nearly ten million. Figures for VideoPlus De

Luxe, which is a new feature, are not yet available.

There was some confusion between VideoPlus and VideoPlus De Luxe in our video news item in Teletopics, October.

Teletest PC Competition

We are pleased to announce that Reza Hughighat Kish of Richmond, Surrey won the Ozan Teletest PC competition featured in our September issue (page 825). The competition produced a record number of entries.

Obituary

We regret to report that after a long illness Gordon Williamson recently lost his battle with cancer. He was well known to and respected by dealers in the Midlands area from his days with Philips. Subsequently he ran his own business in Birmingham. He will be remembered for his sense of humour and his everlasting store of jokes, and will be sadly missed by his friends and colleagues. Our best wishes go to his widow Betty, daughter Dawn and son Derek. P.B.



Reports from **Brian Storm and** David C. Woodnott

Panasonic NVR50

This C-cassette model incorporates a colour viewfinder. The problem was erratic colours, sometimes all red and sometimes covered with lines. On test we found that the fault could be cured by moving the viewfinder. The cause of the trouble was eventually traced to a hairline crack across the ribbon cable between the viewfinder and the main PCB. Its part no. is VWJ0739. B.S.

Sony CCDF555E

The complaint with one of these camcorders was "striations on the viewfinder picture". Replacement of C909 (1µF) on the electronic viewfinder PCB cured the fault. A general service completed the repair. D.C.W.

Canon UC40HiE

No eject was the complaint with this recent slimline model. There was a tape in the mechanism. When the eject button was pressed the mechanism shuffled then returned to its initial state. With units that use this mechanism it's fairly common for the supply reel spindle to become bent. This leads to various mechanical faults such as no tape eject, stopping in any mode with "eject" flashing in the viewfinder, and excessive back tension (because the underside of the reel is in continuous contact with the chassis). In this case however the reel spindle was OK.

The cause of the trouble was a faulty capstan motor FG sensor.

Camcorner

The point worth noting is the apparent reason for its failure. When we removed the motor and inspected it under a microscope we could see that the surface of the sensor was scored across in the direction of motor rotation. Grains of sand were evident: they were stuck to the sensor - and everywhere else! A new motor cured the

Since that first one we have had two similar models in with failed capstan FG sensors, both with score marks across the surface and evidence that sand/grit was the cause. One of them had come in because of a detached grip strap and worked all right until it failed during a soak test! Life isn't fair, is it?! We had to replace this one FOC, but have now learnt to inspect and clean the sensor unit whenever we get one of these units in for repair. This avoids similar, expensive problems. D.C.W.

Sony CCDTR305E

The customer thought that his handycam's on/off switch was faulty and was pleased when we agreed with his diagnosis. He wasn't quite so pleased at the cost! The complete operation assembly (switch block control), which includes the aforementioned switch, was required. The fault symptoms were as follows: no camera power up; power up in the VTR mode OK but no functions available. D.C.W.

Canon E600E

This fairly recent model (July 1992) displayed the all too familiar capacitor leakage symptoms we have experienced with earlier Canon models (E60E etc.), i.e. intermittent playback colour and so on. Internal inspection revealed that we would have to replace a total of 48 capacitors to avoid subsequent failure - they were all showing signs of imminent leakage. The estimate was accepted, and we completed the work successfully. It's worrying when such relatively new units suffer from this type of

We have since had others in the

range (E200 etc.) with significant capacitor failures. D.C.W.

Sony CCDV900E

This early Hi8 machine came in because it was "dead", which it certainly was! As I had not seen many of these camcorders I thought I'd try to save a bit of time by looking through my collection of fault reports from previous issues. I was not let down. A previous report (no on command to the DC-DC converter etc.) mentioned IC101 on board FP10P. A replacement chip cured the fault. Thank you whoever contributed that report!

I have since come across the same fault in other Sony camcorders (Model V600E) which use this chip in the same way, so it's

worth noting.

Another V900E came in recently because of intermittent iris operation, no autofocus and intermittent E-E pictures (vertical lines only, of the type you get when there is CCD or SSG drive failure). As anyone who has worked on the camera section of an early Sony camcorder will know, it can take a considerable time to get at the innards because various screening cans have to be unsoldered etc. When I was finally able to inspect the relevant PCBs I found that there was severe capacitor leakage.

A quick look at the mass of similar capacitors on the deck PCBs revealed the same state of affairs. We advised the customer that in our opinion repair was not worthwhile, because of the high risk of subsequent failure in almost any circuit area. Thankfully our advice was taken.

More and more models of all makes of this vintage are falling victim to the leakage problems so often reported in these pages. Because of the high cost of replacing maybe 80 or more components, and the risk of finding severely corroded print etc., we are reluctantly advising customers that to repair their 'old friends' is in no one's interest. Comments on this would be welcome. D.C.W.



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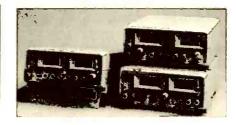
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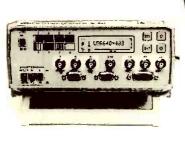
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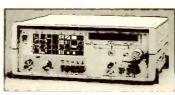


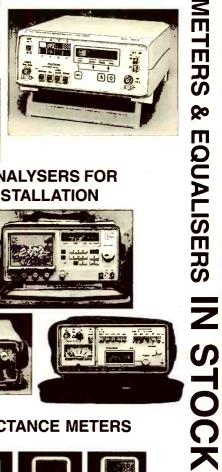
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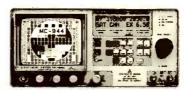






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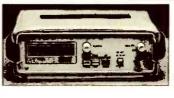














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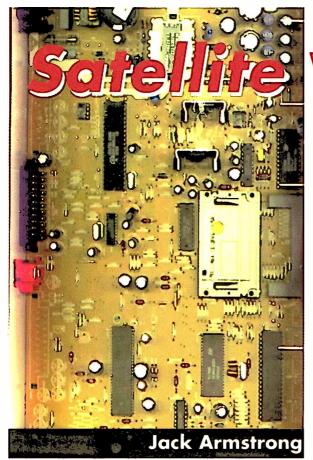
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Ferguson SRD6

Most mornings I nip out and have a cup of tea with Jerry at the local TV repair shop. As most of my business is with the trade, I can go for days without seeing a 'real' customer. Today, Jerry had a present for me. "An SRD6 from Tom" he beamed, "he'd like you to have a look as it." Tom repairs TVs and VCRs but works in the next town, so he and Jerry get along just fine. They both give me their satellite receivers to fix, unless it's a simple power supply repair.

I took the SRD6 back to my workshop and connected it up. The picture rolled and jumped. There were no decoder messages, and the unencrypted channel pictures looked dull – as if the contrast control had been turned down.

I had to turn the video level adjuster PV01, which is close to the tuner module, quite a long way anticlockwise before the picture stopped jumping. As decoder messages then reappeared, I inserted my card. The picture obtained was stable but very grainy, with some sparklies and a herringbone pattern for good measure. Although the picture was watchable – many undiscerning customers would have been happy with it – I knew that it was not as Ferguson had intended.

WORKSHOP

Besides, no one had been inside with a screwdriver, and the adjuster couldn't have slipped half a turn by itself.

I turned the adjuster back until the picture was again scrambled, then used the hairdryer to heat the area around the tuner. This restored decoder operation temporarily. A few electrolytics in this area were replaced, but there was no improvement. A more marked effect was obtained when the underside of the PCB was heated, so I came to the conclusion that the faulty component was probably a surface-mounted device. Use of freezer spray and the hairdryer confirmed my suspicions, but I was unable to pinpoint the item at fault. Then I had a brainwaye.

My desoldering station is made by a US company called Pace (no connection!). It's very robust and effective. One feature I'd never used before was the ability to blow instead of suck. I cleaned out the glass reservoir, then switched the iron to blow hot air. This airstream could be directed very accurately, and soon revealed the culprit - the BC858 transistor TV04, which is connected to PV01. I used a BC856B as a replacement, the nearest pnp-type transistor I had in the workshop. It restored the normal high-quality pictures.

Tom will be pleased, or maybe not – it's going to cost him half an hour's labour.

Pace PRD900

One of these receivers, which had come all the way from Manchester, had similar symptoms to the Ferguson SRD6. The owner thought that they were caused by the rain. When the rain finally stopped and the symptoms remained, he sent the receiver to me.

I put it on test and watched the rolling pictures, bemused. Despite the help of the excellent manual and the use of my oscilloscope, I was unable to trace the cause of the fault. So out came the hairdryer. By directing the warm air at the capacitors around the tuner, I was able to stop the picture rolling. Easy I thought, it's one of those electrolyt-

ics. Be fixed in a jiffy.

It wasn't! An hour later I was directing the hot air at the same spot, with the same result. But by now I'd replaced all the electrolytics in this area. Well, we all make mistakes. Then I realised that there was a significant time delay between directing the heat at the board and seeing the effect. The faulty part was underneath the board!

The only item in this area is the surface-mounted emitter-follower transistor Q100. A new FMMT2369A restored normal operation.

Amstrad SRD700

These receivers occasionally turn up dead. All that's needed is a new fuse and a new TOP202 chopper device. The one brought in by Charlie the butcher was not so easy to fix.

After scraping off a layer of dripping, I discovered that the 200V avalanche diode had also failed. Unhelpfully, the circuit diagram shows this as being a 5W, 300V diode. SatCure (01270 753 311) stocks the correct device however – it comes in the relevant repair kit – so all was not lost.

Once the receiver was up and running it exhibited more faults. The screen would sometimes blank out, or the picture would disappear in a mass of sparklies, or the receiver would refuse to come out of standby. The cause of all this was flux in the microcontroller chip's socket. I've come across the trouble in the SRD540 and similar models. A quick scrub with Isopropanol, using a toothbrush, restored normal working.

The Pace Prima

Four of these receivers arrived by Land-Rover from a retailer some miles away. He'd done a deal, swapping a 21in. Hitachi TV set for these "perfect working order" receivers. They looked perfect, but they didn't work.

The first problem was that none of them would respond to my remote control unit. Then I realised that I was holding an MSS type remote instead of a Prima RC10

type, which has identical looks.

The first receiver displayed the "no signal" message on a blue background. Audio was present when the channel tuning menu was selected (the audio mutes with a blue background). Close inspection showed that there was a dry-joint at L305.

The second receiver had similar symptoms, but there was no sound apart from a hiss. Channel changing produced pictures and sound with some of them. I found that the installation menu had been set for a "single" LNB, which seems to lock the LNB supply at 18V. Selecting "universal" restored correct operation.

The third receiver had no E-to-E, that is it didn't pass signals from the terrestrial aerial. I've had this problem with lots of MSS100 receivers. The cause is a static charge built up on the UHF aerial being discharged via the TDA8275 chip. In this case the electrical storm must have been a large one, because the 39Ω resistor in series with the chip's input was also open-circuit.

The fourth Prima was simply dead. It didn't light up, and there

were no outputs from the power supply. A new TOP202 chopper chip and 1 A fuse brought it back to life. I think the cause had been a mains surge.

Don't Call Me

Several people have phoned me at home recently, having been given my number by Erm. If I catch him I'll wring his neck.

I was just sitting down to my dinner when the telephone rang. It was a Plymouth number, according to the display. Thinking that it might be my sister, I picked up the handset and mumbled hello.

"Hi! I was given your number by erm . . . Anyway, I've got this bush."

"Sorry, I deal with satellite repairs. You want the Garden Centre."

"No, yes, that is Jack, isn't it?" "Ye-es" I replied, wearily.

"Ah good. I've got this Bush. A thirty five hundred I think. Same as a Pace six hundred."

"Six thousand?"

"Bless you. I had a cold last week. Yes, it's an ess ess six hundred. Anyway, it's dead. You can get the kits, can't you?" 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.

"It uses a transformer. It's not a chopper power supply."

"Right, a transformer. How much?"

"Well, I've got one in the workshop. You can have it for ten pounds. It's heavy, you see."

"Ten pounds?!"

"Includes carriage. Heavy you see. Long way to Plymouth."

"But I can get a second-hand receiver up the road for fifteen!"

I put the receiver down abruptly, and returned to my dinner. He probably thought that very rude of me. What I was about to suggest would have been more rude.

Test Case 420

Though they no longer have to do much in-depth diagnosis or repairwork in customers' homes, field technicians nevertheless have to be knowledgeable about many makes and types of equipment, and to know how to tune, set up and program anything from an audio stacker to a satellite receiver. Our first-line man is Doc Colin, whose initial meeting with Mr Greig and his Pace MSS500 satellite receiver turned out to be the first of several, as we shall see.

The start of the saga was a cry for help because of interference with UHF reception. When he called, Colin found that the UHF signals were fed to the TV set via the satellite receiver. There was patterning on the pictures. Satellite reception was OK, with no patterning - a scart lead was used for connection to the TV set with satellite reception. The trouble seemed to have started after an aerial rigger had called to improve Channel 5 reception - he'd been successful with this. Colin, who is experienced in this sort of thing, noticed that the severity and nature of the patterning changed when the satellite receiver was switched to standby; also, to a lesser extent, when certain satellite channels were selected.

It was not clear why the terrestrial UHF signal had been looped through the

satellite receiver when a scart link was in use for satellite reception. The level of interference was reduced when the UHF signal was fed directly to the TV set. It disappeared completely only when the satellite receiver's mains plug was withdrawn from the socket. Colin returned to his van and sat on its tailboard while he prepared an alternative lead. What sort? That's part of the question! This cured the interference problem. Mr Greig paid Colin's modest fee, and our man went on his way.

Two weeks later Colin was once more summoned to the Greig residence, this time because some of the satellite channels had gone missing – quite different programmes had replaced two of them, and these were covered with sparklies. In fact the satellite receiver had lost some of its memory. The Doc had to go into the installation menu to retune and store the lost channels and frequencies. There was little possibility of extracting a fee for this second call, which was done for free – as is so often the case.

A few days later Colin was exasperated to hear that "Mr Greig has been on the phone again". This time the Pace receiver had refused to come out of standby. The solution was simple: a mains reset was carried out by withdrawing the mains

plug for a few minutes then reinserting it. The box now powered up in response to the remote control command, and all the programmes were still stored. No charge again then, and Colin was soon off down the road to deal with "real" faults.

Three days later – you guessed it! – the sat-box was in trouble again. This time the surround-sound menus had disappeared. There were apparently no other symptoms. This fault was cleared by carrying out a 'factory reset', but Colin had decided to take the troublesome receiver back to the workshop. He'd gone armed with an identical receiver for loan to Mr Greig.

When it was back at the workshop we connected the MSS500 receiver to a dish and a TV monitor and left it to run on test, tuned to Sky News. Each day after that it was thrashed through all its channels and the menus were inspected. It responded correctly. After two weeks of this we removed its top and then tapped and flexed its PCBs, all to no effect. The receiver continued to perform impeccably for a further five weeks. It was time to return it to the customer - where Colin was in for a surprise. What was the root of the trouble, and what exactly did the Doc do on his first visit? For the solutions, turn to page 138.

Amstrad SRD510/520 Tuning Range Mod

Martin Pickering, B.Eng. describes a simple way of increasing the tuning range of these satellite receivers

> he Amstrad Model SRD510 has 99-channel capability with a full audio tuning range, but the actual channel frequency range is limited to 950-1,700MHz. By changing the microcontroller and EEP-ROM chips to those used in Model SRD540, 199 channels can be stored and an increased tuning range obtained in the on-screen menu. Unfortunately however the tuner module itself will go no higher than 1,900MHz, so with an enhanced (9.75GHz) LNB you still can't get Sky Sports 3.

> The solution to this problem came to me via e-mail from a clever young engineer in Poland. Tomasz Urbaniec runs his own repair business in Warsaw. He discovered that by simply removing and then resoldering one surface-mounted capacitor inside the tuner in a slightly different position you can shift the tuning range upwards. You might lose the German ARD channel at the bottom end of the range, but you will gain Sky Sports 3.

Procedure

This is not a job for the faint of heart – and it helps if you are short-sighted!

The modification is shown in the accompanying photographs (see Fig. 1), which identify the capacitor concerned before at A and after at B. Dismantle the receiver and carefully desolder the tuner module from the PCB. Lift off its side cover and look inside. Locate the varactor diode marked T3. Next to it there's a capacitor which sits between two ICs. Its value is 1nF. Touch both ends of this capacitor very carefully with a fine, hot soldering iron. Flick the capacitor off its solder pads and put it somewhere safe.

Use a sharp blade to scrape away the square solder pad

cuit, at an angle of 45°, by soldering one end of it to T3. The idea is to reduce the effective circuit reactance by a fraction. Use the bare minimum of solder, removing any excess with solder wick. If you lose or damage the capacitor, the replacement must be of identical size. A larger device simply won't work.

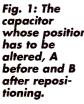
Replace the tuner and reassemble the receiver. Test it to ensure that it still works as before. Dismantle the receiver again and replace the microcontroller chip (the largest one) using type AM242306. A 40-pin socket would be a good idea. Remove the EEPROM chip, which is type 24C08 or 2856, and fit a 24C16 in its place. Reassemble the receiver and switch on.

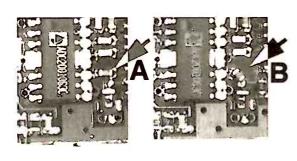
The red and green LEDS will come on for a few seconds while the microcontroller reprograms the EEP-ROM. I have occasionally had to perform a factory reset, which is done by pressing the appropriate handset button sequence - press OK, setup and status while in standby, holding the status button until both LEDs flash or 88 appears in the display. The receiver should now have 199 channels and should work perfectly with an enhanced LNB.

The new microcontroller chip does not provide a dish A/dish B option, so you can no longer control an ADX unit automatically (see article in the July 1997 issue). With an enhanced LNB you won't need an ADX unit anyway, but if you use a universal LNB you will need an external 22kHz tone inserter. In this case you should use an AM242284 microcontroller chip. This has an 'external audio' option which, in the SRD510/520, controls the voltage at pin 14 of the decoder scart socket. You can use this to control an external unit on a perchannel basis.

Reliability and Component Source

Before you carry out this major modification to a relatively old receiver, it would be wise to replace the components that tend to cause problems. An SRD510 reliability kit, which contains capacitors and resistors with instructions, is available for £5.45 inclusive from SatCure, PO Box 12, Sandbach, Cheshire CW11 1XA (01270 753 311). Add £4.11 for a 24C16 EEPROM and £8.66 for an AM242306 microcontroller chip (subject to availability).







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Reports from Pete Gurney, LCGI Hugh Cocks and John C. Priest

Amstrad SRD500-545

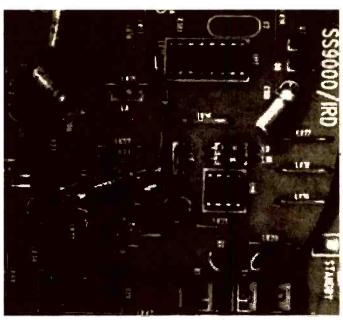
No decoding of scrambled channels, sometimes with field bounce on all channels depending on model, and no card messages is a problem we quite often get with these receivers.

They all have a TEA2029 chip (IC6) on a daughter board. It's used as a sync separator to produce line and field sync pulses for the VideoCrypt decoder. The usual cause of the problem is loss of one of the sync pulse outputs - in my experience it's usually the field sync output. As you look at the daughter board, with IC6 to the left of the panel, you should have the following from left to right at the six-pin connector: 0V, 12V, 5V, line sync pulses, composite video and field sync pulses. There should be a line sync output at pin 11 of IC6, a field sync output at pin 3 and a composite video input at pin 27. A 503kHz ceramic resonator is connected between pins 18 and 19. Check the power supplies and the 503kHz signal, and suspect IC6 if there is an input but no output.

This IC is also used in the decoder in the SRD400 and the Pace SS9000 and its clones. **P.G.**

Pace SS9000

The customer complained that since he had extended the lead to the dish he could get only "one station of every channel". On site I found that according to the onscreen graphics the channels were changing, but the channel number displayed was always the same — on Astra 1D, which the customer couldn't get.



Things became clearer when I had the receiver on the bench. Because of bad joints on the secondary side of the chopper transformer the 24V tuning supply had almost disappeared. In fact the joints were so bad it was amazing that the receiver worked at all. The solder must have finally given up when the unit was moved.

C9, C11 (both $1\mu F$) and C15 (2· $2\mu F$) were all replaced as they were the original ones. For improved reliability, $105^{\circ}C$ types were fitted. The mains rectifier's reservoir capacitor C7 (47 μF) was checked for loss of capacitance. Pace suggests that, depending on the mains supply voltage, there should be about 330V DC across this capacitor. Replace it if the voltage is anything much less.

When I finally had the receiver running I found that there was no H/V switching because Q3 (FXT749) was short-circuit. For good measure the customer had managed to short across his new lead when fitting it. **P.G.**

LNB Local Oscillator Trouble

The owner of a five-year old Pace SS9200 receiver phoned to say that his pictures disappeared at nine every morning, like clockwork, and reappeared as if by magic at three o'clock each day. When I called round, during the 'off' period, I found that the Pace receiver and the TV set were working normally – channel identifications could be seen when the Pace remote control unit was used to change channels. A replacement MTI LNB cured the problem.

Being curious by nature, and never having had this problem before, I decided to take a look at the LNB's local oscillator circuit (for more on this, see *Television* January 1996). Normally the oscillator just stops, removing the picture. It doesn't restart and is not temperature dependent. The signals had been returning because the dish was mounted on an easterly wall, and by three was no longer affected by the sun.

I replaced the local oscillator transistor, but when the LNB was mounted on our test dish its performance was still variable, depending on the temperature. My next step was to remove the dielectric resonator from the PCB. The glue that fixed it to the PCB had a discoloured look, so this was scraped off. The resonantor was then stuck back on the board using a minimal amount of Araldite. Once this had set the unit was tested. Its performance was well up to par, with no appreciable frequency drift or loss of sensitivity even when it was cooking in the sun. The LNB has now gone into our MTI exchange stock. We keep a stock so that customers can buy a replacement when the local oscillator fails: the bracket that supports this device is much larger than that for a Marconi LNB. H.C.

Pacelink Update

The latest version (V1.25) of the Pacelink computerised channel download system can now handle 99-channel PRD700 series receivers and the new MSS466 MAC receiver, which is intended primarily for the Scandinavian mar-

ket. The PRD700 was sold as the Thorn Sat 99 and under a number of brand names including Mitsubishi.

Software upgrades are available for earlier versions of Pacelink. For more details check with Pacelink on 01365 631 449 or, if you have access to the internet, follow the service links from the Pace web site:

http://www.pace.co.uk H.C.

Digital Woes

A French customer recently brought us a TPS digital receiver to install. Some prefer this package because it includes the French national terrestrial services, which others don't transmit – I like the frequently updated meteosat weather pictures that can be called up for different parts of the world.

The receiver ran very warm, and after half an hour or so the trouble began. Above channel 60, the picture would split itself horizontally, with a frozen part and a moving part – not unlike a video effects generator. Channels below 60 seemed to be OK, though after a long period of use the 'video effect' started to appear in channels in the fifties and forties.

A partial cure was obtained by taking off the top and positioning a fan to blow over the receiver – till the owner could exchange the unit in France. I wasn't going to get involved! It was daunting enough to look at the innards, and touching most items would result in scorched fingers.

A Dutch customer had similar heat problems with a Pace DVR500 receiver. After a few minutes' use, the receiver displayed the message "E05 Unknown Smart Card". Fortunately I was able to check the card with a friend's receiver, which produced the same message. A replacement card was requested, and the receiver is now kept in a cooler place. H.C.

Pace PRD800+

This receiver produced a 'lace-curtain' effect with encrypted channels and a dull picture with clear ones. When we took it back to the workshop and tested it the symptoms had progressed to no decoding, no decoder messages, and field bounce and a dull picture on the clear channels.

A scope check showed that the baseband video waveform suffered from sync crushing prior to the

Echostar SR5500

There aren't many of these receivers in our neck of the woods. The owner of this one was concerned because Sky Sports 3 couldn't be tuned in. I checked that the other horizontally-polarised channels could be received, and that the signals were strong. The entire equipment – 1.8m dish, receiver and 2,000ft of cable – had been shipped over from the States about five years ago, by the US owner. I then arranged to return on the following day in time for an upcoming golf competition due to be shown on Sports 3.

Reception of CNN and the two coded Spanish channels at a similar IF was fine, also NTV which is horizontally polarised and 30MHz below Sports 3. The moment Sports 3 was approached, the tuner produced a fluttery effect/oscillation with weak Sports 3 sound beneath the flutter. I decided to absolve the cable of any blame first – it was a long run. Fortunately there was plenty of cable to hand on large wooden drums. So a length was unrolled, cut and connected up. There was absolutely no difference to the fluttering effect.

I then went over to Eutelsat at 13°E, but could see no problems with signals at around this frequency – apart from some disturbance to the noise at the Sky Sports 3 frequency. So it seemed that the tuner was faulty, and I didn't relish the thought of doing battle with an Echostar tuner. As the effect occurred over a very narrow frequency band, the easiest course was to move the LNB's local oscillator frequency

slightly. This proved to be fairly easy to do, by unscrewing the local oscillator screw on the LNB a little – it was a Gardiner prime-focus LNB, which has an external local oscillator screw under a plastic cap.

Unscrewing it slightly moved Sky Sports 3 to 11-7GHz. The channel that now couldn't be received was NTV, a German news channel that was of no interest. I told the owner that at some stage the problem might worsen to cover a wider frequency range, but he felt that this was preferable to the possible replacement cost of a new tuner. Unfortunately it did mean that all the other channels had to be retuned slightly, though the LNB offset menu helped and the owner enjoyed retuning – how about an Echostar link to go along with the Pacelink tuning system?

In the course of retuning the LNB I discovered that a 4GHz C-band LNB was also fitted, along with a second long IF cable. The owner wasn't aware of this and, being American, was keen on the US-based C-Span station via Intelsat 601 at 27.5°W. This was soon tuned in, along with Russian TV and some Arabic and French channels.

Now that the dish was beginning to scan the heavens after spending five years quietly moving between 19·2 and 13°E, the dish mount took an intense dislike to the exercise and, a few days later, fractured. This was soon cured with the welder – wonderful activity at the dish on a hot summer's afternoon! H.C.

energy-dispersal clamp. Blanket replacement of the electrolytics around the Nicky chip U9 cleared the fault. The capacitors replaced were C98, C99, C107, C544 (all $10\mu F$, 35V) and C110 (470 μF , 16V). J.C.P.

Pace Prima

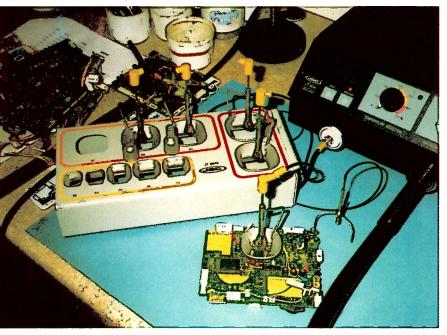
Note that the Prima has a different remote control command set from all previous Pace models. At first glance the remote control unit appears to be identical to the ones used with Models MSS100-1, MSS200-1 etc., but on closer inspection you will see that "RC-10" is printed in the bottom righthand corner of the button plate. The RC10 type handset won't operate any earlier models, and their handsets won't operate the Prima receiver. This fact isn't mentioned in the service manual for the Prima, and I became aware of it only by accident. One of my satellite installer colleagues brought me a Prima

receiver that had suffered from ingress of water via the UHF aerial socket. He didn't bring in the remote control unit or any of the leads.

After cleaning the underside of the PCB around the RF modulator, and checking the outputs from the power supply, I found that the receiver worked normally using the front control buttons but could not be operated using any of my Pace remote control units. I spent some time checking the output from the remote control sensor through to pin 12 of U700, but everything seemed to be in order. As it was saturday morning I couldn't check with Pace Technical, and it took me some time to get hold of my rigger friend. When I did, I asked him to bring along the receiver's handset. As I suspected, remote control operation was now OK. But I'd wasted twice as long as the job should have taken. J.C.P.

Test Report

The JBC Desoldering Station



he problem with flatpack IC removal is avoiding damage to the PCB and adjacent components. The more advanced the technology involved, the greater the number of legs a chip is likely to have and the smaller the components that surround it.

Most such ICs are stuck down with a red compound that softens when heat is applied to the body of the IC. Some are not stuck to the PCB at all, while others – in particular microcontrollers in VCRs – seem to be bonded with a superglue which has almost to be chiselled off. But that's another story.

Desoldering Techniques

ICs can be removed using a heated and shaped desoldering tip or a shaped tip with a vacuum plunger in the centre. Ensure that the IC's legs have all reflowed before removing it from the PCB, otherwise the print may peel away when it is lifted. There are two ways of going about this. One is to apply flux to all the IC legs to aid reflow. The other is to apply solder and flood all the legs to form a single solder blob.

Here are the disadvantages. With the former tech-

Steve Beeching, I.Eng. examines various flatpack IC desoldering methods and the way in which the JBC JT6040 solves the problems

nique not all the legs may reflow: significant print damage can occur even if only one leg is left soldered. With the latter technique, rather too much heat may build up around the IC: although full reflow is achieved, the print can overheat and lift.

When the desoldering tool incorporates a vacuum pump, the IC will be released even if it is still attached to the print by either its leg(s) or the PCB bonding compound. In the latter case the tendency is for the operator to twist the IC with the tool in order to break the glue bonding. This can also damage the print.

An alternative approach is to use hot air to reflow the IC. Many shaped tips are also available for this, including rectangular ones with four jets, and ones for J-leg ICs. These have tilted vents to drive the hot air beneath the IC. Gentle lifting pressure ensures that all legs are reflowed before IC removal. A vacuum pen can be used for lifting.

Hot air is a disadvantage with a high-density board, where peripheral components the size of an ant's reproductive organs are mounted around the IC and adjacent to its legs. Unless they are protected, these components can go walkabouts. And as you can't see them, you can't find them. More stress! One way of getting round this is to use tape to mask off the area around the IC. But again problems arise, one of them being fire! Another is cleaning off the glue layer left by the masking tape.

Enter the JT6040

The soldering iron market was once dominated by two or three major firms. There are now more players in the desoldering game. Last year we had the Pace system, which is expensive but good, and the Welwyn system which is not so expensive but has limited capacity for resoldering. This year the Spanish have arrived in the guise of JBC (not to be confused with JCB, which

makes very large 'solder' removers, or JVC who don't!).

The JBC JT6040 desoldering station makes real headway. Basically it consists of a hot-air blower with variable temperature and flow, and a vacuum sucker to lift the IC. The surprise is in the end pieces, which are called extractors and protectors – see Figs. 1 and 2. The extractors come in a number of large sizes: they consist of a rectangular-shaped bowl with a vacuum cup mounted above the centre.

Operation

You place the bowl around the IC to be removed and lower the vacuum cup on to it. The cup sticks to the IC when the vacuum pump is activated. Because the cup is lightly spring-loaded, the IC will be lifted gently when its legs have been reflowed with hot air. See Fig. 3.

What about the problem of peripheral components? Well, there doesn't seem to be one. Components that are outside the bowl are protected from the hot air. Those that are inside are subjected to eddy currents rather than a sideways blast, and won't blow away easily. They might however if you go mad with the air flow.

It's a magical sight seeing an IC lift off the PCB quietly and gently – makes you want to take more off just to watch it happen again!

There's a neat accessory called the 'tripod', which consists of a vacuum extractor with three legs. You place it over a small IC that's to be removed. It can be used on its own if there are no adjacent peripheral components, or with one of the smaller protector bowls if there are.

This is the easiest IC removal unit I've come across, and is an ingenious design.

Temperature can be controlled over the range 150-450°C, while the air flow is calibrated from 6-34 Lt/min on a scale of 1:10. As a starting point, the handbook recommends a temperature of 350°C and a flow rate of 6. With experience, you will soon learn the best settings for a given IC size.

Two touch buttons are used to start the vacuum pump and the hot-air flow. A foot pedal controls the latter. When you take your foot off the pedal, the air flow continues for a short period to cool down the hand-piece.

Protection is built into the controller, with error codes to indicate a problem such as a blocked filter or overheating. The controller cuts out if the pedal is activated for more than fifteen minutes.

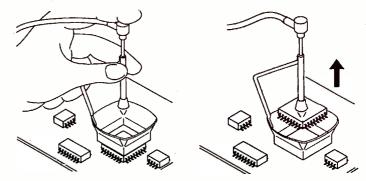


Fig. 1: Use of an IC extractor.

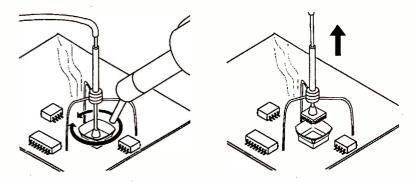


Fig. 2: Use of the tripod and protector to remove a small IC.

What You Get

Basically you get a control unit with an 800W hot-air blower and three types of nozzle, controlled by a foot pedal. There's a stand for the extractors and protectors. Five large extractors from 20 x 20mm to 33 x 33mm, five protector bowls from 10 x 10mm to 17 x 17mm, and a tripod are provided. Spare filters for the vacuum inlet, spare rubber cups for the extractors and tripod and a length of rubber tubing are supplied with the kit.

The basic kit is available at £1,280 plus VAT (trade discounts will apply) from Willow Vale Electronics, 11 Arkwright Road, Reading, Berks RG2 OLU (01189 876 444, fax 01189 867 188).

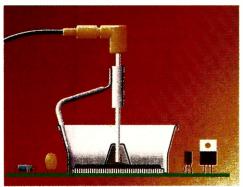


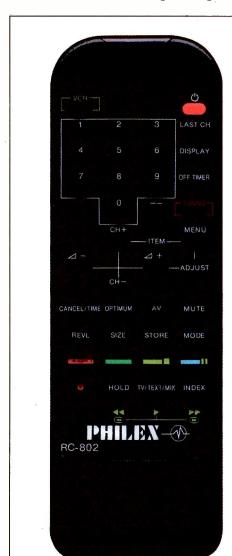




Fig. 3: How to desolder an IC using an extractor. First position the extractor (left), apply heat until the solder melts (centre) and finally remove the desoldered IC (right).

Repairing RC Handsets

While cheap RC handsets are not worth repairing, expensive ones can repay attention. Chris Watton explains what can be done by way of economic repair



Examples from the Philex range of replacement RC handsets. Philex can be reached on 0181 202 1919.



early everything nowadays seems to be operated by a remote control handset. These devices can cause a number of problems that result in customer complaints. You may have sold a second-hand TV set to a customer who finds that the remote control unit is not 100 per cent reliable. In some cases this can lead to the customer being given a refund. Oooh the pain! Or, if a cheap replacement is not available, you may have to obtain the original type.

Many handsets are available for only £5-£10. Repairs are therefore not worth the time. But some of them are very expensive, for example VCR types that have a built-in clock display. One such unit we required recently was priced at around £80. This could have meant scrapping a top-of-the-range VCR. It prompted us to try to repair the unit.

We've all tried to bodge handsets at one time or another. The unit may then work all right for say a week or two. Typical bodges are to put pencil lead on the pads or scrape the contact area on the PCB. The latter course actually makes matters worse, as the abrasive used will reduce the contact area. So we mustn't do it!

The problem with the expensive unit we had was that some of the most used buttons either didn't work or needed Charles Atlas to press them in.

The first thing we did was to take the unit apart. With most units this can be done without sticking a screw-driver in the edge. It's worth taking a little time to get the unit apart, as a ruined case will make it a write-off – even if you can get the electronics to work properly.

Testing

Once we had it apart we could test the innards. This is done by putting a remote receiver/tester in front of the unit or, preferably, the machine with which it is supposed to work. Then, with the keypad removed, supply the voltage required and connect a 220Ω resistor cross each set of contacts in turn to check the various functions. We now use a stick with a remote pad glued to the end however. This is better, as it's easier to put the pad on the contacts than wire an 0.5W resistor across them.

If the PCB is working correctly the pad is at fault, which is usually the case. You can often see that a pad is worn, but others don't look so obviously defective. In this case an ohmmeter can be used to test them. A reading of anything up to a few $k\Omega$ is acceptable. Readings can be compared with those obtained from the pads that work.

Pad Repair

A product is now available for pad repair. It recoats the pad's contact area, is flexible and has a surface resistance which is much lower than the original material. This results in a handset with a very quick response. The product is called a remote keypad repair kit and is made by Chemtronics. It consists of a two-part polymer coating: one is a silver and carbon resin, the other a hardener. Once mixed, curing takes about seventy two hours.

You simply brush the mixture on to the keypad contact area and leave it to dry. Don't be unduly surprised by the smallness of the contents. There is enough to restore about twenty handsets completely. And a pack contains two kits. The instructions in the pack must be followed to the letter, otherwise the mixture might not stick. Once the pad is dry it should cause no more trouble.

Other Problems

Remote control unit faults that are not caused by the pad are not so easy to sort out. But it's worth carrying out a few checks before consigning the unit to the bin.

The battery running out quickly is a frequent complaint. This can be caused by the electrolytic capacitor that's connected across the supply. It usually has a value of 470-1,000µF with a voltage rating of 10V. The capacitor can develop leakage or fall in value. In either

case the result will be premature battery failure.

Liquid in the unit will have the same effect of course. This is easily cleaned out, but remember not to damage the contacts.

The crystal or ceramic resonator often breaks away or loses a leg. Once it is refitted, a spot of glue will stop this happening again.

Poor joints often develop at the infra-red LEDs. Remember that they draw a fair amount of current, possibly over 1A (in short bursts), so the connections are critical. This emphasises the need for the high-value reservoir capacitor to be in good condition.

It can be difficult to check the IC used in a handset when you don't have the circuit diagram. A few tests can be carried out however. Check the supply voltage, whether the clock is working, and the output that drives the LEDs. There is usually a transistor or perhaps two transistors between the IC and the LEDs. So check back from the base of the driver transistor to the IC when a button is pushed. You may in this way find that there's a faulty transistor.

To scan the operation of the buttons the IC used in a handset has a key scan and key encoder, as with the control chip in a VCR or a TV set.

In Conclusion

The keypad repair kit mentioned above is available from CPC of Preston (01772 654 455) under part no. SA00478. It costs about £15.

Those who require more detailed information on remote control operation should refer to page 488 in the May 1994 issue of *Television*, where Eugene Trundle explains it all. It's a good read.

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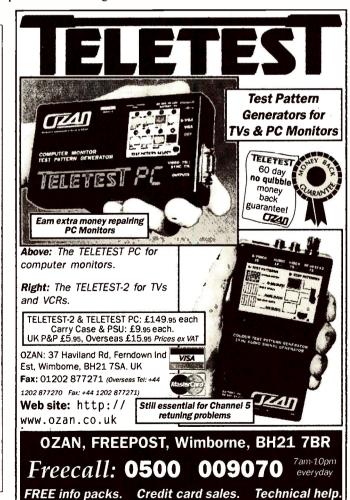
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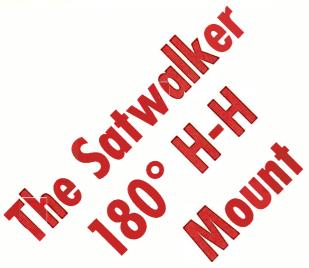
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Mike Hancox, technical director of Satellite Scene, finds this unit simple to install, inexpensive, reliable and silent in operation Test Re

he new Satwalker 180° horizon-to-horizon mount is one of the best and most underrated pieces of equipment I have ever reviewed. How can I make such a claim for a relatively new item?

The Original Satwalker

I was one of the first to purchase from the importers a quantity of the original Satwalker units when this unique horizon-to-horizon mount initially appeared the UK. Others in the satellite business were less than enthusiastic. They felt that the mounts were difficult to obtain, too cheap, unreliable (though they had not tried them) and poorly made. The unfavourable view of the Satwalker seems to have been based on two main factors: first that the units did not span a full 180°, and secondly because they are not made by Jaeger, which seems to be the only name that counts when it comes to H-H mounts.

We didn't adopt this negative attitude. Instead we decided to give the units a fair try, and have been well rewarded. In fact we had struck lucky in finding a mount that runs truly silent and is, for fitting, extremely versatile. Over a period of time, my decision to use these units has been completely vindicated.

Initially we supplied a number of the mounts to customers, including hotels and language colleges, that make much use of their steerable dishes. Four years later they are all still working and we have not had a single fault that could be attributed to the mount. That's better than our record with other products.

The 180° Version

The latest version of the Satwalker has the one thing that the initial version lacked, a full 180° swing. I was concerned about one thing when I first examined the 180° Satwalker – the nylon instead of metal teeth that provide the 180° arc drive. Would there be excessive wear and tear, resulting in dish 'slap' and override? As I was concerned about this I decided to delay my review for four months in order to give the unit a thorough site test.

A mount was installed at the home of a customer whom we knew would make a great deal of use of it. He is of nordic extraction, and his wife is a Greek Cypriot. The unit would continually be whizzing from the Cypriot transmissions at 7°E through 1°W and back to Astra for the kids. For four months it did just that, changing from one satellite to another at least ten times a day. This had no detrimental effect on the unit what-

soever. My initial concern about the nylon teeth was unfounded: there have been no wear and tear problems, and no slap and backlash. The unit is as tight and reliable as when it was first installed.

The nylon teeth are certainly a help when it comes to silent operation. There is nothing more annoying at two o'clock in the morning than the sound of a neighbour's dish churning around in search of those elusive porn channels. This super-quiet unit emits hardly a sound, even in the dead of night. I have in fact not come across a quieter-running unit than the new Satwalker, which should sell it to a lot of people.

Versatile Fitting

The final plus point with this unit is the extremely versatile fitting arrangements. While other H-H mounts

have to be fitted to the top of a vertical pole, the Satwalker can be fitted in several ways – at the top of a pole, at the side of a pole, on a horizontal pole such as a J pole, or to an old right-angled dish bracket for example. We have even fitted a Satwalker half way up a TV mast and on a balcony handrail.

This versatility makes life much easier for the installer. It can save a lot of time, especially as the connections are via the good old-fashioned single coaxial cable and a four-core cable for the motor and pulse reed-switch feeds. A ribbon cable is not required, and there is no need to resort to the silly new system – a unit that is powered by the LNB supply via the coaxial

cable, with consequent loss of signal and the inability to look for what is out there between the preset satellites.

mount plus positioner retails at £159 including VAT. Discounts are available to trade customers.

Satwalker units can be

purchased direct from

Satellite Distribution

Centre, 10 Addington Road, West Wickham

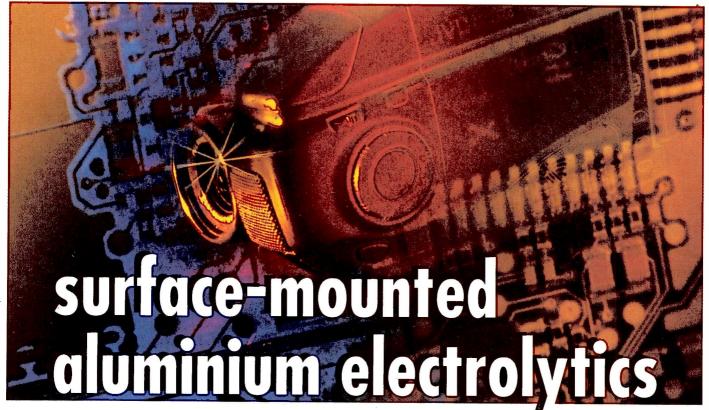
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4849). A 180° Satwalker

In General

The slap and backlash one gets when using an H-H mount with a dish in excess of 1m (or 80cm or less in some cases) is almost non-existent with Satwalker units even after four years of use.

I am left with one question. Why is the availability of the Satwalker so poor? Could it be that suppliers think only familiar-name products will sell? Some of the better-known and more expensive mounts are dreadful in comparison. Take my advice: shop around and find yourself a Satwalker 180° horizon-to-horizon mount. It will give you a really easy, maintenance-free installation – and silent nights!



The tiny surface-mounted electrolytics used in camcorders and some other equipment give rise to a lot of problems. Nick Beer explains the failure mechanisms and repair methods and provides guidance on fault-finding

he surface-mounted aluminium electrolytic capacitor is the cause of a lot of failures in certain types of equipment, in particular camcorders and also some VCRs. The capacitors fail when the equipment is a few years old, regardless of use during that period. Because these electrolytics will be used extensively throughout a particular piece of equipment, a multitude of symptoms may be present.

In this article we will look at brands, models and faults, also how to replace these troublesome devices and where to obtain them. Fig. 1 shows a typical board assembly using surface-mounted aluminium electrolytic capacitors.

Failure Patterns

Electrolytic capacitors are chemical devices that dry out, giving us much work and keeping us in our jobs! While a surface-mounted aluminium capacitor can dry out, what almost always happens is that the device leaks its electrolyte. There is thus loss of capacitance, and the device can well go open-circuit. As with most electrolytic capacitor failures, a surface-mounted type will often reform when heated, which can provide a useful clue when fault-finding.

Unfortunately the leakage can result in some nasty PCB damage. In camcorders, where minimal size and high component density are important, multilayer PCBs have for many years been used. Through-the-board links are used to provide connections between the layers, and are the first to suffer from this leakage. It's interesting that different camcorder models suffer differently in this respect, as we shall see later.

The usual situation is that a single symptom occurs

then others soon develop. You may well find that by the time the unit reaches you for repair there are symptoms in addition to the one originally complained about. Alternatively the camcorder may have worked perfectly when it was put away the previous summer, but when it was taken out on the day the owner was due to go on holiday a couple of faults were present. Guess who's got a couple of hours in which to carry out the repair?!

These devices can fail whatever their value, and in my opinion it's best to replace the lot when you come across one that has failed. But there are certain values that are guaranteed to fail before the others. Look for $10\mu F$, 16V and $22\mu F$, $6\cdot 3V$ capacitors: these always go first. Note that renewing all the surface-mounted aluminium electrolytics in a camcorder could mean that seventy or so have to be replaced. Even the most experienced practitioner is going to take a couple of hours to do that, so don't get caught out when you provide your estimate.

Clues

There is usually more than one symptom. They can vary with time, and may well clear. If you find that a unit which is more than a couple of years old uses surface-mounted electrolytics, they are probably faulty. Perhaps the most useful clue however is the smell.

Remove the covers and sniff around a board that uses the devices and is in the area where the fault has probably occurred. If there is no obviously obnoxious smell, look for a 10µF or 22µF capacitor and heat one leg. The likelihood is that the resultant smell, best described as ammonia like, will knock you back. There will also be a gentle hissing/crackling sound as the leakage boils.

All this is welcome to the engineer on the trail of a fault.

Repair

Let⁵s make no pretence about it, the job is a smelly one. One of my colleagues reacts very badly to the smell, which makes him ill. With most people however the smell has a fairly neutral effect, but it is best to work in a well-ventilated area – the stuff can't be doing you any good!

Because of component density, capacitor replacement can be tricky. It is often necessary to remove several other components around a capacitor to enable the latter to be replaced. It's far better to do this than to risk damage to the PCB or other devices.

To remove a surface-mounted aluminium electrolytic capacitor, first use solder braid to mop up as much solder as possible from each of its legs. Then, to free one leg, heat it while tilting the capacitor away from the iron. Do the same to the other leg. Finally, mop the lands clean. Use miniature pliers or tweezers to manoeuvre the capacitors — if you try to use your fingers they will get burnt. A device designed for handling these capacitors was shown at the Sony Service Expo last year — it was a sort of pick-up pencil — but I am not sure about its availability. I think it was of Spanish origin. One of those small, four-pronged grab tools is also helpful.

Once the leaking capacitor has been removed, the board beneath should be cleaned thoroughly with a suitable solvent. Attend to any obvious corrosion, paying particular attention to any through-the-board links under or near the capacitor. If you are in any doubt as to whether a link may have been affected, link it out to be on the safe side. For those who are not familiar with through-the-board links, they appear as small dots or holes in the PCB, always in a print land of course. You can use an ohmmeter to check a link, by measuring the resistance between the relevant pads on each side of the board. Scrape the lacquer from the top and bottom pads if necessary.

Who Suffers?

Apart from the engineer, that is! My first encounter with the problem came with a now pretty ancient machine, the Sanyo VMD3P, which is riddled with these capacitors. Readers of the camcorder fault column will have seen references to this on several occasions. Anyway, here's a run down on the models with which we've had the problem. Individual capacitors for particular symptoms are not specified, because I feel that replacing capacitors one at a time is a mistake, inevitably leading to recalls.

Sanyo VMD3P: Symptoms include no picture in the cue/review/pause mode(s); no EVF picture; excessive dropouts (because the DOC video path has been interrupted); and others. A slightly perplexing fault is no mode motor movement because the supply ICP has failed – it does this when the supply's reservoir capacitor leaks. Thus a wide variety of symptoms may be present. This model suffers from corroded print and through-the-board links.

Sony CCD-F330/340/350/500: These camcorders are by no means identical but suffer equally from electrolytic capacitor problems. Typical symptoms include severely distorted playback luminance; very poor record chroma with bars of alternating phases; etc. The camera head suffers, with bars visible on E-E pictures –

apparently because of the CCD timing pulses. These models seem to escape serious corrosion problems.

Ferguson FC27 (amongst others): These horrible-looking units suffer from various symptoms, especially because of faults in the system control and camera head areas. Examples are no auto-focusing or power zoom. They are also particularly prone to corrosion problems.

Canon A1/A2HiE: This range of camcorders was very popular with more serious users some years ago, having been given much praise in relevant magazines. Their rather unusual design makes them look more like stills than video cameras. The problem with servicing Canon products is that the company is not particularly helpful: Canon prefers to have its products returned for repair in its own workshops. Manuals cease to be available after a very short period of time, and are very expensive. As a result you often find that a customer has had difficulty getting his camcorder repaired – this could provide you with a business opportunity!

Once you get used to it, dismantling these units is fairly straightforward. The servo/motor drive PCB at the back of the mechanism gives rise to a lot of trouble, with drum and capstan rotation problems. There's a massive number of surface-mounted electrolytics on the audio board. Note that the mechanism has a Sony look about it and suffers from the same coaster and guide problems – and the Sony kits fit!

Canon UC10E: This odd little unit has a 10µF electrolytic on the thick-film PCB into which the imager plugs. This electrolytic leaks, and can be quite difficult to replace – because it is on a thick-film board and the solder doesn't melt easily. While you have the machine in for repair, check the tape path for loose guides – for alignment purposes the FM envelope waveform is available at the apparently unused connector on the main PCB. The head switching waveform is also available here

Panasonic NVFS90B: This is not a camcorder – it's an S-VHS VCR. It is quite common for the S-mode luminance to be lost with the machine's own recordings. The cause of the fault is the thick-film hybrid module IC303. It is best to replace this module, but you will notice that

Fig. 1: Typical camcorder PCB with surface-mounted aluminium electrolytic capacitors.



it contains a couple of our beloved surface-mounted electrolytics – and I bet they are leaking!

It is interesting that Panasonic camcorders do not seem to suffer from the sorts of problems we've been discussing, though surface-mounted aluminium electrolytics are used in various models. Unless, that is, someone knows better!

Sources

It's sensible to obtain your capacitors from a wholesaler rather than a manufacturer. The reason for this is that you will be buying in bulk, especially if you repair more than one unit a month! RS Components and Farnell both have very good ranges available, at both 85°C and 105°C rating. The devices typically cost pence when obtained in packs of ten. You could pay around £1 a capacitor when you obtain them from a manufacturer.

Make sure that the physical size is the same when a capacitor is obtained from a wholesaler. It is tempting to go for 105°C types in place of 85°C ones (they may not leak!), but make sure they will fit. Similarly some originals will be rated at 6V, so you will need to order 6.3V types.

Some of the capacitors used by Sony and Canon have

odd values that cannot be obtained from a wholesaler. So you must obtain these from the manufacturer. Furthermore there are some slim-gauge capacitors in use, i.e. with standard values and voltages but with a much smaller diameter. The pads and component placing mean that standard-sized equivalents can't be fitted.

Try to obtain these slim-gauge capacitors from the manufacturer. Unfortunately this is not always possible. If you try to obtain them from Canon for the A2HiE for example you will be told that they are not available though a complete board can be supplied. To be fair, the PCB price is quite good – for a PCB, but not for six or so capacitors! You can get these devices from Sony however. The information in Table 1 may be helpful in this respect.

Table 1: Small-diameter (3mm) electrolytics

Value/rating	Sony part no.
10μF, 16V 22μF, 4V	112800411 112800311
3⋅3µF, 35V	112800811
0·47µF, 50V	116400591

85°C rai	ige				105°C r	ange	*
Voltage	Value (μ F)	Stock no.	Ċase		Voltage	Value (μF)	Stock no.
6-3V	22	108-148	В		6.3V	22	108-390
	47	108-154	Č			33	108-407
	100	108-160	C			47	108-413
10V	33	108-176	Č			22	108-457
	47	108-182	D			47	108-463
16V	10	108-198	В		25V	4.7	108-479
	22	108-205	C		204	6.8	108-485
	47	108-211	D			10	108-491
25V	4.7	108-217	В			22	108-508
-01	10	108-233	C		50V	0.1	108-558
	22	108-249	D		50 V	0.22	108-5564
	33	108-255	D			0.47	108-570
36V	3.3	108-261	В			0.47	108-586
,	4.7	108-277	В			1	
	10	108-277	C			2.2	108-592
5	22	108-299	D				108-609
50V	0.1	108-299	В			4.7	108-615
V	0.22	108-312	В			10	108-621
	0.33	108-312	B			2	
	0.33	108-326	В				
	1	108-334	В				
	2.2	108-356	В				
	3.3		_				
		108-362	В				
	4.7	108-378	C				
	10	108-384	D				
Case d	mension	s (mm)					
Case Ø	D L	A B	1	Ρ.	W	ØD is case diam	neter.
	0.5 +0.1	±0.2 ±0.2		±0.2		L height includi	
	-0.2					A width of base	g .ogo,
						B depth of base	
B 4	5.4	4.3 4.3	1.8	1	0-5-0-8	I length of legs,	
C 5	5.4	5.3 5.3	2.2	1.5	0.5-0.8	P distance betw	
D 6.		6.6 6.6	2.4	2.2	0.5-0.8	W width of legs	con legs,

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What a Life!

A fuse-blowing video recorder and mysterious phone calls are amongst the things that plagued Donald Bullock this month

This autumn Steven and Paul spent about ten days enlarging the workshop. Steven's girlfriend Jeanne felt sufficiently encouraged to tidy up some of their long-standing muddles. I returned from Spain to witness the result, which was so heartwarming that I offered to open up next day while they went tench fishing in the lovely Walham water.

On the following day I awoke to a soft and sunny morning and later found myself humming happily as I unlocked the shop door and breathed the scent of newly-worked wood and Mansion polish. Then the phone rang.



Steven and Paul enlarging the workshop.

I picked it up. No one there. So I pulled the first job on to the bench.

Videos

It was an Hinari VXL8 video recorder which was dead. I opened it up and soon found that the 1.25A fuse Z601 had blown. A replacement brought the machine back to life, and I put it on soak test to see whether the fuse would blow again.

Then the phone rang. I picked it up but there was nobody there.

The next job was a JVC camcorder, Model GRA2E. On the job card it said "mine" and "dead" in Steven's scrawly writing. When it was switched on the 'on' light lit for half a second then died. So I opened it up and made for the crop of half a dozen so-called circuit protectors that are to be found close to the DC input socket. CP6 was opencircuit, for no apparent reason, and a new one seemed to cure the trouble. The circuit boards in this model are very thin, so I took care when removing the PCB plugs and sock-

As I was reassembling the unit I managed to flick a screw along the bench. It rolled past the telephone and on to the floor. When I bent down to retrieve it the phone suddenly rang in my ear, which was about an inch above it. I snatched the handset and put it to my other ear, which wasn't throbbing - yet. Nobody there.

Next thing Vivian Dunby mooched in, looking as though she'd just been poleaxed.

"What's up, Vi?" I asked.

"Well me 'usband's run off again and me daughter's gone off to Jamaica with a chap old enough to be me father. And me canary's died an' the cat's got the mumps. And now this sod's playin' up." She held up an Amstrad VCR6000 video

recorder. "He won't give me me tape back" she moaned.

Then the phone rang. I picked it up. Nobody there.

"Give me an hour" I said to Vi as I waved her out.

I tried to eject the tape, but the flap wouldn't open. When I dismantled the machine I found that the little lug at the flap's left side had broken off. As a result, the sweeping pin couldn't locate and raise it. I tried all ways to glue it back on, without success. So I got a bit of Perspex and succeeded in welding it in place.

This cured the flap problem but the picture was awful. All was well once the heads had been cleaned.

When Vi returned I handed her the recorder. "It's not all gloom" I

"Me 'usband's come back" she replied.

"Oh . . . er . . . never mind" I

Then the telephone rang. I picked it up. Nobody there.

Ping

As I stood there, puzzled, I heard a ping from the soak-testing Hinari VCR. It was now dead. So I opened it up again. A lengthy examination failed to reveal anything obviously amiss, and none of the components seemed to be unduly warm. I pressed the plugs and sockets home and fancied that one was a little loose. Could that have been the cause of the trouble? I reassembled the machine and put it back on soak test.

Spry Sydney

At this point Spry Sydney strutted in looking, as always, as if his jacket was still wearing its coathanger. A while ago he bought a hotel and installed an Huanya 14in, colour set in every room - twenty four of them in all. Those that didn't simply walk gradually developed a loud 150Hz note to accompany the sound.

Our remedy has been to replace the STR4211 chopper chip IC901 and the 27V zener diode ZD907. This one was the same, and I gav e it identical treatment.

"How many of these do you still have, Syd?" I asked.

"Only five" he replied. Then a thought struck him. "Eh, could you take the handles off them?"

"Sure can Syd" I said. "You should have asked at the outset and got a quantity discount."

The phone rang and I picked it up. Nobody there.

The Shop Steward

Who should come in next but Len Grunt. He's a local shop steward and had with him an old Matsui 1455 portable. After thumping it on the bench he stood facing me with his right index finger poised over his left hand – as though he was about to write down a speech.

"Missus put 'im on. OK. Next day I puts 'im on. OK. Yesurday wife's brother calls in. Puts 'im on. Dead!"

He put his hands aside and addressed Steven. "Always was the trouble, wife's brother. Won't join no union. Never would!"

Steven opened the set and switched it on. The chopper circuit was dormant. We didn't have the circuit diagram, but he drew my attention to the 2SD820 chopper transistor Q604. The transistor and its heatsink were quite warm.

"Can you take over?" he asked. "I'm off to see the vicar about getting married."

"Struth!" I said.

When he'd gone I decided to look for shorts on the secondary side of the power supply. The HT rectifier D607 read short-circuit both ways, so I replaced it. This made no difference. When I checked the new diode I once more obtained a short-circuit reading. At this I retested the original diode, which was all right. Further checks revealed that one of the protection capacitors in parallel with D607 was the culprit. The offending item was C613 (4.7nF, 1kV). I should have checked D607 out of circuit if course. A thorough approach is essential when fault finding.

A Reply at Last

As I was reassembling the Matsui set the phone rang again. I picked it up.

"Bullocks" I screamed.
"Ooh. I owp yoo can 'elp me"

said a voice, "or are you just the old man?"

"Never you mind that" I said, "this is the boss."

"Oh well" croaked the voice, "you'll 'ave to do. Right now I'm needing a camcorder, so I'm asking you which is the best?"

"Well, if it's any recommendation Steven's got a JVC" I said.

"Does Argos sell JVCs?" asked the cracked voice. "Do you happen to have their latest catalogue there?"

"Of course I have" I replied, oozing kindness. "I keep it specially for enquiries like yours. If I could trouble you to hang on for a second I'll look into the camcorder section. If they've got what you want I'll shut the shop and nip along and buy it for you. I think I can afford it, and they are only three miles down the road. May I ring you back?"

As I put the phone down I noticed that the Hinari VCR had failed again. Fuse Z601 was once more open-circuit, and I spent an hour trying to find out why. Eventually I resorted to resoldering every joint in the power supply. Then I boxed it up again and put it back on soak test.

The phone rang. I picked it up. No one there. I slammed it down and picked up the next job.

Hikona Portable

It was an Hikona RM2000, which is a 14in. colour portable made in Turkey. The set was dead and groaning, and it had my sympathy. I noticed a 10µF, 250V electrolytic – C320 – and hooked it out for testing. You know my suspicion and prejudice about electrolytics. I was right – it was open-circuit. When I'd fitted a replacement a picture of a harem scene came up. As the sheikh galloped in, the set died again.

After a further bout of diagnostic effort I discovered that one end of the 47Ω , 5W wirewound resistor R505 was dry-jointed. I cleaned it off and resoldered it. When I switched the set on again I was just in time to see the sheikh galloping off into the sunset.

The Hinari's Secret

As I boxed up the Hikona set I heard a ping from the fuse in the soak testing Hinari VXL8. This time I plugged in the bench light magnifier then studied and carefully tapped every inch of the chassis and the panels in the machine. I eventually came to the capstan drive chip IC206. When I moved it the fuse blew.

Homing in on its pins I found that one of them, while looking as if it was perfectly soldered to the blob, was ringed by a very fine crack. I resoldered it and once again put the machine on an extended soak test. This time it was all right.

Ribby Ellis

Then Řibby Ellis, the telephone engineer, came in – grinning as usual.

"Who's that looking over your shoulder, Don?" he enquired.

I turned round and there was nobody there of course.

"Oh it's all right. It's your ears" he bawled, shaking with mirth.

"What's your trouble?" I asked, "apart from the fact that you're a prat."

"This 'un" he said, holding up a 14in. Philips portable, Model 14CT2006 (CTX chassis). "Picture gradually goes dark – sound's OK though."

I opened it up and studied the panel area beneath the line output transformer. The transformer's pins were dry-jointed. So I resoldered them, boxed the set up and gave it back to him.

"Ribby" I said, you've not inflicted any of your silly practical jokes on me of late. So I'm going to show my appreciation. Have this one on me."

"Gosh Don, that's good of you" he said. "Makes me feel guilty about playing you up all day."

I looked at him and he pointed to the phone.

"You?" I exclaimed.

He nodded. "I'm working over the road" he said.

"Clear off" I hissed, "you ought to be birched!"

Getting Around

Television certainly gets around. It's always a pleasure to hear from fellow sufferers in this trade. Recently I received a letter from Bill Challoner, a lad of 84, formerly of Southport but now living at 5 Erica Street, Geraldton, Western Australia.

Bill was originally a cinema projectionist. He studied TV servicing when Australian outdoor cinemas became extinct, and managed to make a living from it. Now ill, he's just undergone surgery. Bill reckons that reading in *Television* about the slings and arrows we suffer brightens his day. His letter certainly brightened mine. I know that he would be interested to hear directly from other readers who have tales to tell.



Reports from
Philip Blundell, AMIEEIE
Stephen Leatherbarrow
Robert Marshall
Chris Watton
Brian Storm
Michael Dranfield
Mike Orr, Owen Green
Maurice Kerry
John C. Priest and
Nick Beer

Philips 25ML8300/05B (FL1.7AA Chassis)

There was no sync – the field and line scans could be seen slipping slowly through. A scope check at pin 5 of IC7400 showed that the sync signal from the high-end box (where 100Hz scanning conversion takes place) was missing, though it was present at pin 6 of ribbon cable H/S20. There was a crack in the print where the track runs along the edge of the board. When this had been bridged however the fault had hardly changed. R3228 in the highend box was misadjusted.

Incidentally your eyes are not deceiving you when you look at the circuit diagram: yes, there are two TDA2579B chips in this set! **P.B.**

Grundig GT2101 (G1000 Chassis)

Loss of one colour has become a common problem with these sets lately. So far we have had two causes: either the 330Ω emitter bias resistors (R903, R908 or R913) for the RGB output transistors on the CRT base panel, or the BC847 RGB emitter-follower transistors (TR801/2/3) on the main panel. The resistors go open-circuit while the transistors develop base-emitter leakage.

There's a trap for the unwary. Because of its auto grey-scale action, the video processor chip IC800 will probably be producing a greater output in the channel affect-

TV Fault Finding

ed than in the other two. So in the case of an open-circuit 330Ω resistor the faulty channel is the one with the largest signal on the main board! **P.B.**

Sharp DV5935H (BCTV-A Chassis)

The 2SD1546 line output transistor Q600 was short-circuit in one of these sets. As I was removing it I noticed that R619 (39 Ω , 0.5W) and R632 (39 Ω , 0.5W fusible) in the line scan circuit were both burnt. The 0.56 μ F line scan coupling capacitor C607 was open-circuit. Normal operation was restored when these four items had been replaced, using components obtained from Sharp. **P.B.**

Philips CP90 and CP110 Chassis

Problems in the IF department are becoming more common as these sets age. The IF/sync module is meant to be replaced rather than repaired, but the price of the module is prohibitive. Probably the most common symptoms are ringing on the picture, with herringbone patterning and loss of teletext. In this case coil L5082 is usually the culprit. I have not so far been able to find a source of replacement coils, and instead rob them from old modules. **P.B.**

Hitachi C2114R

If one of these sets keeps reverting to standby, check that the 112V HT supply is correct – measure it at the cathode of D951. If the voltage is high, suspect that R951 (39k Ω , 0.5W 5%) has risen in value. In one set I had in recently the high voltages had killed the TA8427K field output chip IC601. **P.B.**

Child Lock

A Tatung Model TU2C52 was stuck on ch. 1 and there was no

control of the analogue functions, either via the on-board controls or by remote control. Before you suspect the microcontroller chip or an EEPROM problem, don't forget the child lock. The set proved to be in this lock-out mode. To return to normal operation, hold in the programme + button whilst switching the set on.

While on this subject, with Ferguson ICC5 series sets you use the Fastext keys to remove the child lock: press red, green and blue and hold yellow until successful (usually after a few seconds). S.L.

Philips K40 Chassis

This set was dead with the line output stage screaming to be put out of its misery. When the supply to the line output stage was disconnected, the HT voltage returned to normal. The BU508A line output transistor T7162 turned out to be leaky. A replacement didn't alter the symptoms however.

When I disconnected the scan coils there was EHT, sound and the tube's heaters lit up. With some relief, I fitted a replacement scan yoke. Sadly, this didn't cure the basic fault.

I eventually found that someone had fitted two $47k\Omega$, 1W resistors in parallel in the feed to the line driver transistor. As there should be a 680Ω resistor in this position, the supply was insufficient. For those who are not aware of it, the line driver stage is actually on the power supply board which is mounted centrally beneath the neck of the CRT. S.L.

Sony KVM1421 (BE2A Chassis)

This set, the teletext version of the KVM1420, was stuck in standby. Only the standby light could be seen, though the power supply was

working. A tap on the teletext board would sometimes get the set to start up, but resoldering the power transistors Q01-03 on this board didn't provide a lasting repair.

In desperation I removed the chip transistor Q02 and reconnected it using wires. This enabled the set to work. So did refitting Q02 slightly off the board. The transistor's mounting seemed to have been the cause of the trouble. **R.M.**

Boots CTV1417R

This 14in. portable had a burnt out resistor (R306 – 10Ω , 0.5W safety) in the supply to the field output stage. But a replacement resistor wasn't all that was required. R234 was unrecognisable (should be 39Ω , 1W) because its neighbour D212 (12V zener diode) was shortcircuit. When I looked for a common cause of all this I found that C609 (47 μ F) in the power supply was low in value and leaky. It lay between two power resistors. I fitted a 105°C type as a replacement, with sleeving on the full length of its leads to keep it away from the heat. R.M.

Philips G90AE Chassis

This set produced a strange picture – only part of it could be seen. The sound was OK. There was a pulsing white line at the top of the display, which was rolling and pulled into a contorted triangle with jagged parts at the bottom.

Thankfully replacing the TDA2579 timebase generator chip IC7470 restored normal pictures. R.M.

Sony KVM1421 (BE2A Chassis)

This set was stuck in standby – the only thing you could watch was the standby light! The power supply was working, and as no obvious fault could be found I ordered a new ST24C02CP memory chip (IC001) from Sony. When this had been fitted all I had to do was to tune in the channels. **R.M.**

Philips 25PT4101 (AA5 AB Chassis)

The LEDS were pulsing: the timing of their flashes gives an indication of the cause of the fault. On this occasion they were flashing on and off for three seconds, which means that there is an EEPROM error. But a new ST24C02A chip made no difference. I then found that the LM317T regulator had no output and replaced it. The set still didn't work, because there was a hairline

crack at pin 1 of the line output transformer.

Service manual 727 20783 for the AA5 AB chassis should have attached to it 727 20875 for the AA5 95.01 colour TV. This supplement is essential. **R.M.**

Loewe Concept 55/63/70

This set, which had been brought into the UK from the Netherlands, was dead. I found that the BD139 line driver transistor T525 was leaky. As a result, the $3\cdot3\Omega$ safety resistor in the 27V supply was open-circuit. This supply is also protected by R666, an $0\cdot22\Omega$ safety resistor. **R.M.**

JVC AV25F1

A line across the screen with no sound is what you get when regulators IC521 and IC522 become dryjointed at the same time. **R.M.**

Samsung CI213R

These 10in. portables seem to be more reliable than the similar Akura type. But this one was intermittently dead. The cause was eventually traced to the mains bridge rectifier going open-circuit. C.W.

Hitachi G6P Chassis

I've had quite a few of these sets that would sometimes fail to start because the values of the $82k\Omega$ start-up resistors R902 and R903 had changed. So I now replace them without bothering to check their values. With one set recently however this failed to cure the fault. C905 (4·7 μ F, 160V) was open-circuit. A replacement restored good starting every time. C.W.

Nokia 6354

The symptoms with this Nicam set were an intermittent crackle and intermittent loss of sound, both affecting the right-hand channel. Good signals were present at pins 28 and 29 of the DACM chip NA10, but not so good at pin 9 of the TDA2615 audio output chip NA90. I found that the surfacemounted BC858B transistor VA80 was noisy. A replacement cured both faults. C.W.

Hitachi CPT2178 (G6P Chassis)

This set didn't start up every time. Sometimes it would come on with a blank raster, and at other times it would come on with a two inch band of dots across the centre of the screen and no picture.

Occasionally it would come on all right. It took me some time to trace the cause of these symptoms. The culprit turned out to be the $2\cdot 2\mu F$, 50V non-polarised electrolytic capacitor C911 in the power supply. C.W.

Nokia 5864 (Monoplus Chassis)

With the HT voltage set correctly, at 109V, the raster just met the edges of the screen. Consequently the customer complained that with some pictures there was lack of width. The cause of the fault was coil LK11, which is in series with the line scan coils. It was quite hot when the set was in operation, and I presume that it had shorted turns.

To set the HT voltage with these receivers you short-circuit test point XF01 to chassis, enter the service mode by pressing Mute, M and TV on the remote control unit, move up and down the service options then use the volume control for adjustment. Measure the HT voltage at point X003. C.W.

Grundig CUC4635 Chassis

After replacing the tripler I found that there was no picture. Checks on the I2C bus lines showed that while the clock line pulse level was correct the data line pulse level was low. After some time I found that the cause of the problem was in the Nicam module, where a short was present in the MC144130 chip IC2250. A replacement restored all functions, but the customer was a bit shocked at the cost of the tripler and IC. C.W.

Toshiba 2539DB

The customer said that this set was dead. In fact it was tripping very quickly and the standby LED was flashing. Transistor Q841 (2SA1015) in the power supply was faulty. C.W.

Ferguson TX100 Chassis

This set took about five minutes to come on – the HT would rise slowly to about 100V. The cause turned out to be the chopper drive coupling capacitor C117 (100 μ F). C.W.

Bush 2121

The picture was shifted to the left, with a black margin on the right, slight foldover on the left and a blanked stripe about 1cm from the right-hand edge of the raster. This stripe wriggled like a snake, in sympathy with the video content of the picture. The cause of the trou-

ble was failure of the line pulses from the output stage to reach the line oscillator chip. R419 (470k Ω) was open-circuit. C.W.

Panasonic Euro 1 Chassis

This digital chassis can be quite daunting when dead. But not this time: R628 (470k Ω) which feeds pin 5 of the TDA4601 chopper control chip IC611 was open-circuit. **B.S.**

Panasonic TX25AD1DP (Euro 2 Chassis)

This Dolby Pro-Logic receiver had a phosphor burn on its CRT. The cause was not immediately obvious. When it had been for some days on the soak test bench I happened to switch it to standby, using the remote control unit instead of the on/off switch. This provoked a display of lights of which Blackpool would have been proud, so I hastily unplugged the set.

It soon became apparent that when standby was selected the main power supplies remained active as the line and field scans decayed. Relay RL6101 on the front panel was sticking. A replacement (part number TSE10818) and a new CRT put matters right. Panasonic recommends replacing R668 on panel E as well as RL6101. **B.S.**

Panasonic TX29AD2DP (Euro 2 Chassis)

This Dolby Pro-Logic receiver produced a display with ragged verticals and picture break up. I suspected the digital video processor chip IC601. Fortunately a replacement, part number VDP3108APPA1, restored normal operation. **B.S.**

Hitachi NP6C Chassis

This set produced slightly distorted sound, as if the speaker was faulty. But a new speaker made no difference. The cause of the fault was eventually traced to a dry-joint at pin 10 of the HA11485NT video/sound chip. Pin 10 is part of the feedback circuit. M.Dr.

JVC CS2181EKT (BYX Chassis)

This set would come on in the AV mode. When TV was selected all the channels were tuned to the same programme. This situation occurs when the -30V supply to the memory chip on the tuning module falls below -26V. Try replacing the 2SA1015 transistor Q956 in the active ripple filter circuit, also this transistor's base decoupling capaci-

tor C959 (3.3μ F, 50V) and the -30V reservoir capacitor C958 (33μ F, 35V). In addition, replace the electrolytic capacitors C016 (10μ F, 16V) and C017 (10μ F, 50V) on the station selector module. These surface-mounted electrolytics can be obtained from Farnell Electronic Components, Leeds (01132 633 411). **M.Dr.**

Tatung 190 Chassis

These sets usually come in because they are dead, the cause being failure of one or both of the $15 \mathrm{k}\Omega$ start-up resistors R802 and R803. If you fit ordinary carbon resistors, the set will be back before long. Obtain resistor pack part number 337-316 from Farnell Electronic Components (01132 633 411). It contains ten 0.75W metal-film resistors rated at 350V. Fit a couple of these resistors and you'll never see the set again.

If the chopper transistor is short-circuit, replace R811 $(470k\Omega)$ as well. Use Farnell part number 337-493. These resistors cost about 6p each. **M.Dr.**

Panasonic TX25MD1 (Euro 2 Chassis)

This set had no teletext. When it was put in the text mode it displayed only P100 and the word TEXT**** appeared in the station identification box. The cause of the fault was traced to an open-circuit capacitor, C3508, which is a surface-mounted $0.047\mu F$ component that feeds composite video to the teletext processor chip IC3502. M.O.

Mitsubishi CT29A4STX (Euro 12 Chassis)

This set produced a good picture for just a few minutes. Then rows of vertical dots, about three inches apart, would appear. After that the picture would intermittently black out. I first checked the supply lines, which were all OK. I then checked the voltage at pin 21 of the colour decoder/timebase generator chip IC201. This is the blanking feed from the text board. In the picture mode the voltage here should be 0.2V. I found that it was changing from 0.5V to 0.8V. Q7705 (JC501Q, R) on the text panel was at fault. M.O.

BPL 9009KDR

This small portable is the same as the **Sanyo CBP3001**. There were lines superimposed on its picture: in addition and as a result the verticals were kinked and variable. The lines were also visible when the set was displaying a blank raster in the AV mode. It seemed to be a decoupling fault. I traced the cause to C421 (1,000 μ F), which decouples IC201's supply pin 6. **M.O.**

ITT CT3537

Intermittently dead was the complaint with this set. When it was first switched on it would run for about half an hour. If you then switched off and on again the set was OK for a further period. These periods between switch off/ons gradually decreased to about one minute. The cause of the problem was a 5V regulator on the control panel, IC405. M.O.

Finlandia C59GZ7 (Salora M Chassis)

When this set was switched on from standby the status display was left blank, with no raster or sound. The 150V HT supply was low at about 20V. I replaced the S2000AF line output transistor TB525, as failure of this item is a common fault with these sets, but the fault was still present. Replacing DB525 (BYV95C) cured the fault – it's connected in series with TB525. O.G.

Dynatron CTV114 (Philips CP110 Chassis)

The cause of an irritating "on-off" flashing picture, with misleading symptoms as though there was a dry-joint, was traced to the 22µF, 250V HT reservoir capacitor C2670. I also replaced the HT smoothing capacitor C2621 (same value etc.) as its plastic insulating sleeve had shrunk. **O.G.**

Panasonic Z5 Chassis

At switch on the EHT came up then tripped off and the standby light kept flashing. Tests showed that the protection switch Q502/3 was being activated, cutting off the line drive. By shorting across C507 to disable the protection circuit the set was made to operate, with normal picture and sound. The voltage at the base of Q505 should be 7V: it was 5.2V, which is low enough to activate the protection switch. The cause of the trouble was R525 $(300k\Omega, 0.5W)$ which was opencircuit. When it had been replaced the set workled perfectly. M.K.

Hitachi C28P759 (Salora M Chassis)

This set would come on when the mains switch was operated and could then be put into the standby mode using the remote control unit. The trouble was that the remote control unit wouldn't bring the set out of standby. A check on the voltage (SB5V) at pin 27 of the microcontroller chip IC01 showed that in the standby mode it was low at 2.7V. When not in standby it was correct at 5V. The SB5V supply is derived from the 10V supply, which in the standby mode was low at 4.6V. The relevant reservoir capacitor is CB622 (470µF, 16V) which had gone low in value. M.K.

Panasonic TX29AD1DPB (Euro 2 Chassis)

This set was tripping slowly with picture collapse. When plug W7002 was disconnected from the audio board the set came on with a picture but no sound. Checks in the power supply on the audio panel showed that it was dead, with the start-up resistors R7000 (150k Ω) and R7005 (180k Ω) open-circuit. The I2C bus was being loaded by the inactive chips on the sound panel - disconnecting W7002 had removed this load, allowing the I2C bus in the rest of the set to work. Replacing R7000 and R7005 restored normal operation. M.K.

Aiko/Perdio 512

Excessive brightness with flyback lines is a common fault with these sets. The usual culprit is the reservoir capacitor for the first anode supply, C120 (2μF, 250V). It's as well to replace the associated rectifier as a precaution, though it rarely fails. J.C.P.

GoldStar CI990LT

This set refused to come out of standby. The relay would click, but there was no sound or picture and the CRT's heaters remained unlit. After a few minutes a slight, warm smell would be noticed. The chopper and line output transistors both measured OK, but the HT voltage was low at 60V instead of 115V. C8075 (33µF, 160V) was found to be hot. Fitting a replacement cured the fault. J.C.P.

Hitachi CPT2198 (G8Q Chassis)

When this set was switched to the text mode it displayed a blank grey raster with just P100 in the top lefthand corner. There was no further response to handset commands until the set was returned to the picture mode. As we had another similar set in the workshop, we were able to check the text PCB by swapping it over. It was OK.

PCB connector CN2101 was removed, cleaned and refitted to the main PCB. Its partner on the text PCB was resoldered. The print on the underside of the main PCB in the general area of CN2101 was examined with a magnifier and any suspect points were cleaned off and resoldered. When the set was reassembled it worked perfectly after adjusting C2044 to remove character dropouts. J.C.P.

Salora M Chassis

There was lack of height but good linearity. A check showed that the software height adjustment was at maximum. I found that the 1Ω current sensing resistor RB575 in the field output stage had gone high in value. It's in series with the field scan coils and forms part of the feedback circuit. This was a 110° set – the resistor's value is 1.54Ω in 90° sets. J.C.P.

Sanyo CBP2560

The mains switch is a weak point with these sets. It's rarely a contact problem, usually a faulty latch/return spring. This means that the set will either not stay on after being switched on or won't switch off.

As a temporary measure if you don't have a replacement switch with you, withdraw the chassis, apply a small squirt of switch lubricant to the switch spring/shaft and flick the shaft in and out a couple of times. This should provide a cure but get back as soon as possible with the correct replacement. J.C.P.

Goodmans C1401R

For intermittent loss of the picture, remove the screening cans from the IF module and look for dry-joints, especially at the miniature ceramic capacitors between transformer windings.

Faults caused by dry-jointed line output transformer pins are also common with these sets. You can get picture fade out because of loss of the CRT heater supply for example. J.C.P.

Goodmans 3375

This monstrous set was dead. The cause was an arcing joint at the chopper transformer pin that's connected to the chopper transistor. As has been my experience with these sets, there were plenty of other dryjoints that required attention. N.B.

Toshiba 217D9B

There was severe field distortion for the first hour or so. So there was obviously a faulty electrolytic

somewhere. It turned out to be C317 (2.2uF, 50V), which is in the linearity feedback loop. Violent field linearity variations occurred when I cooled and heated it. N.B.

Salora 22J20

There was very intermittent but severe width contraction with attendant EW correction problems. The cause was eventually traced to a dry-joint at L508. N.B.

Finlux 5810

This 10in, portable was dead. It would come out of standby then go straight back again, with the 11V supply doing the same. The cause of the trouble was failure of the 11V supply to reach the line output stage because of a microscopic break around the leg of L652 in the feed. N.B.

B and Q LX2500/2800

For various intermittent faults related to going off then coming back on again, check for dry-joints around transistors 1TR1/2/3 on the microcontroller/tuner board at the bottom of the cabinet. N.B.



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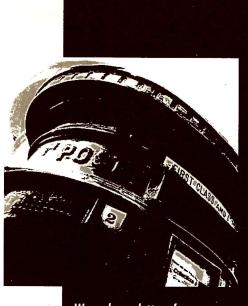




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Camcorder Tapes

As I was experiencing occasional sound drop-out with my Sony CCD-F500E camcorder I decided that it was time I bought new tapes. So I purchased some from CPC, type 2PS-90MP. The results were now even worse, with tape judder a scraping noise from the tape transport system - and of course severe picture break up and noise bars. Thinking that there might be a fault with the camcorder, I had it serviced by an advertiser in your columns. But after a lot of toing and froing, phone calls and a bill for £200 I was told that the tapes were faulty.

CPC was very helpful and agreed to replace them. When I used the new ones however the results were exactly the same - judder, noise etc. It seemed unlikely that this was a batch problem, as four months had elapsed between the supply of the original and the replacement 2PS-90MP tapes. I decided that it was time to phone Sony Customer Services, and was told that 2PS-90MP tapes are not suitable for use in the CCD-F500E camcorder. The correct type is 2PS-60SRB. The tapes I had originally used, for five years, were type P590HG.

Has anyone else had this problem? Why is type 2PS-90MP not suitable for use in the CCD-F500E? I can't get an explanation from Sony.

L.E. Swain, Buckden, Huntingdon.

Letters

Two Wires or Three?

The letter from C.N. Cory last month under this heading raises an important issue. For some forty years TV receivers have been of safety Class II construction (IEC 65/BS 415/EN60065). The number of electric shock incidents from aerial terminals has been very low, even with older receivers that have a live chassis. These were fitted with 'aerial isolator units' which had to meet very stringent construction and quality requirements. Modern receivers have either a double-wound mains transformer (in small sets) or a switch-mode power supply with high-frequency transformer isolation of the mains supply from any accessible parts and connectors. There is no likelihood of a return to Class I construction (protection by earthing) partly because in other countries, such as Germany, there have been reported problems of aerial leads (for example) melting because of circulating currents when a system has more than one earth connection. Aerial systems have by law to be earthed in Germany and, although German TV sets are also of Class II construction, there may be a signal connection to earthed audio equipment or something else.

C.N. Cory's experiences are astonishing. While faults such as those he mentions are not entirely unknown, to come across two cases in two days must be an event of very small probability indeed. The second case indicates why the IEE Regulations (now BS 7671) disallow Class II for extended systems outside the home – though, as is common, the wording is very confusing.

These days most consumer electronic products have very little accessible metalwork. I suspect that the "child user's whole contact area" is a slight exaggeration. But this is not to minimise the seriousness of the incident. In fact both incidents should be fully investigated to determine in detail why such unusual failures occurred. Did the aerial isolator fail in the first case? Had the insulation of the degaussing coil been interfered with, or perhaps damaged by unskillful rein-

sertion of the chassis in the cabinet, in the second case? These isolation barriers are tested in production (each single product) with 3kV RMS or 4.25kV DC, and the materials have to be both durable and non-hygroscopic.

An allied matter was discussed recently by the BSI committee that's responsible for BS 415/EN60065. It is this committee's duty, not that of the BEAB or the IEE, to determine such matters. In this case it was decided to retain BS 5373:1997(1988) Specification for electrical safety requirements for room aerials and to reconfirm it in due course, on the grounds that, while it is considered unnecessary for aerials used with current receivers to include a second stage of isolation, room aerials are often used with older receivers. The BS has no European equivalent however, and its requirements cannot be used to remove non-compliant products from the market.

Although I am a member of the relevant BSI committee, the opinions expressed above are all mine alone.

John Woodgate, B.Sc(Eng.), C.Eng., M.I.E.E., M.A.E.S., F.Inst.S.C.E., Rayleigh, Essex.

ITT Monoprint BNN Chassis

After reading Barry Gibbons' letter in the October issue following my suggested modification to this chassis in a fault report note (September) I couldn't rest, thinking that I had made an unnecessary design change. The fault had not returned, even after several months, but I've now checked C722 as Barry suggested. Its value was 320µF instead of 470µF, and its ESR was 2.5Ω . A new one produced an ESR reading of 0.5Ω and fitting it cured the fault, with R1427 restored to its original value. I also found that the supply ripple had been reduced by a factor of almost ten.

Thanks for the tip, Barry. The moral is to use a scope when DC readings don't make complete sense.

Ray Porter, M.Sc., C.Eng., M.I.E.E. Stourbridge, W. Midlands.



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BC14	7 8p BD441	40p 40p 50p	BU204 BU205 BU206	65p 70p 100p	BUV93 BUW11A BUW11AF	375p 200p 225p	MJ15003 MJ15004 MJ15015	300p 250p	BY133 BY164	8p 40p	AN228 AN252	280p 150p	AN6352 AN6356	450p 300p	BA511 BA514	145p 160p	BA7252S BA7604N	150p 100p
BC14 BC15 BC16	9 8p BD534	38p 38p	BU207 BU208	150p 70p	BUW12 BUW12A	125p 150p	MJ15016 MJ15022	350p 250p	BY179 BY184 BY206	35p 32p 11p	AN259 AN262 AN271	250p 140p 230p	AN6359 AN6360	500p 320p	BA516 BA518	150p 150p	BA7751LS BA7752	150p 250p
BC17 BC17	1 10p BD536 2 10p BD537	38p 40p	BU208A BU208AT	75p 200p	BUW12F BUW13A	250p 200p	MJ15023 MJ15024	400p 400p	BY207 BY227	20p 19p	AN274 AN277B	250p 400p	AN6362 AN6363 AN6367NK	400p 375p 400p	BA521 BA524 BA526	100p 240p 180p	BA7755 BA7767AS BA8504	150p 155p 350p
BC17 BC17 BC17	8 14p BD643	40p 50p 50p	BU208B BU208D BU209	200p 130p 90p	BUW32A BUW48 BUW49	500p 550p 550p	MJ15025 MJE340 MJE350	700p 25p 80p	BY228 BY298	28p 15p	AN278 AN301	60p 330p	AN6368 AN6371	275p 350p	BA527 BA532	95p 100p	BA15218 CA3140E	60p 38p
BC18 BC18	2 7p 8D647	50p 50p	BU225 BU226	120p 120p	BUW50 BUW81A	400p	MJE520 MJE2955T	30p 65p	BY299 BY329-1200 BY448	18p 150p 20p	AN302 AN303 AN304	650p 250p 360p	AN6387 AN6550	480p	BA534 BA536	220p 150p	CNX62A CNX82A	80p 60p
BC18	3 7p BD675 3L 7p BD676	40p 40p	BU312 BU325	90p 55p	BUW84 BUW85	75p 85p	MJE3055T MJE13004 MJE13005	65p 100p 60p	BYT11 BYT13-1000	25p 30p	AN315 AN316	210p 350p	AN6551 AN6552 AN6554	50p 45p 80p	BA546 BA612 BA614	160p 120p 70p	CNX83A CX136 CX139A	80p 600p 750p
BC18 BC18 BC21	4L 7p BD678	38p 40p 40p	BU326A BU406 BU406D	75p 60p 85p	BUX10 BUX11 BUX12	150p 200p 150p	MJE13007 MJE13009	100p	BYV96E BYW96E BYX10	25p 36p 15p	AN337 AN360	600p 100p	AN6555 AN6605	50p 35p	BA618 BA631	55p 280p	CX141 CX145	750p 725p
BC21 BC21	2L 7p BD680 3 7p BD681	40p 45p	BU407 BU407D	55p 75p	BUX20 BUX21	350p 450p	MJE15028 MJE15029	200p 200p	BYX55/600 IN4001	25p 3p	AN362 AN363 AN366	140p 150p 150p	AN6612 AN6650	60p 45p	BA656 BA658 BA681A	110p 350p 350p	CX150B CX175 CX187	325p 325p 825p
BC21 BC21	4 7p BD705	45p 50p	BU408 BU408D BU409	60p 75p 85p	BUX22 BUX23 BUX37	450p 900p 220p	MJE15030 MJE15031 MJE18004	250p 400p 125p	IN4002 IN4003	3p 3p	AN610 AN3211K	160p 375p	AN6651 AN6652 AN6671K	45p 45p 425p	BA682A BA683A	300p 300p	CX804A CX867	775p 575p
BC21 BC23 BC23	7 7p BD709 8 7p BD711	50p 50p 50p	BU412 BU413	175p 175p	BUX39 BUX40	450p 210p	MJF18004 MJF18204	175p 350p	IN4004 IN4005 IN4006	3p 3p 3p	AN3215K AN3231K AN3236K	350p 300p 450p	AN6676 AN6780S	600p 80p	BA684 BA685	400p 400p	CX868 CX877	525p 300p
BC23 BC30	9 7p BD736 0 20p BD826	50p 50p	BU414B BU415A	250p 170p	BUX41 BUX42	200p 200p	OC28 OC29	350p 250p	IN4007 IN4148	4p 2p	AN3310K AN3312	325p 350p	AN6870 AN6875 AN6878	450p 150p 65p	BA715 BA718 BA728	45p 45p 55p	CX7925B CX20015A CX20106A	550p 600p 75p
BC30	2 20p BD828	50p 55p 50p	BU426A BU433 BU500	70p 120p 100p	BUX47A BUX48A BUX55	220p 150p 800p	OC35 OC36 \$2000A3	350p 250p 175p	IN5400 IN5401 IN5402	9p 8p 8p	AN3313 AN3320K	300p 450p	AN6879 AN6880	225p 75p	BA806 BA843	220p 130p	CX20109 CX20187	140p 700p
BC30 BC30 BC32	4 25p BD899 7 7p BD977	50p 50p	BU500D BU505	225p 90p	BUX80 BUX81	180p 160p	S2000AF S2055A	130p 175p	IN5402 IN5403 IN5404	8p 8p	AN3331K AN3792 AN3794	450p 300p 325p	AN6882 AN6884	300p 200p	BA1310 BA1320	160p 75p	CXA1001AP CXA1019P CXA1019S	1600p 150p 225p
BC32 BC33	8 7p BDX33 7 7p BDX37	60p 100p	BU505D BU505DF	90p 90p	BUX84 BUX85	50p	\$2055AF \$2530A	175p 100p	IN5405 IN5406	11p 12p	AN3814K AN3821K	450p 600p	AN6888 AN6889 AN6913	150p 100p 60p	BA1330 BA1332 BA1350	120p 60p 130p	CXA10195 CXA1044P CXA1044BF	550p
BC33 BC44 BC44	1 28p BDX47	100p 60p 75p	BU506 BU506D BU506DF	100p 70p 100p	BUX86 BUX87 BUX98A	30p 50p 350p	TIP29 TIP29A TIP29C	15p 22p 25p	IN5407 IN5408 RGP10	12p 12p 25p	AN3822K AN3830K	600p 800p	AN700 AN7010K	650p 250p	BA1355 BA1356	125p 100p	CXA1081 CXA1081M	275p 250p
BC47 BC51	7 18p BDX620	150p 175p	BU508A BU508AF	70p 95p	BUZ71 BUZ71AF	75p 100p	TIP29E TIP30	40p 25p	RGP15 RGP30	25p 16p	AN3990K AN3991K AN5010	300p 400p 250p	AN7025K AN7060	90p 175p	BA1360 BA1404	160p 120p 125p	CXA1081S CXA1082AS CXA1191M	300p 1000p 250p
BC53 BC54	7 25p BDX640 6 8p BDX65	80p	BU508APH BU508D	75p	BUZ72A BUZ72AF BUZ73A	100p 100p 150p	TIP30C TIP31A TIP31C	25p 22p 27p	SR2M	60p	AN5011 AN2020	225p 80p	AN7062 AN7072 AN7081K	300p 250p 200p	BA1604 BA2266A BA3306	250p 60p	CSA1209P FT5754M	400p 600p
BC54 BC54 BC54	8 8p BDX670	175p 275p 70p	BU508DF BU508DR BU508V	85p 130p 110p	BUZ73AF BUZ76A	60p	TIP32 TIP32A	24p 21p	I.C. SOCKE		AN5025 AN5033	250p 400p	AN7105 AN7106K	170p 135p	BA3308 BA3312	70p 60p	FT5764M HA1124	250p 125p
BC55 BC55	0 8p BDX77 6 8p BDX870	175p 175p	BU508VF BU526	100p 75p	BUZ80 BUZ80AF	135p 200p	TIP32C TIP33	28p 50p	8 PIN 14 PIN 16 PIN	4p 5p 6p	AN5034 AN5070 AN5071	400p 125p 100p	AN7110 AN7111	75p 100p 45p	BA3402 BA3406AL	90p 120p 80p	HA1125 HA1137W HA1151	120p 150p 175p
BC55 BC55	8 8p BDW24	150p 55p 50p	BU536 BU546 BU603	100p 125p 125p	BUZ83 BUZ90A BUZ91A	200p 180p 260p	TIP33C TIP34 TIP34C	60p 65p 60p	18 PIN 20 PIN	9p 10p	AN5111 AN5132	450p 250p	AN7112 AN7114 AN7115	120p 110p	BA3416BL BA3422 BA3505F	350p	HA1197 HA1199	130p
BC55 BC56 BC63	0 8p BDW94		BU606D BU608D	225p 120p	BY448 BYT11	20p 25p	TIP35C TIP36C	65p 65p	22 PIN 24 PIN 28 PIN	12p 13p 13p	AN5135NK AN5138NK	400p 350p	AN7116 AN7117	90p 65p	BA3506A BA3516	70p 120p	HA1201 HA1202	225p 125p
BC63 BC64	9 20p 8DY56 0 20p 8DY58	225p 500p	BU626 BU705	120p 130p	IRF120 IRF130	225p 475p	TIP41A TIP41C	20p 22p	40 PIN	15p	AN5150 AN5151 AN5210	400p 200p 675p	AN7120 AN7130 AN7131	100p 75p 90p	BA3520 BA3521 BA3704	130p 225p 200p	HA1319 HA1338 HA1339A	200p 300p 350p
BCY3 BCY3 BCY7	34 200p BDY92	125p 100p 35p	BU706F	175p 150p 100p	IRF140 IRF230 IRF240	550p 550p 425p	TIP42A TIP42C TIP47	20p 22p 40p	ZENER DIC		AN5215 AN5222	100p 200p	AN7133N AN7134	325p 300p	BA3706 BA3812L	75p 80p	HA1367 HA1377	300p 120p
BCY7	71 16p BF167 72 16p BF181	30p 18p	BU801 BU806	70p 70p	IRF250 IRF330	375p 600p	TIP48 TIP50	40p 60p	400 mWatt 2V7 to 39V	ts 5p	AN5250 AN5256 AN5260	160p 150p 300p	AN7140 AN7141	170p 70p	BA3822LS BA3824LS	80p 75p	HA1384 HA1388	600p 320p 210p
BD11 BD12	5 30p BF183 4P 50p BF195	20p 7p	BU807 BU807F	60p 75p	IRF340 IRF350	325p 750p	TIP51 TIP52	80p 80p	1.3 Watts 2V7 to 39V	9р	AN5262 AN5262 AN5265	175p 80p	AN7142 AN7145 AN7146	80p 195p 210p	BA3920 BA4110 BA4210	300p 75p 85p	HA 1389 HA 1392 HA 1394	120p 170p
BD13 BD13 BD13	25p BF200	8p 16p 30p	BU808DF BU810 BU824	210p 110p 60p	IRF450 IRF510 IRF520	650p 110p 110p	TIP54 TIP102 TIP105	85p 70p 65p	VOLTAGE		AN5315 AN5352	600p	AN7147 AN7148	180p 140p	BA4220 BA4234L	60p 70p	HA1396 HA1397	650p 200p
BD13	85 20p BF240	16p 25p	BU826 BU826A	120p 160p	IRF530 IRF540	120p 120p	TIP106 TIP107	65p 65p	7805	<i>1</i> 8p	AN5411 AN5421	450p 150p	AN7149 AN7154	160p 180p	BA4236L BA4402	110p 45p	HA1398 HA1406	175p
BD13 BD13	37 20p BF254 38 20p BF255	15p 12p	BU902 BU903 BU910	110p 110p 80p	IRF610 IRF611	120p 120p 160p	TIP110 TIP111 TIP112	40p 40p 35p	7806 7808	18p 25p	AN5429 AN5431 AN5435	420p 275p 125p	AN7156 AN7158 AN7160	240p 310p 350p	BA4403 BA4405 BA4412	220p 80p 50p	HA11123 HA11211 HA11215	350p 170p 350p
BD14 BD14 BD14	10 20p BF257	18p 18p 18p	BU912 BU920	100p 100p	IRF620 IRF630 IRF640	110p 300p	TIP112H TIP115	50p 30p	7812 7815 7818	18p 25p 25p	AN5436N AN5512	160p 100p	AN7161N AN7163	375p 175p	BA5101 BA5102	350p 140p	HA11219 HA11221	280p 180p
BD15 BD16	7 38p BF262 30p BF270	25p 18p	BU922 BU930	110p 130p	IRF642 IRF650	200p 200p	TIP116 TIP117	30p 30p	7824 7905	25p 25p	AN5515 AN5520 AN5521	160p 550p 100p	AN7166 AN7168	350p 200p 225p	BA5115 BA5115L BA5204	75p 75p 200p	HA11225 HA11235 HA11244	130p 100p 375p
BD17 BD17 BD17	77 30p BF311	15p 21p 20p	BU932 BU941 BU2508A	175p 250p 100p	IRF710 IRF720 IRF730	150p 150p 125p	TIP120 TIP121 TIP122	37p 35p 30p	7906 7908 7912	30p 30p 30p	AN5560 AN5601K	350p 750p	AN7169 AN7170 AN7171K	260p 400p	BA5208AF BA5402	110p 180p	HA11247 HA11251	375p
BD18	31 45p BF337	20p 20p	BU2508AF BU2508D	110p	IRF740 IRF820	125p 110p	TIP125 TIP126	30p 40p	7915 7918	30p 30p	AN5612 AN5613	200p 200p	AN7172K AN7173K	325p 450p	BA5406 BA5408	180p 180p	HA11412 HA11414	600p 300p
BD18	34 60p BF362 37 30p BF367	30p 13p	BU2520AF	170p	IRF830 IRF840	110p 110p	TIP127 TIP130	35p 30p	7924 78L05	30p 24p	AN5615 AN5620 AN5622	300p 250p 275p	AN7177 AN7178 AN7205	375p 180p 35p	BA5413 BA6104 BA6109	225p 250p 110p	HA11423 HA11440 HA11485B	110p 250p V 400p
BD20 BD20 BD20	2 38p BF421	17p 18p 21p	BU2525A	325p	IRF9140 IRF9510 IRF9511	1000p 150p 150p	TIP131 TIP132 TIP136	30p 30p 40p	78L08 78L12 78L15	24p 24p 24p	AN5625 AN5630	400p 375p	AN7213 AN7216	40p 175p	BA6110 BA6125	225p 75p	HA11702 HA11703	330p 400p
BD22	04 42p BF423 22 31p BF455	25p 12p	BU2527AF BUF405A	400p 200p	IRF9520 IRF9530	150p 200p	TIP137 TIP162	65p 110p	78L18 78L24	24p 24p	AN5633 AN5635N AN5640	350p 330p 500p	AN7218 AN7220 AN7222	60p 85p	BA6137 BA6138 BA6146	55p 130p 150p	HA11706 HA11710 HA11713	280p 500p 250p
BD23 BD23 BD23	32 31p BF462	19p 50p 28p	BUH315 BUH315D BUH515	200p 175p 200p	IRF9531 IRF9540 IRF9541	200p 240p 200p	TIP141 TIP142 TIP145	65p 75p 50p	79L05 79L08 79L12	35p 35p 35p	AN5700 AN5701	90p 150p	AN7223 AN7224	75p 105p 75p	BA6149LS BA6154	700p	HA11715 HA11716	250p
BD23	32p BF472 35 28p BF479	28p 30p	BUH515D BUH517	250p 275p	IRF9610 IRF9620	120p 110p	TIP146 TIP147	70p 80p	79L15 LM309K	35p 100p	AN5710 AN5712	100p 180p	AN7225 AN7254	175p 150p	BA6208 BA6209	175p 85p	HA11718 HA11724	700p 650p
BD23	36 30p BF494 37 21p BF495	16p 16p	BUH715	175p 425p	IRF9622 IRF9630 IRF9640	200p 180p 280p	TIP150 TIP151 TIP2955	90p 60p 50p	LM317T LM323K	100p 350p	AN5720 AN5722 AN5730	70p 140p 160p	AN7256 AN7273 AN7310	250p 75p 60p	BA6218 BA6220 BA6222	85p 55p 130p	HA11741N HA11744 HA11745	7 950p 330p 330p
BD23 BD23 BD24	39 30p BF596	16p 16p 30p	BUT11A BUT11AF BUT12	40p 40p 80p	IRFD9220 IRFBC30	100p	TIP3055 TIPL760	50p 100p	78H08KC 79H12KC 79HGKC	800p 700p 800p	AN5732 AN5750	120p 75p	AN7311 AN7312	90p 70p	BA6227 BA6229	50p	HA11749 HA11751	350p 1500p
BD24	11A 40p BF617 13A 50p BF760	30p 40p	BUT13 BUT18	310p 80p	IRFBC40 IRFP140	250p 250p	TIPL762A TIPL763A	200p 200p			AN5753 AN5763	130p 250p 240p	AN7315 AN7330	40p 110p 200p	BA6235 BA6238A	50p 130p 130p	HA11752 HA11839N HA11847	325p
BD24	50p BF763 50p BF870	40p 22p		65p 1700p 65p	IRFP150 IRFP240 IRFP250	300p 300p 280p	TIPL791A 2N2369 2N2646	80p 15p 40p	LEDs 3mm		AN5790 AN5791 AN5836	225p 450p	AN7362 AN7363 AN7410	200p 225p 150p	BA6247 BA6248	150p 140p	HA12002 HA12003	220p 150p
BD26 BD26 BD26	65 45p BF960 67 45p BF961	22p 38p 35p	BUT76A BUT90	80p 1300p	IRFP350 IRFP450	325p 325p	2N2904 2N2905	20p 20p	RED YELLOW	5p 8p	AN5862K AN5900	225p 130p	AN7411 AN7414	50p 275p	BA6259 BA6280AF	170p 300p	HA12005 HA12010	180p 300p
BD2	59 45p BF964 78 50p BFQ23	38p 2 75p	BUT92 BUV18	1200p 650p	IRFP460 IRFP9140	775p 1450p	2N2906 2N2907	18p 18p	GREEN 5mm RED	. 8p 5p	AN608P AN620 AN6130	125p 250p 130p	AN7415 AN7470 AN8053	70p 100p 200p	BA6294	200p 250p 150p	HA12016 HA12017 HA12026	120p 100p 125p
BD3	14 100p BFR90	2A 60 p 85p 99p	BUV21	650p 400p 475p	IRFP9240 IRFPC50 IRFRC20	350p 600p 250p	2N3019 2N3053 2N3054	28p 18p 40p	RED YELLOW GREEN	8p 8p	AN6135 AN6209	120p 120p 350p	AN8275 AN8370	250p 1000p	BA6304 BA6305	120p 140p	HA12038N HA12044	T 140p
BD3	17 150p BR100 31 40p BR103	14p 37p	BUV24 BUV25	350p 110p	IRFZ20 IRFZ42	65p 275p	2N3055 2N3055H	38p 50p	<u> </u>		AN6250 AN6247	50p 200p	AN8377 AN8387	400p 350p	BA6321 BA6328	250p 250p	HA12045 HA12047	280p 450p
BD30	32 40p BR303 61 60p BU105	85p 80p	BUV26 BUV27	150p 125p	IRFZ44 MJ2501	160p 100p	2N3440 2N3441 2N3442	45p 175p	RECTANG LEDs	ULAR	AN6270 AN6300 AN6306	400p 600p 380p	BA222 BA225 BA314	65p 100p 40p	BA6410	75p 220p 250p	HA12058 HA12088 HA12116	320p 375p 130p
BD3 BD3	70 30p BU109	100p 80p 90p	BUV37	110p 175p 75p	MJ2955 MJ3000 MJ3001	55p 100p 100p	2N3771 2N3772	85p 85p 90p	5mm x 2.5	5p	AN6310 AN6320	200p 180p	BA301 BA311	55p 80p	BA6418N BA6435S	100p 425p	HA12411 HA12412	175p 175p
BD4:	10 50p BU111	100p 60p	BUV47	120p 175p	MJ4032	175p 175p	2N3773	100p 29p	YELLOW GREEN	8p 8p	AN6326N AN6332	250p 320p	BA313 BA333	60p 80p	BA6993 BA7001	150p 150p	HA12413 HA12430	70p 200p

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Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
HA13001 HA13002	110p 200p	LA2800 LA3120	350p 200p	LA7096 LA7113	200p 275p	LF353 LF355	48p 60p	MC3302 MC3401	50p 45p	SAB3029 SAB3035	525p 275p	STK3102 H STK3106	530p	STK5478 STK5479	380p 300p	STR16006	500p	TA7281	200p
HA13006	400p	LA3150	200p	LA7116	125p	LF357	70p	MC3423P	100p	SAB3036	725p	STK3122 III	2500p 725p	STK5481	470p	STR17006 STR20005	500p 450p	TA7282 TA7210	160p 200p
HA13007 HA13108	300p 280p	LA3160 LA3161	120p 40p	LA7123 LA7210	1300p 60p	LF398 LH2426S	300p 600p	MC3488AP MC34063A	250p 200p	SAB3037 SAB3042	700p 825p	STK3152 II STK3156	900p 500p	STK5482 STK5483	285p 440p	STR20012 STR20015	450p 450p	TA7283	200p
HA13117	175p	LA3210	65p	LA7212	150p	LM301	26p	MN1220T	600p	SAB3064	130p	STK4017	400p	STK5486	450p	STR30110	330p	TA7284P	400p
HA13118	140p	LA3226	60p	LA7214	150p	LM311	35p	MN1226	450p	SAB3209	225p	STK4019	480p	STK5487	525p	STR30115	275p	TA7288	220p
HA13119 HA13127	140p 350p	LA3246 LA3300	75p 140p	LA7220 LA7222	125p 110p	LM319 LM324	165p 30p	MN1228 MN1276	600p 1300p	SAB3210 SAB6456	250p 125p	STK4021 STK4024 II	380p	STK5488	480p	STR30120	400p	TA7291P TA7292P	200p 325p
HA13128 HA13130	400p 450p	LA3301 LA3361	110p 100p	LA7224 LA7225	150p 250p	LM335Z LM339	120p	MN1280	70p	SAB8048	225p	STK4025	550p 530p	STK5490 STK5632	450p 450p	STR30123 STR30125	450p 550p	TA7294P TA7299	450p 200p
HA13135	500p	LA3365	70p	LA7292	275p	LM348	35p 50p	MN3004 MN3005	600p 2000p	SAB8051AI SDA2003	450p	STK4026 STK4028	480p 550p	STK5720 STK5725	400p 450p	STR30130 STR40090	250p 350p	TA7302P	75p
HA13139	600p	LA3370	70p	LA7294	200p	LM358	45p	MN3011	4000p	SDA2004	325p	STK4032 II	510p	STK5730	450p	STR40115	600p	TA7303	70p
HA13150A	1150p	LA3373	70p	LA7295	160p	LM380	80p	MN3101	110p	SDA2005	700p	STK4034 X	925p	STK6316	300p	STR41090	330p	TA7307	100p
HA13151	875p	LA3375	300p	LA7297	120p	LM381	150p	MN3102	110p	SDA2007	300p	STK4036	470p	STK6324B	500p	STR43111	950p	TA7310	100p
HA13403	400p	LA3376	80p	LA7305A	350p	LM382	130p	MN3207	375p	SDA2008	400p	STK4038	680p	STK6327	1200p	STR44115	475p	TA7312	120p
HA13406W HA13408	400p 350p	LA3380 LA3390	300p 250p	LA7308 LA7311	70p 200p	LM386 LM387	60p 100p	MN3208 MN6030B	950p 350p	SDA2112 SDA2120	450p 200p	STK4040 II STK4042 II	650p 800p	STK6328A STK6431	800p 850p	STR45111 STR50020	550p 350p	TA7313	70p
HA 13412	600p	LA3400	250p	LA7320	120p	LM389N	105p	MN6163A	700p	SDA2131	225p	STK4044	800p	STK6607	400p	STR50092	550p	TA7314	175p
HA 13426	500p	LA3401	90p	LA7323	325p	LM393	45p	MTA001M	600p	SDA2208	450p	STK4046	950p	STK6722	725p	STR50103A	260p	TA7315	200p
HA 13432	400p	LA3410	150p	LA7330	350p	LM431	50p	NE555	20p	SDA4212	775p	STK4048	1280p	STK6732	1000p	STR50113	500p	TA7317P	120p
HA 13441	450p	LA3430	135p	LA7331	250p	LM710	45p	NE556	40p	SDA5241	725p	STK4050 II	1600p	STK6822	900p	STR50115	500p	TA7320P	200p
HA17524 KA2102	250p 100p	LA3600 LA3605	60p 100p	LA7332 LA7340	225p 300p	LM723 LM741DIL	40p 18p	NE558 NE565	80p	SDA5243-2	450p 1450p	STK4060	510p	STK6922	500p	STR51041	500p	TA7322	130p
KA2130 KA2131	150p	LA3607 LA4030	125p	LA7376	150p	LM741MET	45p	NE567	110p 115p	SDA5343 SDA5640	200p	STK4065 STK4101	650p 500p	STK6932 STK6962	525p 275p	STR50213 STR53041	500p 400p	TA7323 TA7234	80p 75p
KA2206	110p 150p	LA4031	180p 140p	LA7391 LA7520	550p 200p	LM747 LM1017	55p 200p	NE571 NE592	290p 85p	SDA5642 SGSF444	450p 500p	STK4111 STK4112	500p 500p	STK6972 STK6981B	490p 600p	STR54041 STR55041	320p 450p	TA7325 TA7326	90p 200p
KA2209	125p	LA4032	140p	LA7530	200p	LM1035N	350p	NE5532P	140p	SGFS465	500p	STK4121	480p	STK6982	600p	STR56041	550p	TA7328	110p
KA2210	230p	LA4051	160p	LA7535	175p	LM1040N	650p	SAA1000	350p	SLA4031	750p	STK4122	560p	STK6982H	600p	STR58041	250p	TA7330P	80p
KA2212 KA2213	65p 130p	LA4100 LA4101	85p 80p	LA7545 LA7550	160p 275p	LM1203 LM1203AN	225p 225p	SAA1004 SAA1005	650p 325p	SLA7020M STA301A	450p 200p	STK4131 STK4132 II	480p 600p	STK7216 STK7217	420p 400p	STR59041 STR60001	300p 525p	TA7331P	80p
KA2214	100p	LA4102	100p	LA7555	150p	LM1875T	330p	SAA1006	300p	STA341M	180p	STK4133 II	750p	STK7225	500p	STR80145	475p	TA7333	100p
KA2224	50p	LA4110	120p	LA7620	500p	LM1881N	375p	SAA1008	450p	STA401A	220p	STK4141 II	420p	STK7226		STR81145	375p	TA7335	85p
KA2244	75p	LA4120	270p	LA7680	675p	LM1886	250p	SAA1010	400p	STA403A	270p	STK4142	530p	STK7251	500p	STR90120	425p	TA7336	180p
KA2261	100p	LA4138	105p	LA7681	650p	LM1889	300p	SAA1024	250p	STA405A	280p	STK4147 II	1450p	STK7253	450p	STRD1206	500p	TA7337P	175p
KA2263	100p	LA4140	60p	LA7710	250p	LM1894N	200p	SAA1025	250p	STA431A	250p	STK4151	680p	STK7308	350p	STRD1406	600p	TA7339P	175p
KA2264	100p	LA4142	65p	LA7800	90p	LM1895N	275p	SAA1026	400p	STA432A	220p	STK4152	650p	STK7309	400p	STRD1706	360p	TA7341	250p
KA2284 KA2309	75p 175p	LA4145 LA4160	65p 100p	LA7801 LA7802	100p 300p	LM2901N LM2902N	35p 40p	SAA1027 SAA1029	400p 150p	STA434A STA435A	270p 270p	STK4161 STK4162	650p 550p	STK7310	470p 400p	STRD1806 STRD1816	360p	TA7342P	70p
KA2401 KA2412	150p 225p	LA4162 LA4178	110p 150p	LA7806 LA7808	260p 250p	LM2902N LM2903N LM3900	40p 40p 40p	SAA1042 SAA1043P	325p 675p	STA441C STA451C	270p 220p 280p	STK4164 II STK4171	1175p 900p	STK7348 STK7356 STK7358	400p 425p 440p	STRD1906	350p 550p	TA7343 TA7347P	120p 120p
KA2912	125p	LA4180	150p	LA 7820	100p	LM3909	100p	SAA1044	400p	STA456C	240p	STK4172 II	680p	STK7402	560p	STRD3035 STRD4412	300p 500p	TA7348P TA7349P	125p 175p
KA2913A	175p	LA4182	180p	LA7823	200p	LM3911N	200p	SAA1056	300p	STA471	210p	STK4181	680p	STK7404	400p	STRD4420	550p	TA7354P	65p
KA2914A	200p	LA4190	300p	LA7824	130p	LM3914	160p	SAA1057	375p	STA901M	280p	STK4182 II	750p	STK7406	650p	STRD4512	400p	TA7357	
KA22427	100p	LA4192	140p	LA7830	90p	LM3915	160p	SAA1058	225p	STK0025	420p	STK4191	700p	STK7408	675p	STRD5441	475p	TA7358	340p
KIA6213S	60p	LA4200	130p	LA7831	85p	LM3916	270p	SAA1060	375p	STK0029	360p	STK4192	700p	STK7410	1500p	STRD5541	450p		85p
KIA6210AH	400p	LA4201	120p	LA7832	130p	LM8363	320p	SAA1061	250p	STK0039	600p	STK4211 V	1000p	STK7458	1250p	STRD6008	575p	TA7359P	90p
KIA6281H	250p	LA4260	230p	LA7835	150p	LM8560	175p	SAA1062	250p	STK0040	520p		800p	STK7554	600p	STRD6009E	450p	TA7361	125p
KIA6283K	150p	LA4261	300p	LA7837	150p	LM13600	150p	SAA1063	250p	STK0049	510p	STK4231 II	1200p	STK7561	650p	STRD6018	450p	TA7362	150p
KIA6299H	210p	LA4265	125p	LA7838	200p	LM13700	125p	SAA1064	275p	STK0050	440p		700p	STK7562	1000p	STRD6602	475p	TA7364P	175p
KIA7227CP	200p	LA4270	300p	LA7850	225p	LM18293	500p	SAA1070	550p	STK0059	620p	STK4241	1050p	STK7563	800p	STRD6601	650p	TA7366P	65p
KIA7313	45p	LA4282	350p	LA7851	200p	M491BB1	600p	SAA1073	325p	STK0060	820p	STK4241 V	1250p	STK7573	400p	STRM6545	900p	TA7368P	35p
L149V	300p	LA4420	140p	LA7910	150p	M494B1	700p	SAA1075	350p	STK0070	1100p	STK4272	500p	STK7576	1500p	STRM6546	900p	TA7373F	150p
L165V	250p	LA4422	130p	LA7913	90p	M5265P	200p	SAA1086	175p	STK0080	580p	STK4273	550p	STK7703	1000p	STRM6549	500p	TA7374	
L200 L272	200p 200p	LM4425A LA4430	130p	LA7930 LA7940	350p 200p	M50115P M50117P	320p 500p	SAA1089 SAA1101	325p 700p	STK011 STK015	330p 440p	STK4301 STK4311	500p 650p	STK8050 STK8250	750p 500p	STRS5741 STRS5941	800p 750p	TA7376P	175p 100p
L272M	110p	LA4440	200p	LA7953	300p	M50119P	525p	SAA1124	200p	STK016	760p	STK4332	365p	STK8260	1200p	STRS6307	600p	TA7378P	60p
L290B	225p	LA4445	200p	LA9200	300p	M50422P	750p	SAA1130	550p	STK025	650p	STK4352	500p	STK8280	1850p	STRS6308	600p	TA7401	250p
L291B	300p	LA4446	170p	LB1205	170p	M50461	350p	SAA1250	280p	STK050	1600p	STK4362	450p	STK73405 I	550p	STRS6309	600p	TA7402P	200p
L292	750p	LA4460	120p	LB1216	150p	M50784	300p	SAA1251	380p	STK077	520p	STK4372	600p	STK73410	350p	STRS6707	1000p	TA7403	325p
L293B	225p	LA4461	120p	LB1258	100p	M50786	500p	SAA1271	400p	STK078	580p	STK4392	500p	STK7340 II	500p	STRS6708	575p	TA7404	150p
L293C	325p	LA4466	225p	LB1268	70p	M50790	600p	SAA1274	280p	STK080	550p	STK4412	450p	STK73605	375p	TA7054	190p	TA7405P	200p
L293D	225p	LA4470	300p	LB1274	85p	M51014L	120p	SAA1290	750p	STK082	540p	STK4432	600p	STK73907	700p	TA7061	115p	TA7411AP	150p
L293E	250p	LA4475	225p	LB1290	120p	M51143AL	110p	SAA1293	550p	STK084	600p	STK4773	820p	STK78617	2400p	TA7062	200p	TA7415P	350p
L294 L295	475p 450p	LA4476 LA4480	225p 225p	LB1292 LB1405	110p 70p	M51161 M51161P	300p 250p	SAA1294 SAA1300	800p 200p	STK085 STK086	900p 800p	STK4793 STK4803	800p 640p	STR370 STR371	300p 400p	TA7066 TA7075P	120p 300p	TA7417AP	225p
L297	525p	LA4485	300p	LB1407	130p	M51162P	250p	SAA1310	200p	STK0100	900p	STK4813	800p	STR380	350p	TA7089	300p	TA7521P	350p
L298	400p	LA4495	250p	LB1409	200p	M51164AL	80p	SAA1350	275p	STK0100II	1200p	STK4833	850p	STR381	390p	TA7102P	500p	TA7607	200p
L465A	525p	LA4496	250p	LB1412	300p	M51166P	300p	SAA1351	750p	STK420	400p	STK4843	720p	STR383	410p	TA7119	150p	TA7608	360p
L482	400p	LA4498	275p	LB1415	100p	M51182L	110p	SAA1900S	475p	STK430	500p	STK4853	730p	STR384	350p	TA7120	55p	TA7609	170p
L497B	525p	LA4500	200p	LB1416	85p	M51191L	85p	SAA3004	400p	STK433	400p	STK4863	700p	STR440	800p	TA7124	250p	TA7611	210p
L702B	400p	LA4505	220p	LB1426	125p	M51231P	200p	SAA3006P	225p	STK435	375p	STK4873	850p	STR441	950p	TA7130P	85p	TA7612	300p
L702N	325p	LA4508	200p	LB1450	110p	M51308SP	550p	SAA3007P	130p	STK436	430p	STK4893	1000p	STR442	1600p	TA7137	60p	TA7613AP	90p
L2720	150p	LA4510	100p	LB1615	270p	M51310AP	900p	SAA3008P	200p	STK437	600p	STK4913	900p	STR450A	700p	TA7140	100p	TA7614	
L2722	175p	LA4520	170p	LB1620	210p	M51316P	300p	SAA3010P	300p	STK439	500p	STK5314	475p	STR451	800p	TA7141	825p	TA7616	170p
L4960	325p	LA4550	200p	LB1622	220p	M51320	200p	SAA3027P	375p	STK441	680p	STK5315	500p	STR452	600p	TA7150P	250p		300p
L6203	600p	LA4555	120p	LB1630	80p	M51356P	400p	SAA3049P	550p	STK443	700p	STK5322	500p	STR453	500p	TA7157	100p	TA7621	300p
L6210	250p	LA4557	150p	LB1639	300p	M51358P	150p	SAA4700	425p	STK457	470p	STK5323	600p	STR454	1300p	TA7172P		TA7622	420p
L6221AS	300p	LA4558	125p	LB1640	150p	M51365P	350p	SAA5000	200p	STK459	560p	STK5324	450p	STR455	550p	TA7193	320p	TA7628	110p
L6506	300p	LA4570	130p	LB1641	75p	M51366P	360p	SAA5010	220p	STK460	660p	STK5325	370p	STR456	470p	TA7200		TA7629	220p
LA1130 LA1135	240p 120p	LA4571 LA4581	175p 175p	LB1642 LB1645	150p	M51381P M51384AP	200p	SAA5012	400p	STK461 STK463	600p	STK5326	750p	STR457	600p	TA7205	200p 150p	TA7630 TA7632	200p 400p
LA1145 LA1150	200p 150p	LA4597 LA4620	125p 400p	LB1648 LB1649	100p 200p 190p	M51387P M51392P	750p 600p 300p	SAA5020 SAA5030	350p 440p 280p	STK465	950p 720p	STK5330 STK5331	850p 300p	STR470 STR1096	400p 275p	TA7207 TA7208	150p 125p	TA7640 TA7641	90p
LA1170 LA1177	90p 130p	LA4630 LA4700	325p 350p	LB3500 LC4966	125p 65p	M51393AP M51395AP	350p 450p	SAA5040A SAA5040B SAA5041	400p 550p	STK501 STK561 STK563	550p 450p 415p	STK5332 STK5333 STK5335	180p 650p	STR1195 STR1229 STR2005	350p 325p	TA7210 TA7214 TA7217	200p 220p	TA7644BP	140p 480p
LA1180 LA1185	75p 150p	LA4705 LA5005	400p 90p	LC7011	500p	M51395AP M51397AP M51436P	425p	SAA5042	425p	STK583	500p	STK5336	350p 350p	STR2012	400p 400p	TA7220	145p 220p	TA76545P TA7658	65p 100p 400p
LA1186	35p 75p	LA5112	200p	LC7060 LC7120	600p 350p	M51496P	350p 275p	SAA5050 SAA5051	650p 400p	STK760 STK770	600p 400p	STK5337 STK5338	500p 295p	STR2013 STR2015	300p 550p	TA7222 TA7223	90p 210p	TA7659P TA7660P	400p 325p
LA1201	75p	LA5511	50p	LC7130	300p	M51533	300p	SAA5052	500p	STK772	650p	STK5339	400p	STR2024	575p	TA7225	300p	TA7666P	100p
LA1205		LA5512	50p	LC7131	260p	M51544	150p	SAA5054	500p	STK772B	480p	STK5340	350p	STR2105	600p	TA7226	290p	TA7668	100p
LA1207	120p	LA5522	45p	LC7132	400p	M51848	150p	SAA5230	850p	STK780	575p	STK5342	245p	STR2124	675p	TA7227	170p	TA7672	400p
LA1210	140p	LA5523	150p	LC7137	450p	M54523P	200p	SAA5231	170p	STK795	450p	STK5343	380p	STR3105	525p	TA7230	100p	TA7676AP	
LA1222 LA1230	80p 130p	LA5524 LA5527	80p 150p	LC7181 LC7185	350p 350p	M54563P M58484	200p 500p	SAA5240PA SAA5243PE	360p	STK1039 STK1040	460p 640p	STK5353 STK5361	400p 375p	STR3113 STR3115	225p 400p	TA7232 TA7233	95p 120p	TA7679	450p 475p
LA1235	130p	LA5530	65p	LC7191	300p	M51516	260p	SAA5244AF	380p	STK1049	700p	STK5362	400p	STR3123	400p	TA7237	300p	TA7680AP	200p
LA1240	80p	LA5531	65p	LC7207	275p	M51518	200p	SAA5246AF		STK1050	650p	STK5372	260p	STR3125	480p	TA7238	400p	TA7681AP	425p
LA1245	110p	LA5537	45p	LC7215	160p	M51995P	250p	SAA5246P	750p	STK1060	700p	STK5373	375p	STR3130	500p	TA7240	160p	TA7687AP	100p
LA1260	75p	LA5655	175p	LC7217	350p	M51977P	300p	SAA5250P	750p	STK1070	850p	STK5391	375p	STR3135	250p	TA7241	165p	TA7688	150p
LA1261 LA1265	75p 125p	LA5658 LA5665	225p 250p	LC7218 LC7230	250p 700p	M52307P M54646AP	900p 400p	SAA5351 SAA7000	375p 550p	STK1080 STK2025	940p 620p 500p	STK5392 STK5421	500p 450p	STR3212 STR3214	275p 275p	TA7242 TA7243	190p 320p	TA7698 TA7699	400p 600p
LA1266 LA1267	130p 150p	LA5667 LA5700	200p 300p	LC7267 LC7351	550p 200p	MB3708 MB3712	275p 600p	SAA7020 SAA7210P	600p 1300p	STK2028 STK2029	480p	STK5422 STK5431	375p 550p	STR3215 STR3315	275p 275p	TA7245 TA7245BPO	225p 200p	TA7705	300p
LA1354	225p	LA6339	35p	LC7364	200p	MB3713	130p	SAA7220PA	600p	STK2030	875p	STK5434	570p	STR4090 A	650p	TA7248P	575p	TA7709P	150p
LA1363	90p	LA6355	50p	LC7432	425p	MB3714	225p	SAA7274P		STK2038	700p	STK5436	500p	STR4142	450p	TA7250B	325p	TA7719P	200p
LA1364 LA1365	200p 120p	LA6510 LA6515	150p 150p	LC7522 LC7535	350p 300p	MB3715 MB3722	250p 200p	SAA7280P SAA9050 SAA9057	1450p 450p	STK2048 STK2058IV	950p 1600p	STK5441 STK5443 STK5446	400p 575p	STR4211 STR4512	315p 400p	TA7251BP TA7256P	325p 225p	TA7727P TA7750	125p 200p
LA1368 LA1369	220p 200p	LA6520 LA6531	175p 250p	LC7537AN LC7537N	400p 450p	MB3730 MB3731	900p 220p	SAB0600	475p 600p	STK2101 STK2110	1050p 550p	I STK5451	350p 390p	STR5015 STR5100	500p 550p	TA7259P TA7262P	225p 400p	TA7757 TA7769	200p 130p
LA1385	170p	LA7007	400p	LC7560	750p	MB3732	240p	SAB0601	525p	STK2125	580p	STK5461	500p	STR5214	475p	TA7263P	325p	TA7772P	150p
LA1503	120p	LA7011	220p	LC7565	300p	MB3735	400p	SAB0602	625p	STK2129	750p	STK5462	500p	STR5315	675p	TA7265AP	300p	TA7784	250p
LA1805 LA1810	175p 130p	LA7016 LA7018	45p 100p	LC7582E LC7800	300p 175p	MB3756 MB3759	160p 200p	SAB1009BP SAB1016	225p 600p	STK2139 STK2155	675p 900p	STK5464 STK5466	300p 500p	STR5412 STR6020	280p 270p	TA7267 TA7267BP	220p 120p	TA7792P	250p
LA1851	300p	LA7019	130p	LC7815H	175p	MB3771	110p	SAB1046P	350p	STK2230	470p	STK5467	400p	STR7001	600p	TΔ7269	260p	TA7796P	75p
LA2000	150p	LA7033	400p	LC7818	280p	MB3773	110p	SAB2015P	525p	STK2240	740p	STK5468	300p	STR9005	400p		170p	TA8101N	230p
LA2001 LA2101	200p 270p	LA7042 LA7046	280p 300p	LC7820 LC7821N	325p 250p	MB8719 MC1391	360p 120p	SAB2016P SAB2022P	150p 525p	STK2250 STK3041	650p 370p	STK5471 STK5472	330p 375p	STR9012 STR10006	300p 450p	TA7270 TA7271 TA7272	220p 260p	TA8105N TA8110AP	140p 110p
LA2110	150p	LA7051	130p	LC7822N	160p	MC1455	45p	SAB3012	675p	STK3042	375p	STK5472	480p	STR11006	325p	TA7273	300p	TA8119P	70p
LA2200	190p	LA7053	130p	LC7881B	135p	MC1488	35p	SAB3013	200p	STK3044	500p	STK5473	500p	STR12006	450p	TA7274	210p	TA8122AN	250p
LA2205	150p	LA7054	350p	LC7881M	325p	MC1489	35p	SAB3017	320p	STK3062	500p	STK5476	350p	STR13006	500p	TA7279P	325p	TA8127N	100p
LA2211	350p	LA7060	150p	LF347	110p	MC1496	65p	SAB3021	450p	STK3082	550p	STK5477	450p	STR15006	500p	TA7280	190p	TA8132AN	200p
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TA8201AK TA8205 TA8207K	300p 220p 175p	TDA1220 TDA1235 TDA1236	50p 300p 240p	TDA2822M TDA2824 TDA2840	60p 85p 200p	TDA4700A TDA4714C TDA4716C	750p 350p 450p	TDA8416 TDA8417 TDA8421	625p 550p 300p	UPC1023 UPC1024H 2 UPC1025	230p	2SA781 2SA786 2SA794	150p 25p 50p	2SA1185 2SA1186 2SA1198	200p 500p 40p	2SB596 2SB598 2SB600	50p 30p 500p	2SC783 2SC790 2SC792	85p 50p 380p
TA8210 TA8211AH TA8214K	260p 200p 260p	TDA1251 TDA1270 TDA1327	150p 150p 200p	TDA3047 TDA3048 TDA3082	100p 130p 200p	TDA4718A TDA4725 TDA4800	250p 750p 300p	TDA8425 TDA8432 TDA8433	500p 550p 600p	UPC1026 UPC1028 UPC1031H	95p 90p 150p	2SA798 2SA812 2SA814	30p 15p 60p	2SA1201 2SA1202 2SA1204	40p 25p 225p	2SB601 2SB605 2SB631	60p 25p 40p	2SC805 2SC828 2SC829	225p 20p 15p
TA8215 TA8216H TA8217P	300p 300p 120p	TDA1405 TDA1410 TDA1412	50p 220p 35p	TDA3083 TDA3190 TDA3301B	200p 100p 400p	TDA4810 TDA4814A TDA4850	250p 300p 475p	TDA8440 TDA8442 TDA8443	300p 200p 350p	UPC1032 UPC1035C UPC1043C	60p 110p 125p	2SA816 2SA817 2SA825	70p 20p 20p	2SA1206 2SA1207 2SA1208	60p 25p 70p	2SB632 2SB633 2SB641	45p 80p 12p	2SC839 2SC867 2SC870	20p 900p 100p 175p
TA8220AH TA8221AH TA8225H	500p 600p 475p	TDA1506 TDA1508 TDA1510	275p 175p 170p	TDA3310 TDA3410 TDA3420	120p 150p 200p	TDA4851 TDA4852 TDA4860	325p 325p 200p	TDA8444 TDA8451 TDA8452	200p 325p 200p	UPC1158H UPC1161 UPC1167	70p 110p 125p	2SA836 2SA837 2SA839	20p 200p 110p	2SA1209 2SA1210 2SA1215	100p 120p 600p	2SB647 2SB648 2SB649	20p 45p 35p	2SC897 2SC900B 2SC930 2SC936	30p 15p 300p
TA8225L TA8227 TA8229K	475p 250p 200p	TDA 1512 TDA 1514A TDA 1515A	140p 325p 200p	TDA3501 TDA3502 TDA3504	300p 360p 300p	TDA4866 TDA4881 TDA4935	275p 200p 300p	TDA8453 TDA8461 TDA8490	350p 950p 225p	UPC1170 UPC1173 UPC1176C	150p 200p 120p	2SA841 2SA844 2SA847 2SA854	20p 20p 25p 30p	2SA1216 2SA1217 2SA1220 2SA1221	550p 100p 75p 70p	2SB673 2SB676 2SB688 2SB703	100p 85p 90p 90p	2SC941 2SC944 2SC945	15p 140p 10p
TA8400P TA8410K TA8410P	200p 200p 200p	TDA1516Q TDA1517 TDA1519	350p 150p 200p 200p	TDA3505 TDA3506 TDA3507 TDA3510	275p 260p 450p 200p	TDA4940 TDA4942 TDA4944 TDA4950	200p 200p 175p 100p	TDA8540 TDA8702 TDA8703 TDA8708	250p 275p 500p 600p	UPC1178H UPC1180C UPC185H2 UPC1186	250p 200p 400p 80p	2SA854 2SA861 2SA872 2SA872A	45p 25p 50p	2SA1222 2SA1226 2SA1227	50p 25p 250p	2SB705 2SB707 2SB716	200p 200p 200p 20p	2SC950 2SC959 2SC980	40p 225p 40p
TA8432 TA8605N TA8606N TA8607P	200p 350p 350p 320p	TDA1519A TDA1520 TDA1521 TDA1522	275p 210p 110p	TDA3510 TDA3520 TDA3530 TDA3540	250p 250p 250p 200p	TDA5030A TDA5140A TDA5330T	100p 100p 200p 300p	TDA8730 TDA8732 TDA8735	225p 300p 175p	UPC1187 UPC1188H UPC1191	150p 350p 300p	2SA879 2SA884 2SA885	30p 100p 35p	2SA1232 2SA1237 2SA1238	180p 25p 30p	2SB718 2SB727 2SB733	60p 100p 75p	2SC982 2SC983 2SC1000	20p 120p 20p
TA8611AN TA8615N TA8628N	250p 480p 350p	TDA1524 TDA1526	200p 225p 2000p	TDA3541 TDA3560 TDA3561	175p 260p 300p	TDA5331T TDA5332T TDA5500	200p 150p 400p	TDA8740 TDA8741 TDA8808T	625p 550p 325p	UPC1197 UPC1198H UPC1210	140p 200p 150p	2SA886 2SA887 2SA893	45p 20p 15p	2SA1239 2SA1240 2SA1242	30p 45p 80p	2SB734 2SB737 2SB739	35p 20p 22p	2SC1001 2SC1008 2SC1010	950p 20p 225p
TA8631 TA8632N TA8644N	500p 550p 425p	TDA1540 TDA1541 TDA1542	420p 500p 250p	TDA3561A TDA3562 TDA3562TF	300p 260p 300p	TDA5600 TDA5660P TDA5700	450p 250p 200p	TDA8809T TDA9045 TDA9080	350p 300p 400p	UPC1215V UPC1222 UPC1225H	125p 130p 220p	2SA896 2SA899 2SA900	25p 40p 45p	2SA1244 2SA1245 2SA1246	120p 55p 80p	2SB744 2SB750 2SB753	55p 60p 100p	2SC1012 2SC1013 2SC1014	75p 170p 140p
TA8646	375p 1500p 900p	TDA1543 TDA1552Q TDA1553AC	200p 350p 325p	TDA3563 TDA3564 TDA3565	350p 325p 220p	TDA5701 TDA5708 TDA5709	200p 275p 375p	TDA9102C TDA9403 TDA9500	250p 130p 750p	UPC1227V UPC1228HA UPC1230	225p 45p 200p	2SA904 2SA907 2SA909	20p 650p 500p	2SA1248 2SA1249 2SA1252	35p 100p 20p	2SB754 2SB764 2SB765	80p 30p 70p	2SC1030 2SC1046 2SC1047	150p 250p 20p
TA8690N TA8691N TA8701AN	700p 450p 275p	TDA1555Q TDA1557Q TDA1558Q	375p 300p 300p	TDA3566 TDA3567 TDA3569	280p 350p 300p	TDA5800 TDA5820 TDA5832	850p 370p 125p	TDA9503 TDA9513 TDA9800	550p 225p 225p	UPC1237HA UPC1238 UPC1241H	120p 150p	2SA912 2SA913 2SA914	70p 100p 90p	2SA1253 2SA1256 2SA1257	30p 30p 30p	2SB772 2SB774 2SB775	25p 50p 100p	2SC1050 2SC1051 2SC1061 2SC1069	280p 250p 85p 175p
TA8718N TA8720 TA8739P	550p 525p 450p	TDA1560Q TDA1571 TDA1572	675p 300p 175p	TDA3570 TDA3580 TDA3586	375p 300p 750p	TDA5850 TDA5930 TDA6100Q	175p 225p 150p	TDA9821 TEA0652 TEA0653T	200p 150p 80p	UPC1242H UPC1245V UPC1270H	150p 130p 250p	2SA915 2SA916 2SA921	30p 30p 40p	2SA1258 2SA1261 2SA1262 2SA1263	70p 150p 110p 280p	2SB776 2SB788 2SB791 2SB794	110p 35p 130p 40p	2SC1070 2SC1079 2SC1080	65p 300p 225p
TA8872N TAA550 TBA120S	450p 25p 40p	TDA1574 TDA1576 TDA1578A	125p 170p 210p	TDA3590 TDA3591 TDA3592A	250p 360p 300p	TDA6101Q TDA6111Q TDA6200 TDA6600-2	120p 225p 750p 700p	TEA0655 TEA0665 TEA1002 TEA1007	300p 300p 650p 120p	UPC1274V UPC1277 UPC1278 UPC1288V	250p 240p 240p 230p	2SA928A 2SA933 2SA934 2SA935	25p 30p 30p 40p	2SA1263 2SA1264 2SA1265 2SA1283	280p 200p 50p	2SB795 2SB810 2SB816	45p 15p 160p	2SC1096 2SC1098 2SC1106	40p 120p 180p
TBA396 TBA520 TBA530 TBA540	70p 120p 100p 90p	TDA1579 TDA1589 TDA1591 TDA1596	130p 275p 275p 200p	TDA3601Q TDA3602 TDA3611 TDA3640	375p 225p 450p 350p	TDA6610-2 TDA6612-2 TDA7000	1100p 900p 170p	TEA1009 TEA1015P TEA1017	100p 110p 280p	UPC1297CA UPC1298 UPC1313H A	325p 320p	2SA937 2SA939 2SA940	20p 140p 50p	2SA1284 2SA1286 2SA1289	60p 60p 50p	2SB817 2SB819 2SB822	175p 60p 40p	2SC1114 2SC1115 2SC1116	415p 280p 290p
TBA560 TBA800 TBA810AS	90p 40p 40p	TDA1598 TDA1600 TDA1602A	160p 200p 400p	TDA3645 TDA3651 TDA3652	400p 200p 400p	TDA7010T TDA7020T TDA7021T	120p 175p 200p	TEA1019 TEA1024 TEA1035	130p 150p 200p	UPC1316C UPC1318 UPC1330HA	70p 300p 80p	2SA942 2SA949 2SA950	60p 70p 18p	2SA1290 2SA1293 2SA1294	150p 110p 450p	2SB824 2SB825 2SB826	60p 135p 75p	2SC1124 2SC1161 2SC1162	270p 110p 30p
TBA820 TBA820M TBA920	55p 35p 100p	TDA1670A TDA1675 TDA1701	200p 200p 300p	TDA3652-TX TDA3653 TDA3654	10800p 85p 80p	TDA7050 TDA7052 TDA7053	100p 120p 200p	TEA1039 TEA1045 TEA1060	150p 300p 225p	UPC1335V UPC1350 UPC1352C	320p 115p 450p	2SA951 2SA952 2SA953	60p 30p 60p	2SA1295 2SA1301 2SA1302	500p 260p 300p	2SB827 2SB828 2SB829	200p 200p 200p	2SC1164 2SC1165 2SC1166	600p 750p 100p
TBA950 TBA990 TC5020	100p 60p 200p	TDA1771 TDA1870A TDA1872A	200p 200p 275p	TDA3654Q TDA3710 TDA3720	85p 300p 175p	TDA7056 TDA7057Q TDA7072	200p 225p 100p	TEA1061 TEA1062 TEA1064	175p 250p 250p	UPC1360C UPC1362C UPC1363	200p 250p 190p	2SA954 2SA957 2SA958	30p 185p 60p	2SA1303 2SA1304 2SA1306	400p 110p 110p	2SB835 2SB857 2SB861	75p 80p 110p	2SC1170 2SC1172 2SC1173	180p 150p 33p
TC5081AP TC5082P TC5090A	80p 170p 230p	TDA1904 TDA1905 TDA1908A	80p 80p 90p	TDA3724 TDA3725 TDA3730	300p 300p 400p	TDA7077 TDA7211 TDA7220	175p 100p 65p	TEA1067 TEA1068 TEA1080P	150p 350p 170p	UPC1363C UPC1364C UPC1365	300p 350p 250p	2SA963 2SA965 2SA966	120p 30p 25p	2SA1307 2SA1309 2SA1315	100p 50p 100p	2SB863 2SB865 2SB882	220p 25p 180p	2SC1195 2SC1212 2SC1213	210p 35p 10p
TC9125BP TC9130P TC9134	410p 150p 750p	TDA1910 TDA1940 TDA1941	160p 180p 300p	TDA3740 TDA3750 TDA3755	400p 400p 425p	TDA7222 TDA7230A TDA7231A	100p 150p 80p	TEA1087 TEA1101 TEA1330	40p 425p 65p	UPC1366C UPC1370C UPC1373	130p 300p 85p	2SA968 2SA970 2SA979	55p 25p 35p	2SA1317 2SA1318 2SA1319	30p 20p 25p	2SB885 2SB891 2SB892	45p 35p 25p	2SC1214 2SC1215 2SC1216	15p 25p 200p
TC9135P TC9137P TC9138AP	125p 500p 150p	TDA1950 TDA2002 TDA2003	175p 50p 65p	TDA3760 TDA3765V TDA3771	350p 225p 460p	TDA7233 TDA7240 TDA7241	60p 175p 250p	TEA1511 TEA2000 TEA2014A	150p 500p 80p	UPC1377C UPC1378 UPC1379C	200p 180p 170p	2SA984 2SA985 2SA988 2SA991	25p 60p 25p 30p	2SA1320 2SA1321 2SA1327 2SA1329	45p 80p 130p 200p	2SB895 2SB908 2SB926 2SB941	60p 70p 30p 60p	2SC1222 2SC1226 2SC1237 2SC1247A	15p 75p 250p 35p
TC9142 TC9143 TC9145	320p 300p 150p	TDA2004 TDA2005 TDA2006	150p 150p 70p	TDA3780 TDA3791 TDA3800	400p 200p 250p	TDA7245 TDA7250 TDA7255 TDA7256	225p 400p 400p 400p	TEA2018A TEA2019 TEA2025B TEA2028	110p 600p 75p 325p	UPC1382 UPC1384 UPC1387C UPC1394	110p 425p 250p 120p	2SA992 2SA993 2SA995	30p 50p 60p	2SA1346 2SA1348 2SA1352	20p 45p 100p	2SB950 2SB951 2SB953	180p 190p 90p	2SC1252 2SC1278 2SC1279	850p 110p 30p
TC9148 TC9149 TC9150 TC9151P	200p 225p 425p 425p	TDA2007 TDA2008 TDA2009 TDA2010	120p 100p 160p 150p	TDA3803A TDA3810 TDA3825 TDA3827	500p 200p 150p 110p	TDA7262 TDA7272 TDA7272 TDA7273	325p 170p 80p	TEA2028B TEA2029A TEA2029C	375p 650p 270p	UPC1397 UPC1403CA UPC1406HA	350p 650p	2SA999 2SA1005 2SA1006	30p 25p 90p	2SA1353 2SA1356 2SA1357	100p 100p 65p	2SB975 2SB985 2SB986	100p 30p 40p	2SC1308K 2SC1312 2SC1318	350p 40p 10p
TC9152 TC9153 TC9154AP	425p 300p 225p	TDA2020 TDA2030 TDA2030H	120p 80p 100p	TDA3840 TDA3842 TDA3843	200p 200p 200p	TDA7274 TDA7275 TDA7282	45p 75p 50p	TEA2031A TEA2037 TEA2114	125p 200p 200p	UPC1420CA UPC1421CA UPC1423CA	450p 650p	2SA1008 2SA1009 2SA1010	125p 200p 225p	2SA1358 2SA1359 2SA1360	130p 45p 45p	2SB1009 2SB1010 2SB1012	110p 25p 55p	2SC1325 2SC1327 2SC1328	400p 20p 15p
TC9156 TC9158P TC9162	300p 450p 275p	TDA2040 TDA2048 TDA2051V	140p 600p 450p	TDA3845 TDA3856 TDA3857	225p 300p 200p	TDA7284 TDA7302 TDA7310	100p 450p 800p	TEA2117 TEA2130 TEA2164	450p 350p 160p	UPC1470 UPC1474HA UPC1484CA	200p 75p 300p	2SA1011 2SA1012 2SA1013	80p 85p 100p	2SA1362 2SA1370 2SA1371	25p 50p 100p	2SB1015 2SB1016 2SB1017	60p 130p 40p	2SC1342 2SC1343 2SC1345	15p 200p 15p
TC9163 TC9164 TC9167P	375p 400p 100p	TDA2052V TDA2054M TDA2107	525p 110p 250p	TDA3950 TDA4001 TDA4050	225p 250p 150p	TDA7313 TDA7318 TDA7330A	650p 550p 700p	TEA2260 TEA2261 TEA2262	225p 185p 275p	UPC1488H UPC1498H UPC1505C	115p 400p 400p	2SA1015 2SA1016 2SA1018	10p 30p 100p	2SA1376 2SA1380 2SA1381	30p 75p 100p	2SB1018 2SB1020 2SB1039	130p 120p 65p	2SC1346 2SC1358 2SC1359	100p 270p 15p
TC9172P TC9174P TC9176P	300p 325p 500p	TDA2148 TDA2151 TDA2170	325p 375p 260p	TDA4052 TDA4060 TDA4092	500p 500p 250p	TDA7350 TDA7359 TDA7360	300p 300p 700p	TEA3717DP TEA3718S TEA5030	175p 135p	UPC1513HA UPC1514CA UPC1515CA	200p 250p	2SA1020 2SA1021 2SA1023	30p 35p 60p	2SA1382 2SA1385 2SA1386 2SA1387	120p 180p 400p 75p	2SB1066 2SB1068 2SB1077 2SB1098	40p 160p 180p 80p	2SC1360 2SC1364 2SC1368 2SC1382	70; 25; 75; 40;
TC9177P TCA9940 TCEP100	225p 100p 100p	TDA2220 TDA2270 TDA2320	200p 250p 80p	TDA4100 TDA4173AI TDA4180	145p	TDA7361 TDA7370V TDA7374V	175p 325p 350p	TEA5040 TEA5101A TEA5110 TEA5114A	650p 175p 175p 200p	UPC1520CA UPC1521HA UPC1536C 2SA329	250p 120p 550p 75p	2SA1026 2SA1029 2SA1036 2SA1037	90p 60p 60p 50p	2SA1396 2SA1399 2SA1400	120p 25p 150p	2SB1099 2SB1109 2SB1123	75p 40p 50p	2SC1383 2SC1384 2SC1393	25p 20p 20p
TD62308AP TD62382 TD62506 TD62705	200p 200p 200p 250p	TDA2501 TDA2502 TDA2503 TDA2504	300p 175p 200p 200p	TDA4190 TDA4200 TDA4210 TDA4260	180p 300p 160p 250p	TDA7770 TDA8114 TDA8115 TDA8116	140p 225p 200p 350p	TEA5115 TEA5116 TEA5170	220p 220p 220p 200p	2SA467 2SA473 2SA483	40p 29p 90p	2SA1038 2SA1048 2SA1051	40p 25p 300p	2SA1423 2SA1428 2SA1441	30p 35p 110p	2SB1133 2SB1134 2SB1135	50p 65p 60p	2SC1394 2SC1398 2SC1399	15p 55p 100p
TD6304AP TD6306P TD6350P	300p 350p 200p	TDA2505 TDA2506 TDA2507	220p 400p 450p	TDA4280 TDA4282 TDA4283T	320p 360p 450p	TDA8120B TDA8124 TDA8134	400p 250p 225p	TEA5500 TEA5501 TEA5550	325p 225p 150p	2SA484 2SA489 2SA490	80p 50p 45p	2SA1052 2SA1060 2SA1061	15p 120p 300p	2SA1442 2SA1443 2SA1450	110p 130p 30p	2SB1140 2SB1143 2SB1151	45p 40p 75p	2SC1400 2SC1403 2SC1407	50p 500p 50p
TD6359P TDA1001 TDA1002	300p 200p 200p	TDA2507T TDA2510 TDA2514A	450p 450p 500p	TDA4290 TDA4400 TDA4420	125p 175p 120p	TDA8135 TDA8136 TDA8137	225p 225p 200p	TEA5560 TEA5570 TEA5580	130p 85p 165p	2SA493 2SA495 2SA496	25p 40p 30p	2SA1069 2SA1073 2SA1076	150p 375p 230p	2SA1459 2SA1462 2SA1469	40p 25p 100p	2SB1162 2SB1163 2SB1168	400p 370p 50p	2SC1413 2SC1419 2SC1426	150 50 700
TDA1003 TDA1005A TDA1010A	150p 175p 80p	TDA2515 TDA2530 TDA2532	450p 300p 100p	TDA4421 TDA4426 TDA4427	300p 170p 200p	TDA8138 TDA8138A TDA8138B	200p 130p 200p	TEA5581 TEA5591 TEA5620	200p 200p 300p	2SA505 2SA509 2SA537	120p 35p 170p	2SA1077 2SA1080 2SA1081	300p 125p 80p	2SA1475 2SA1488 2SA1489	95p 150p 300p	2SB1182 2SB1185 2SB1202	40p 50p 45p	2SC1429 2SC1431 2SC1444	400 275
TDA1011 TDA1012 TDA1013A	75p 120p 110p	TDA2540 TDA2541 TDA2542	150p 70p 110p	TDA4431 TDA4433 TDA4437	150p 100p 125p	TDA8139 TDA8140 TDA8143	200p 200p 160p	TEA5630 TEA5640E TEA5701	225p 750p 650p	2SA539 2SA544 2SA550	20p 650p 150p	2SA 1082 2SA 1083 2SA 1084	80p 20p 100p	2SA1490 2SA1491 2SA1492 2SA1493	225p 300p 260p 500p	2SB1203 2SB1204 2SB1205	45p 45p 40p	2SC1445 2SC1446 2SC1447 2SC1449	350p 55p 70p
TDA1015 TDA1016 TDA1020	85p 140p 110p	TDA2543 TDA2544 TDA2545	210p 200p 120p	TDA4439 TDA4440 TDA4442 TDA4443	220p 180p 240p	TDA8145 TDA8146 TDA8160 TDA8170	120p 200p 125p 170p	TEA6000 TEA6100 TEA6200 TEA6300	400p 350p 225p 500p	2SA562 2SA564 2SA571 2SA603	30p 15p 650p 100p	2SA1085 2SA1091 2SA1093 2SA1094	75p 100p 180p 190p	2SA 1493 2SA 1494 2SA 1516 2SA 1519	450p 280p 20p	2SB1223 2SB1243 2SB1274 2SB1282	60p 40p 40p 300p	2SC1450 2SC1454 2SC1470	120; 200; 250; 120;
TDA1022 TDA1023 TDA1024 TDA1025	330p 130p 150p	TDA2546A TDA2548 TDA2549 TDA2555	200p 200p 300p 175p	TDA4445 TDA4450 TDA4452	250p 220p 225p 250p	TDA8172 TDA8173 TDA8174	200p 175p 200p	TEA6310T TEA6414A TEA6415B	425p 425p 525p	2SA606 2SA608 2SA614	200p 15p 150p	2SA1095 2SA1096 2SA1102	300p 80p 130p	2SA1523 2SA1535 2SA1538	45p 175p 55p	2SB1318 2SB1375 2SB1382	40p 45p 350p	2SC1472 2SC1473 2SC1474	40; 15; 45;
TDA1028 TDA1029 TDA1035	320p 175p 200p 160p	TDA2556 TDA2557 TDA2558	230p 225p 400p	TDA4453 TDA4480 TDA4481	275p 280p 215p	TDA8175 TDA8178 TDA8179S	300p 400p 750p	TEA6420 TEA8172 TL431	360p 125p 45p	2SA628 2SA634 2SA636	20p 50p 50p	2SA1103 2SA1104 2SA1105	130p 140p 250p	2SA1540 2SA1598 2SA1599	50p 220p 220p	2SB1468 2SC182 2SC372	100p 75p 25p	2SC1501 2SC1505 2SC1507	70 55 45
TDA1035 TDA1038 TDA1041E TDA1041P	500p 250p 180p	TDA2574V TDA2575A TDA2577A	350p 100p 200p	TDA4482 TDA4500 TDA4501	200p 300p 280p	TDA8185 TDA8190 TDA8191	180p 200p 425p	TL494 TLO61 TLO64	100p 40p 80p	2SA639 2SA640 2SA642	60p 60p 50p	2SA1106 2SA1111 2SA1112	160p 90p 150p	2SA1600 2SA1601 2SA1625	250p 200p 40p	2SC380 2SC388A 2SC394	10p 25p 60p	2SC1509 2SC1514 2SC1515	35 35 60
TDA1044 TDA1047 TDA1048	110p 200p 200p	TDA2578A TDA2579A TDA2582	200p 210p 130p	TDA4502 TDA4503 TDA4505A	400p 250p 300p	TDA8192 TDA8196 TDA8205	200p 120p 1250p	TLO71 TLO74 TLO83	38p 80p 55p	2SA643 2SA673 2SA677	25p 15p 35p	2SA1115 2SA1120 2SA1123	30p 40p 40p	2SA1626 2SA1640 2SA1652	90p 100p 70p	2SC403 2SC454 2SC458	25p 15p 10p	2SC1520 2SC1541 2SC1545	45 110 120
TDA1053 TDA1054 TDA1057	300p 180p 60p	TDA2590 TDA2591 TDA2591Q	170p 110p 150p	TDA4505E TDA4505K TDA4505M	275p 450p 850p	TDA8213 TDA8214B TDA8215H	175p 225p 300p	TLO84 TMP47C-434I TPU2732	70p 1250p 800p	2SA678 2SA683 2SA684	26p 25p 25p	2SA1124 2SA1127 2SA1133	60p 50p 120p	2SA1667 2SA1668 2SA1671	175p 180p 310p	2SC460 2SC461 2SC495	10p 15p 45p	2SC1567 2SC1568 2SC1569	40) 35) 55)
TDA1059B TDA1060 TDA1062	40p 140p 140p	TDA2593 TDA2594 TDA2595	80p 300p 200p	TDA4510 TDA4532 TDA4555	200p 200p 275p	TDA8217 TDA8303 TDA8304	225p 250p 400p	TPU2735 UC3524 UC3842N	500p 100p 80p	2SA699 2SA705 2SA706	100p 70p 140p	2SA1135 2SA1141 2SA1142	130p 200p 100p	2SA1673 2SA1680 2SA1706 2SB175	425p 40p 25p 45p	2SC496 2SC497 2SC515 2SC535	25p 85p 100p 30p	2SC1570 2SC1571 2SC1573 2SC1576	40) 50) 25) 550)
TDA1068 TDA1072 TDA1074	75p 150p 280p	TDA2600 TDA2611A TDA2616	400p 100p 250p	TDA4556 TDA4557 TDA4560	370p 200p 270p	TDA8305 TDA8340 TDA8341	500p 150p 250p	UC3843 UC3844 UPC20C	125p 70p 220p	2SA708 2SA711 2SA715	50p 280p 50p	2SA1143 2SA1145 2SA1146 2SA1151	15p 40p 200p 30p	2SB175 2SB324 2SB337 2SB474	45p 40p 150p 250p	2SC535 2SC536 2SC605 2SC619	30p 20p 100p 100p	2SC15/6 2SC1580 2SC1583 2SC1586	600 ₁ 25 ₁ 540 ₁
TDA1077 TDA1082 TDA1083	250p 275p 95p	TDA2630 TDA2640 TDA2653A	300p 350p 200p	TDA4565 TDA4566 TDA4568	150p 250p 225p	TDA8349A TDA7350Q TDA8351	200p	UPC554 UPC555 UPC556H UPC571	130p 60p 80p	2SA719 2SA720 2SA725 2SA726	50p 20p 80p 20p	2SA1151 2SA1152 2SA1153 2SA1154	30p 150p 30p 22p	2SB474 2SB492 2SB511 2SB525	250p 80p 55p 65p	2SC641 2SC644 2SC647	80p 10p 300p	2SC1586 2SC1617 2SC1619 2SC1623	340 170 50
TDA1085 TDA1087 TDA1092	170p 60p 100p	TDA2654 TDA2658 TDA2670	200p 300p 150p 100p	TDA4570 TDA4580 TDA4600	200p 400p 200p	TDA8360N: TDA8361N: TDA8362AN TDA8362N3	3 900p 1200p	UPC574 UPC575C2 UPC577	220p 60p 90p 64p	2SA726 2SA733 2SA740 2SA742	20p 15p 90p 450p	2SA1154 2SA1156 2SA1162 2SA1163	90p 30p 15p	2SB525 2SB527 2SB531 2SB536	130p 400p 80p	2SC681 2SC683 2SC708	250p 35p 100p	2SC1624 2SC1626 2SC1627	60; 55; 15;
TDA1097 TDA1151 TDA1154 TDA1170	475p 40p 50p 85p	TDA2690 TDA2710-1 TDA2721 TDA2730	400p 200p 200p	TDA4600II TDA4601 TDA4605 TDA4610	160p 120p 190p 370p	TDA8366N2 TDA8372A TDA8380	1500p	UPC592 UPC595 UPC596	95p 190p 190p	2SA747A 2SA748 2SA764	425p 60p 200p	2SA1169 2SA1170 2SA1173	500p 500p 60p	2SB537 2SB544 2SB546	90p 22p 45p	2SC710 2SC711 2SC730	15p 15p 350p	2SC1628 2SC1634 2SC1667	75p 50p 450p
TDA1170N TDA1175	85p 175p	TDA2740 TDA2750	300p 200p	TDA4650 TDA4660	300p 200p	TDA8385 TDA8390A	275p	UPC1004C	220p 130p	2SA769 2SA770	80p 200p	2SA1174 2SA1175	25p · 30p	2SB549 2SB560	50p 25p	2SC732	40p 40p	2SC1669 2SC1674	100 15

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						JA	PAN	ESF	T	RAN	ISIS	STO	RS						
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 2SC1729	30p 900p	2SC2274 2SC2275	15p 50p	2SC2749 2SC2750	350p 300p	2SC3271 2SC3277	75p 280p	2SC3831 2SC3832	250p 135p	2SD315 2SD325	75p 30p	2SD894 2SD895	35p 100p	2SD1348 2SD1350	65p 150p	2SD1773 2SD1776	100p 70p	2SK332	175p
2SC1730	10p	2SC2278	70p	2SC2751	270p	2SC3279	30p	2SC3833	250p	2SD330	65p	2SD896	200p	2SD1376	60p	2SD1783	70p	2SK359	40p
2SC1735	70p	2SC2283	700p	2SC2752	75p	2SC3280	200p	2SC3851	100p	2SD348	300p	2SD898B	225p	2SD1378	60p	2SD1785	160p	2SK363	50p
2SC1740	10p	2SC2290	1800p	2SC2767	300p	2SC3281	200p	2SC3852	80p	2SD350	320p	2SD900	400p	2SD1379	100p	2SD1789	210p	2SK364	40p
2SC1741	35p	2SC2291	40p	2SC2769	400p	2SC3284	600p	2SC3853	220p	2SD357	40p	2SD905	450p	2SD1380	100p	2SD1796	120p	2SK367	40p
2SC1755 2SC1756	90p 35p	2SC2298 2SC2307	35p 300p	2SC2773 2SC2774	700p 500p	2SC3293 2SC3298	85p 50p	2SC3855 2SC3857	220p 500p	2SD358 2SD359	40p 50p	2SD916 2SD917	130p 300p	2SD1382 2SD1384	60p 50p	2SD1802 2SD1806	75p 75p	2SK369	30p
2SC1758	30p	2SC2308	10p	2SC2785	40p	2SC3299	120p	2SC3858	550p	2SD361	100p	2SD921	320p	2SD1390	350p	2SD1812	45p	2SK373	40p
2SC1760	70p	2SC2312	300p	2SC2786	20p	2SC3300	400p	2SC3866	275p	2SD362	100p	2SD923	360p	2SD1391	250p	2SD1815	50p	2SK374	45p
2SC1775	10p	2SC2314	70p	2SC2787	10p	2SC3303	100p	2SC3868	100p	2SD371	240p	2SD946	120p	2SD1392	85p	2SD1825	60p	2SK386 2SK389	600p
2SC1781	20p	2SC2316	150p	2SC2791	500p	2SC3306	130p	2SC3870	200p	2SD380	650p	2SD947	100p	2SD1395	80p	2SD1827	70p	2SK400	700p
2SC1789	100p	2SC2320	10p	2SC2792	220p	2SC3307	600p	2SC388A	25p	2SD381	50p	2SD950	300p	2SD1396	120p	2SD1843		2SK405	450p
2SC1809 2SC1810	40p 250p	2SC2324 2SC2328A		2SC2793 2SC2808	700p 40p	2SC3309 2SC3310	150p 125p	2SC3883 2SC3884A	210p 200p	2SD382 2SD386	75p 70p	2SD951 2SD957A	200p 520p	2SD1397 2SD1398	100p 120p	2SD1846 2SD1847	350p 275p	2SK414	550p
2SC1815	10р і	2SC2310	25p	2SC2810	360p	2SC3316	280p	2SC3885	250p	2SD388	150p	2SD958	60p	2SD1399	300p	2SD1849	280p	2SK415	500p
2SC1819	70р	2SC2315	175p	2SC2812	40p	2SC3317	350p	2SC3885A	290p	2SD389	60p	2SD965	35p	2SD1400	280p	2SD1850	325p	2SK423	75p
2SC1826	60p	2SC2329	480p	2SC2814	40p	2SC3326	50p	2SC3886A	275p	2SD400	14p	2SD970	170p	2SD1402	120p	2SD1853	40p	2SK427	50p
2SC1827	60p	2SC2230	300p	2SC2824	75p	2SC3327	60p	2SC3890	150p	2SD401	50p	2SD972	40p	2SD1403	225p	2SD1856	40p	2SK430	200p
2SC1829 2SC1833	500p 27p	2SC2331 2SC2333	50p 200p	2SC2825 2SC2826	900p 200p	2SC3328 2SC3330	50p 20p	2SC3892A 2SC3893	250p 225p	2SD402 2SD414	120p 45p	2SD973 2SD973A	60p 70p	2SD1405 2SD1406	80p 60p	2SD1857 2SD1858	75p 40p	2SK511	450p
2SC1834	50p	2SC2334	80p	2SC2827	130p	2SC3331	25p	2SC3895	325p	2SD415	55p	2SD982	90p	2SD1407	60p	2SD1863	35p	2SK513	325p
2SC1841	12p	2SC2335	55p	2SC2832	300p	2SC3333	120p	2SC3896	400p	2SD424	350p	2SD985	120p	2SD1408	125p	2SD1864	85p	2SK526	160p
2SC1844	50p	2SC2336A		2SC2834	280p	2SC3345	100p	2SC3897	400p	2SD426	150p	2SD986	120p	2SD1409	170p	2SD1877	175p	2SK531	350p
2SC1845	15p	2SC2344		2SC2837	250p	2SC3346	130p	2SC3907	250p	2SD427	350p	2SD998	70p	2SD1411	85p	2SD1878	160p	2SK534	700p
2SC1846 2SC1847	35p 45p	2SC2347 2SC2353	35p 120p	2SC2839 2SC2853	40p 70p	2SC3352 2SC3353	200p 280p	2SC3927 2SC3940	250p 40p	2SD438 2SD467	35p 15p	2SD1010 2SD1012	40p 40p	2SD1412 2SD1413	75p 60p	2SD1879 2SD1880	275p 360p	2SK537	900p
2SC1855	85p	2SC2360 2SC2361	120p	2SC2873 2SC2877	60p	2SC3355	50p	2SC3943 2SC3944	75p 80p	2SD468 2SD471	15p 20p	2SD1020 2SD1021	40p 120p	2SD1415 2SD1417	190p 75p	2SD1881 2SD1884	350p 300p	2SK538 2SK539	350p 1100p
2SC1856 2SC1865	25p 700p	2SC2362	150p 50p	2SC2878	120p 20p	2SC3356 2SC3358	120p 50p	2SC3950 2SC3953	120p	2SD476	100p	2SD1022	250p	2SD1425 2SD1426	260p	2SD1886	300p	2SK544 2SK552	30p 250p
2SC1870 2SC1871	700p 425p	2SC2365 2SC2369	280p 100p	2SC2879 2SC2882	3200p 60p	2SC3376 2SC3377	300p 50p	2SC3955	50p 60p	2SD525 2SD526	50p 70p	2SD1024 2SD1027	850p 850p	2SD1427	135p 160p	2SD1887 2SD1894	225p 300p	2SK553 2SK555	225p 320p
2SC1875 2SC1881	220p 70p	2SC2371 2SC2373	25p 210p	2SC2883 2SC2898	60p 200p	2SC3378 2SC3379	120p 1200p	2SC3964 2SC3972	100p 250p	2SD545 2SD549	18p 120p	2SD1030 2SD1031	75p 70p	2SD1428 2SD1430	180p 280p	2SD1895 2SD1910	225p 175p	2SK556	500p
2SC1890	15p	2SC2383	50p	2SC2899	50p	2SC3381	130p	2SC3973	210p	2SD551	300p	2SD1036	600p	2SD1431	200p	2SD1911	300p	2SK557	400p
2SC1895	500p	2SC2389	45p	2SC2909	60p	2SC3383	80p	2SC3975	210p	2SD554	225p	2SD1046	200p	2SD1432	400p	2SD1913	50p	2SK559	600p
2SC1904	125p	2SC2407	110p	2SC2910	25p	2SC3393	80p	2SC3987	160p	2SD555	500p	2SD1047	180p	2SD1433	300p	2SD1929	50p	2SK560	580p
2SC1906	15p	2SC2408	120p	2SC2911	80p	2SC3397	20p	2SC3996	600p	2SD556	225p	2SD1051	130p	2SD1438	60p	2SD1930	50p	2SK566	475p
2SC1907 2SC1909	20p 250p	2SC2412K 2SC2440	50p 200p	2SC2912 2SC2921	120p 650p	2SC3399 2SC3400	50p 35p	2SC3997 2SC3998	1250p 800p	2SD558 2SD560	200p 50p	2SD1055 2SD1060	60p 130p	2SD1439 2SD1441	165p 220p	2SD1933 2SD1939	45p 60p	2SK606	70p
2SC1913	90p	2SC2458	10p	2SC2922	480p	2SC3401	50p	2SC4006	100p	2SD571	20p	2SD1062	150p	2SD1442	80p	2SD1941	350p	2SK612	80p
2SC1914	30p	2SC2459	50p	2SC2923	75p	2SC3402	40p	2SC4020	150p	2SD575	530p	2SD1063	200p	2SD1445	200p	2SD1944	50p	2SK684	950p
2SC1921	15p	2SC2466	55p	2SC2928	550p	2SC3405	130p	2SC4023	325p	2SD592	25p	2SD1064	250p	2SD1446	300p	2SD1958	80p	2SK685	1150p
2SC1922	175p	2SC2486	275p	2SC2929	280p	2SC3409	400p	2SC4029	350p	2SD596	25p	2SD1065	160p	2SD1450	60p	2SD1959	210p	2SK699	100p
2SC1923	10p	2SC2492	50p	2SC2934	75p	2SC3416	30p	2SC4043	45p	2SD600	30p	2SD1069	150p	2SD1451	200p	2SD1978	50p	2SK719	300p
2SC1929	180p	2SC2470	65p	2SC2937	250p	2SC3417	90p	2SC4046	40p	2SD601	40p	2SD1073	350p	2SD1452	275p	2SD1984	60p	2SK724	
2SC1940	110p	2SC2481	120p	2SC2939 2SC2944	400p 300p	2SC3419 2SC3420	120p 80p	2SC4056 2SC4059	200p 400p	2SD602 2SD612	60p 50p	2SD1088 2SD1094	150p 375p	2SD1453 2SD1455	140p 250p	2SD1991 2SD1994	50p 200p	2SK725	500p 550p
2SC1941 2SC1942 2SC1944	27p 350p 350p	2SC2482 2SC2483 2SC2484	20p 120p 185p	2SC2958 2SC2962	50p 800p	2SC3421 2SC3422	45p 75p	2SC4064 2SC4106	140p 150p	2SD613 2SD617	70p 300p	2SD1110 2SD1111	225p 20p	2SD1457 2SD1458	165p 50p	2SD1996 2SD2006	45p 75p	2SK726 2SK727	425p 475p
2SC1945	350p	2SC2485	400p	2SC2979	160p	2SC3423	60p	2SC4107	175p	2SD633	70p	2SD1113	225p	2SD1459	60p	2SD2010	250p	2SK739 2SK758	400p 300p
2SC1946 2SC1947	1500p 450p	2SC2491 2SC2498	200p 50p	2SC2987 2SC2988	250p 150p	2SC3425 2SC3446	`65p 150p	2SC4123 2SC4124	230p 200p	2SD636 2SD637	10p 15p	2SD1128 2SD1133	200p 65p	2SD1468 2SD1487	40p 225p	2SD2011 2SD2012	60p 50p	2SK769	500p
2SC1953	45p	2SC2500	25p	2SC2995	60p	2SC3447	130p	2SC4125	275p	2SD638	15p	2SD1135	75p	2SD1494	150p	2SD2018	65p	2SK786	200p
2SC1957	70p	2SC2502	140p	2SC2999	50p	2SC3456	200p	2SC4137	40p	2SD639	20p	2SD1138	40p	2SD1496	300p	2SD2033	80p	2SK787	800p
2SC1959	10p	2SC2503	600p	2SC3001	1400p	2SC3457	125p	2SC4138	200p	2SD640	350p	2SD1140	40p	2SD1497		2SD2061	100p	2SK791	225p
2SC1962	175p	2SC2512	20p	2SC3019	320p	2SC3459	180p	2SC4157	400p	2SD655	18p	2SD1142	350p	2SD1497-02		2SD2066	250p	2SK792	300p
2SC1967	1300p	2SC2517	120p	2SC3020	1450p	2SC3460	130p	2SC4159	100p	2SD661	60p	2SD1145	25p	2SD1505	90p	2SD2125	180p	2SK793	300p
2SC1969	160p	2SC2519	60p	2SC3022	1850p	2SC3461	275p	2SC4161	125p	2SD666	25p	2SD1148	175p	2SD1506	50p	2SD2136	85p	2SK794	315p
2SC1970 2SC1971	100p 400p	2SC2527 2SC2534	300p 150p	2SC3025 2SC3026	500p 450p	2SC3466 2SC3468	225p 70p	2SC4169 2SC4199	60р 400р	2SD667 2SD669	20p 35p	2SD1153 2SD1159	30p 65p	2SD1508 2SD1509	60p 100p	2SD2144 2SD2151	35p 175p	2SK796	600p
2SC1972	600p	2SC2535	300p	2SC3030	300p	2SC3481	300p	2SC4204	60р	2SD673	350p	2SD1160	150p	2SD1511	75p	2SD2255	175p	2SK809	850p
2SC1973	150p	2SC2538	100p	2SC3037	125p	2SC3482	275p	2SC4231	250р	2SD676	250p	2SD1163A	220p	2SD1519	250p	2SD2331	250p	2SK812	150p
2SC1975	120p	2SC2540	1900p	2SC3038	125p	2SC3486	275p	2SC4235	300p	2SD717	180p	2SD1164	75p	2SD1521	70p	2SD2333	150p	2SK817	325p
2SC1980	30p	2SC2542	300p	2SC3039	80p	2SC3502	50p	2SC4236	450p	2SD718	85p	2SD1168	270p	2SD1525	450p	2SD2340	225p	2SK851	550p
2SC1983 2SC1984	75p 150p	2SC2545 2SC2546	55p 25p	2SC3040 2SC3042	260p 300p	2SC3503 2SC3504	50p 120p	2SC4237 2SC4242	500p 120p	2SD722 2SD725	240p 200p	2SD1169 2SD1173	280p 350p	2SD1526 2SD1541	100p 350p	2SJ48 2SJ56	425p 700p	2SK872	650p
2SC1985	100p	2SC2547	65p	2SC3052	30p	2SC3505	240p	2SC4278	175p	2SD726	275p	2SD1185	280p	2SD1545	275p	2SJ74	60p	2SK875	475p
2SC1986	100p	2SC2550	50p	2SC3057	150p	2SC3506	250p	2SC4288A	650p	2SD731	250p	2SD1186	400p	2SD1546	350p	2SJ76	220p	2SK903	500p
2SC2001	15p	2SC2551	70p	2SC3068	60p	2SC3507	650p	2SC4300	200p	2SD732	250p	2SD1189	55p	2SD1548	400p	2SJ77	350p	2SK904	500p
2SC2002	15p	2SC2552	60p	2SC3070	35p	2SC3509	750p	2SC4301	300p	2SD734	15p	2SD1191	120p	2SD1554	170p	2SJ79	225p	2SK951	275p
2SC2003	20p	2SC2553	200p	2SC3071	25p	2SC3514	170p	2SC4304	225p	2SD741	120p	2SD1192	90p	2SD1555	150p	2SJ103	75p	2SK952	275p
2SC2004	20p	2SC2555	120p	2SC3073	100p	2SC3518	120p	2SC4313	600p	2SD743	130p	2SD1196	150p	2SD1556	225p	2SJ109	200p	2SK955	750p
2SC2022	110p	2SC2562 2SC2563	90p	2SC3074 2SC3075	200p 150p	2SC3519 2SC3526	250p 45p	2SC4381 2SC4382	150p 200p	2SD757 2SD760	120p 70p	2SD1197 2SD1198	150p 60p	2SD1565 2SD1571	75p 170p	2SJ113 2SJ114	1050p 1150p	2SK956	600p
2SC2023 2SC2026	180p 30p	2SC2568	200p 120p	2SC3077	120p	2SC3528	750p	2SC4386	275p	2SD762	100p	2SD1207	40p	2SD1572	100p	2SJ116	1200p	2SK962 2SK1023	700p 550p
2SC2027	200p	2SC2570	30p	2SC3086	150p	2SC3531	225p	2SC4387	425p	2SD763	140p	2SD1210	280p	2SD1575	200p	2SJ117	550p	2SK1036	450p
2SC2036	50p	2SC2571	350p	2SC3089	130p	2SC3549	200p	2SC4408	50p	2SD768	180p	2SD1211	120p	2SD1576	150p	2SJ119	700p	2SK1057	600p
2SC2037 2SC2053	50p 120p	2SC2577 2SC2578	110p 170p	2SC3101 2SC3112	750p 35p	2SC3552 2SC3568	270p 200p	2SC4429 2SC4431	275p 90p	2SD772 2SD773	200p 20p	2SD1213 2SD1218	220p 75p	2SD1577 2SD1579	250p 80p	2SJ162 2SJ175	680p 200p	2SK1058	800p
2SC2055	150p	2SC2579	110p	2SC3114	40p	2SC3577	275p	2SC4466	325p	2SD774	30p	2SD1223	75p	2SD1589	60p	2SJ182	150p	2SK1081	700p
2SC2058	20p	2SC2580	175p	2SC3116	75p	2SC3584	200p	2SC4467	175p	2SD777	400p	2SD1225	70p	2SD1590	100p	2SJ200	625p	2SK1082	450p
2SC2060	40p	2SC2581	225p	2SC3117	120p	2SC3591	200p	2SC4468	250p	2SD784	650p	2SD1227	40p	2SD1591	310p	2SJ307	175p	2SK1102	375p
2SC2061	75p	2SC2588	600p	2SC3122	50p	2SC3595	220p	2SC4517	200p	2SD786	100p	2SD1229	250p	2SD1593	125p	2SK19	45p	2SK1117	250p
2SC2068	60p	2SC2590	40p	2SC3148	145p	2SC3597	75p	2SC4517A	225p	2SD787	20p	2SD1237	300p	2SD1595	70p	2SK33	40p	2SK1118	225p
2SC2071	140p	2SC2591	50p	2SC3149	180p	2SC3599	140p	2SC4531	450p	2SD788	30p	2SD1238	300p	2SD1608	210p	2SK40	50p	2SK1120	
2SC2073	40p	2SC2592	200p	2SC3150	100p	2SC3600	175p	2SC4532	1000p	2SD789	20p	2SD1244	25p	2SD1609	45p	2SK55	100p	2SK1190	550p
2SC2075	60p	2SC2603	10p	2SC3151	175p	2SC3606	100p	2SC4542	400p	2SD792	400p	2SD1246	20p	2SD1632	320p	2SK68	100p		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 2SC2097	1200p 2300p	2SC2626 2SC2630	600p	2SC3158 2SC3159	260p 200p	2SC3642 2SC3657	225p 400p	2SC4757 2SC4762	200p 300p	2SD809 2SD811	45p 450p	2SD1264 2SD1265	55p 75p	2SD1651 2SD1656	150p 250p	2SK109 2SK117	150p 50p	2SK1296	350p
2SC2099	2500p	2SC2631	20p	2SC3164	270p	2SC3659	600p	2SC4769 2SC4770	220p	2SD819	300p 250p	2SD1266 2SD1267	180p 55p	2SD1663 2SD1666	350p 50p	2SK118 2SK125	50p 100p	2SK1299 2SK1317	450p 900p
2SC2118 2SC2120	1100p 10p	2SC2632 2SC2634	35p 10p	2SC3169 2SC3170	150p 300p	2SC3668 2SC3675	120p 100p	2SC4820	250p 225p	2SD820 2SD821	550p	2SD1271	55p	2SD1667	120p	2SK133	650p	2SK1338 2SK1341	250p 500p
2SC2122A 2SC2131	300p 550p	2SC2636 2SC2637	40p 120p	2SC3173 2SC3175	180p 150p	2SC3678 2SC3679	280p 140p	2SC4826 2SC4891	70p 800p	2SD822 2SD826	290p 30p	2SD1271A 2SD1272	200p	2SD1668 2SD1669	90p 85p	2SK147 2SK152	160p 40p	2SK1342	500p
2SC2141	60p	2SC2640	1800p	2SC3178	125p	2SC3680	380p	2SC4923	400p	2SD829	375p	2SD1273	50p	2SD1677	200p	2SK161	30p	2SK1350	200p
2SC2153	40p	2SC2653	100p	2SC3179	70p	2SC3685	450p	2SC4924	250p	2SD836	50p	2SD1274	80p	2SD1680	225p	2SK163	40p	2SK1356	225p
2SC2166	80p	2SC2654	180p	2SC3180	175p	2SC3687	300p	2SC4927	500p	2SD836A	50p	2SD1275	50p	2SD1683	45p	2SK168	40p	2SK1357	350p
2SC2168	120p	2SC2655	50p	2SC3181	200p	2SC3688	550p	2SC5002	300p	2SD837	55p	2SD1276	60p	2SD1684	70p	2SK170	50p	2SK1358	400p
2SC2188	70p	2SC2656	550p	2SC3182	120p	2SC3692	150p	2SC5003	350p	2SD838	500p	2SD1277	190p	2SD1706	325p	2SK184	35p	2SK 1377	150p
2SC2200	250p	2SC2660	100p	2SC3198	30p	2SC3715	480p	2SC5027	100p	2SD841	110p	2SD1279	600p	2SD1707	400p	2SK192	45p	2SK 1400	
2SC2209	50p	2SC2665	200p	2SC3199	40p	2SC3717	120p	2SC5048	300p	2SD844	200p	2SD1288	175p	2SD1708	375p	2SK193	40p	2SK1404	250p
2SC2216	50p	2SC2668	10p	2SC3202	25p	2SC3729	450p	2SC5044	250p	2SD850	170p	2SD1289	250p	2SD1710	200p	2SK195	150p		290p
2SC2221	650p	2SC2671	100p	2SC3209	120p	2SC3746	100p	2SC5086	250p	2SD856	48p	2SD1291	280p	2SD1718	275p	2SK197	140p	2SK1461	220p
2SC2228A	60p	2SC2681	170p	2SC3210	550p	2SC3747	120p	2SC5129	300p	2SD858	250p	2SD1292	60p	2SD1729	230p	2SK212	35p	2SK1462	425p
2SC2229	15p	2SC2682	70p	2SC3211	220p	2SC3748	100p	2SC5148	300p	2SD863	23p	2SD1293	70p	2SD1730	275p	2SK214	170p	2SK1487	250p
2SC2230	80p	2SC2688	27p	2SC3212	260p	2SC3752	250p	2SC5149	300p	2SD864	200p	2SD1297	300p	2SD1732	250p	2SK216	200p	2SK1507	475p
2SC2233 2SC2235	100p 60p	2SC2690 2SC2694	60p 3500p	2SC3225 2SC3242	50p 30p	2SC3781 2SC3782	150p 75p	2SC5250 2SD188	300p 350p	2SD866 2SD866A	120p 140p	2SD1302 2SD1306	20p 45p	2SD1732 2SD1739 2SD1740	180p 125p	2SK223 2SK240	50p 140p	2SK1529	700p
2SC2236 2SC2237	20p 540p	2SC2705 2SC2706	40p 250p	2SC3244 2SC3246	45p 50p	2SC3782 2SC3783 2SC3787	300p 100p	2SD198 2SD199	140p 195p	2SD867 2SD868	350p 260p	2SD1308 2SD1309	80p 140p	2SD1748 2SD1756	90p 275p	2SK241 2SK246	30p 30p	2SK1537 2SK1544	400p 900p
2SC2238	45p	2SC2710	50p	2SC3259	350p 220p	2SC3788	60p 75p	2SD200	180p	2SD869	150p 140p	2SD1310 2SD1311	140p 65p	2SD1758 2SD1760	60p 80p	2SK300 2SK301	25p 40p	2SK1767 2SK2038	275p 295p
2SC2240 2SC2258	15p 30p	2SC2712 2SC2714	20p 20p	2SC3260 2SC3261	230p	2SC3789 2SC3790	120p	2SD201 2SD213	260p 250p	2SD870 2SD871	260p	2SD1313	1000p	2SD1761	60p	2SK303	40p	2SK2039	750p
2SC2259	60p	2SC2716	50p	2SC3262	280p	2SC3795	140p	2SD234	90p	2SD879	60p	2SD1326	200p	2SD1762	50p	2SK304	25p	2SK2134	300p

	REPLACI	EMENT VIDEO	O HEADS	
Model Price			Model Price	Model Price
AKAI VS105, 112, 115, 116, 120, 125, 126, 201,	VHSAN3 800p VHSAY3 1200p	HRD750, HRD830, HRD860 3300p HRD250, HRD257 2300p	NVFS 100 5000p NVFS1 4850p	TLS1100 3100p VHR120, 130, 14, 141, 143G, 14SP, 151,
202, 205, 220, 240, 244, 245, 247, 248, 250, 301, 303, 304, VSP8,	VHSBH1, VHSCH1 2100p 850p	3V32, 8942, HR7655 2200p HRD180, 190, 230, 610, 3V59, FV12L,	N.E.C. N9011, 9012, 9013E, 9014E, 9014G, 9015,	15, 16, 171, 220, 23, 244, 274, VHR310, 330, 4100, 4105, 4200, 430, 4300, 4400, 4500, 5080, 5100.
VSP82 VP7100, VS9300, VS9500 650p	VHSBY3 2600p VHSD52 1600p VHSEH2 VHSDH2 1600p	FV20B, 26, 30, 32, 33, VC141L 2050p HRD370, HRD430, HRD470, 3V58, FV13H 2300p	9016, 901A, 902A, 9033, N9034, 9040, 9053, 9054, 9055, 9056, 9063, 9065, 9066,	VHR5200, 5600, 6850, 7100, 7200, 7250, 7300, 8070, 8100, 8101, 8200, VHR7800,
VP7200, VS9700, VS9800 1200p VS1 1250p VS2 1200p	VHSEH2, VHSDH2 1600p VHSEY1, VHSEY2 1400p VHSFS1, VHSFS2 1300p	HRD530, HRD700, HRD840, HRD870, HRD910, FV14T, FV57H 3100p	906, 9077, N9096, DX1000, 1600, PX1200 1150p N911A, 914C, 915A, 916A, 917, 9110, 9120	7810, 8000SP, 8801SP, VHRD4400, 4410, 4500, 4600,
VS3 1350p VS10 1350p	VHSFG2, VHSFG4, VHSF63, VHSFB3 1300p	GRC1, GRC2, 3 V41 2800 p BR9060, HRD330, 337, 440, 441, 637, 641,	PVC600, 740, 744, 754, 763E, 764,	VHRD4610, 6700, 4800 3100p TLS2000 4250p VHR5300, VHR6500, VHR7400 4500p
VSP1 2100p VS33,35, 37, 38, 38EOG MKII, 53, 55, 66,	VHSTJ1, VHSTJ2, VHSTJ3, VHSWJ3, VHSYJ2 700p	660, 670, 720, 730, 740, 820 HRFC100, SR3300MS, FV44L 2100p	PV2300, 2400, 760, 794, 770, 774 1650p	VHR5300, VHR6500, VHR7400 4500p VHR3500EX 2150p VHR16, 235, 335E, 4150, 4160, 4350,
765, 766, 767, 768, 865, 867, VSF30, 33, 4, 400, 410, 420, 430, 440, 441,	VHSVH4, VHSWH1, VHSXH1, VHSYH2 1600p VHSWJI VHSXJ3 700p	HRD950, HRD960, HRD980, FV46 5000p HRS5000, HRS5500, 5800, 9000,	N380, N381, N830, N831, N832, N833, N834, N835, N836 700p 82611AH1 (FOR MODEL DX3000),	7250, 7260, 8250 1950p VTC3000 1400p
450, 455, 480, 490, 497, VSG51, 54, 55, VXS450, VXS470 2250p	GRUNDIG	FV395.BRS600, SRS368E 5550 p FV22L 1400 p	DX4000, N9610, NS7000 3000p N895 3150p	SHARP VC390, VC393, VC496 2750p
VS512, VS515, VS516 2250p VS462, 465, 467, 467EOG2, VSF12, 15EK,	VS410, 415, 435, 450, 456, 460, 500, 505, 510, 520, 521, 530, 546 1600p BARCELONA, MVS5400, 440, 500, 600,	FV42 2600p VR182LV. VR202LV 1950p	N9052, N9530, DX2000 3400p VCP1 1700p	VC488 4200p VC779 1800p
15EOH, 300, 301, 310, VSF320, 330, 340, 350, VSG30,	SE5100, 6100, 6110, 9100 TVR4500, 4510, 5510, VS400, 440, 441,	FV67HV, FV68TX, FV77 3800p R2000 SERIES 4500p FV61LV, FV62LV, FV67HV 4000p	PVC2300, 2400, 740, 744, 760, 764 1400p DS6000 3500p	VC789, VC790 2900p VC200, 220, 300, 381, 383, 384, 385, 386, 387, 388, 471, 477, 481, 482, VC483, 486,
33, 34, 35	500, 505, 510, 518, 600, 610, VS5180, VS6190, 700, 900, 901, 902, 9091, GV200, 201, 2092,	FV42L £101.00p VP160L, VR172L 1950p	DS6000 3500p D5600 3500p VH3, VH555, VH600, VH700, VH844,	3300, 8381, 9100, 9300, 9400, 9500, 9600, 9700 1100p
VSX9 2250p VSA1100, 1110, 650, VSF500, 510, 550,	SE2100, 5110 1400p MADRID, SE5140, VS540,	HRJ200, HRJ205 3300p HRJ600EG, HRJ600EK, HRJ605EG,	VH900, VH1000 (ALL MODELS) 1100p	VC108, 208, 382, 402, 405, 408, 500, 550, 571, 573, 581, 582, 583, VC5W20E, 600,
560, 580, 590, 600, 650, VSG60, 64, 65, VSG70, 73, 74, 75,	VS5480 3000p MVS550, 620, VS550, 620, 630, 640, 790,	HRJ605UK, HRJ610EK 7100p HRJ300, HRJ305, HRJ315, HRJ316EG,HRJ318E 3750p	VH1, VH2A 700p D1000, D1100 1600p	651, 674, 681, 684, 6V3, 750, 780, 781, 683, 684, 402, VC500, 571, 573, 580, 584, 600, 682, 693,
VSX560, 580 3600p VS155, VS165 2300p VS20, 22, 23, 24, 25, 26, 27, 422, 425, 426,	930, 940 2400 p VS120 2300 p	HRJ615, HRJ715, HRJ815 9200p HRJ400, HRJ405, HRJ407MS, HRJ41	D1000X, D1500X, D4500, VPCD100, D1200, D2000X, D5000 1600p VR6460, VR6520, 64VR60,	700, 772, 7810, 782, 7822, VC783, 8481, 8581, VCA10, 100, 102, 103, 1031, 103,
427, 485, VSF10, 11, 180, 190 VSF200, 210, 220, 221, 222, 230, 240, 260,	VS680, GV280 4600p VS160, VS740 4400p VS170 4600p	OEK, HRJ415, HRJ416 5850p	VR6420 725p VR6711 4 HEAD 1800p	104, 105, 106, VCA111, 113, 116, 131, 140, 202, 203,
261, 262, 265, 270, 275, 280, VSF290, 510, 550, VSG20, 204, 205, 206,	MVS660, SE6160, VERONA, VS660, VS6690 3500p	VX500E, 800A, 810A, 820, 80A, 770B, 773B 1200 p	VR6440 2500p VR6441, VR6540, VR6541, VR6640,	211, 234, 244, 254, 255, 30, 35, VCA40, VCB311N, 320, VCD801, 802, VCM73,
VSG21, 211, 212, 215, VSG217EOG, 23, 24, 25, 405, 411, 415, 417, VSP 100, 100EM, 110,	GRUNDIG MVS710, 720, 910, SE7120, 9120, VS710,	VCRL3, VX730, VX750 1450p VX735, VX755, VX990 1500p VX735A, VX765, VX850 1750p	VR6642 1300p DV761, VR512, 522, 5229, 63SB7, VR6760, VR6761, VR6762, VR63SB7 7172	VCT212, 310, 410, VCT510, 72, VCT1314, VCTS313 1100p VC6000, 6200, 6300, 7300,
VSP88, 88KC, 8111, VSP9, VSR100, 100EDG, 100EM, 110, VSX400 1250p	716, 720, 800, 810, 910, 920, VS922, 9291, GV210, 211, 220, 2292,	VX735A, VX765, VX650 1750p VX600 1100p VX900 2650p	7200p VR6920 2750p	7700, 7750, 8000, 8300 1800p VC793 3000p
VSR9 VS 109, VS603, VS606, VS607 2500p	MV2105, 2115, SE2120 1700p	MITSUBISHI HS303, HS304, HS320, HS700 1400p	41DV2, 4SB11BVR412, 415, 6485, 6490, 6880 1600p	VC473, VC785, VC786 2200p VC699, VCA501, VCA602 2800p
VS75 2500p VS965, VC967 3450p	VXL2, 3, 4, 20, 25, 35 1000p VXL5, V20H 1050p VXL6 1200p	HS306, HS318, HS710 1400 p HS307 2300 p	VR6948 4850p 20DV1, 20DV2, 20RW7, 21DVI, 21DV2,	VC585, VC685 2000p: VC90ET 3900p VFH815 2800p
VSF400, 410, 420, 430, 440, 441, 450, 45S, 480, 490, 497, VSX450, 470 2850p	VXL7 1300p VXL8, 9, 10, 11, 19, 90, VCR34H, VTV 100,	HS319 1900p HS330 2300p HS400 2800p	21DV3, 2SB01, 02, 11, 12, 30DV2, 31DVI, 31DV2, 31DV3, 3SB02, 03, 05, 11, 12, 13, 68SB4, 71SB4, 86SBI, 91SB2, 92SB2,	VC800, VCH851, VCH852, VCH882 2700p
VSG20, 204, 204, 205, 206, 20, 21, 211, 212, 215, 217, 225, 23, 24, 25,	200 1100p HITACHI	HS400 2800p HS349, HSE27, 31, 32, HSB27, 31, 32, HSM33, 34, 35, 37G 2150p	DV186, 190, 291, 292, 468, 471, VR201, 202, 203, 2115, 212, 213, 223, 231, 232,	VCH80, VCH81, VFH815 2800p VCA33, VCA36, VCA43, VCA44, VCA46,
VSP100, 110, 88, VSR100, 110, VSX400 1950p	VT11, 14, 15, 16, 30, 33, 34, 330, 340, 503, 640, 5030, VTP10, 30 1000p	HS411 1900p HSE30, HSB30 2000p	302, 303, 305, 311, 312, VR313, 3210, 3219, 322, 3229, 323, 501, 6180, 6182,	VCA49 1500p VCA55, VCA63 2200p VC570 2800p
VSG415, VSG415EA, VSG425 VS75, VSA77 VSF1000, VSF1010, VSF1030 2800p 5800p	VT35, VT350, VT38, VT39 2300p	HS338 1900p HSE10, HSE11, HSE20, HSE21, HSE41,	6185, 6290, 6291, VR6293, 6362, 6367, 6467, 6468, 6470 4600p VR3260, 6349, 6442, 663, 6448, 6449,	SONY DSR-19R FOR SL-T 9ME 3100p
ALBA VDR3000, VCR4000, VCR5000, VCR6000	VT100, 110, 111, 112, 113, 115, 118, 120, 125, 128, 220, 225, 400, 405, VT410, 413, 414, 415, 416, 418, 510, 515,	HSB10, HSB20 2100p HS300, HS301, HS302, HS310, HS273, HS550Q 1350p	6542, 6643 1250p VR601 1800p	DSR-21 R FOR SLC 8-C9 2600p DSR-35R FORC20, C30, C40, SLF1UB,
VTV10 1650p	517, 518, 520, 525, 526, VTM625, 626, 725, 210, 211, 215, 726,	HS200 650p HS337, HS347 1400p	49SB6, VR6548, VR6648, VR6843 2750p	SLF1E2 PIN, SLC24PS, 33E, 34, 44PS, SLF11 30PE 35, 60PS, SLK85.
VCR7000, 7800, 8000, 8800 1100p	727, 728, 820, 821, 825, 920, 921 1400p	HSB12, HSE12, HSE22, HSM16G, 18, 23, 25, 30, MX1 2100p	SAISHO VR100, 605, 705, 805, 905, 1000, 1100,	SLT20ME, 30ME, SL100 1500p DSR-43R FOR SLC7 RANGE, SL5000, SL5100, SL3000 1 PIN, SLC6E, SL36ES,
VCR4500, VCR5200, VCR9000, TVR1 900p	VT3000 650p VT4000, VT4200, VT5000, VT5500, VT5600 1100p	HS411EZ, HS411GZ 2600p HSB11, HSB21 2000p HSB52, HSE50, 52G, HSM36, 50, 54,	1200, 1600 1200p VR3300X, VR3600X, VR3650X, VR3800 1400p	SL37E 1300p SL3000, SL8000, SL8080, SLC5E, SLT7ME
VCR7000 1000p VCR1000, 2000, 6000, 61000, 62000, 8600, 8602, 8700, 9005, DD8900, DD8904,	VT77, 680, 6500, 6700, 6800, 7000, 8000, 8030, 8040, 8100, 8300, 8500	55, 57, 58, 60 3300p HSE51 3000p	VR3200, VR3500 1400p VR2000, VR3300, VR3600 1400p	1600p SLV201, SLV202 2000p
TVR4 1100p TVR2, TVR3, VCR4600, VCR4600 MKII,	VT8700, 9000, 9300, 9500, 9700, 9900 1000p	HS410 3250p HS412. HS421GZ 4000p	VR2500 2650p VRS5000X, VX6000A, VXL12X 1500p	SLK95, SLT50ME 2900p SLV275, SLV373VB, SLV410, SLV412, SLV427, SLV474 2200p
VCR400 1100p VCR8800, VCR8804, VCR9340 2100p	VT8, 9, 56, 57, 570, 575, 576, 580, 585, 588 3200p VT65 2400p	HS5300, HS5424, HS5600 3050p HSM20, HSM55 2250p HSM40 2850p	SALORA 6500, 6600 1600p	DSR49R, SLHF100P, SLHF100LIR 3850p
VCR8603, VCR8604, VCR8704, VCR8714 1350p VCR9140, VCR9142 2550p	VT130, 135, 138, 145, 250, 255, 258, 420, 425, 426, 428, 430, 431, 435	HSM40	SV7300, SV8200, SV8300, SV9200 1500p	SLV656, SLV715, 725, 727, 757, SLV777, SLV815, SLV825 4600p
VCR9340 3650p VCR9244 3450p	VT438, 535, 536, VTL30, 301, VTM630, 635, 636 1900p	2010, 3000, 7000, 7200.7500, NV7800, 7850, 8170, 8200, 8400, 8600, 8610, 8620	SV7400, SV8400 1600p SV8100 1200p SV900, SV9900 3450p	SLV353UB 2600p CCDF340E, CCDF500E, CCDV90E, CCDV95E, CCDSP5E 4800p
UF020, 22, VCR3000, 3002, 9500 1750p	VT52, VT60, VT61E, VT62E, VT63, VT64, VT640 1100p VT168, VT150, VT260, VT450, VT498	NV777, NV330 1150p	SV601, SV611, SV6910 1500p SV800, SV810 2800p	CCDV95E, CCDSP5E 4800p SLV801, SLV802 3550p SLV310, SLV315, SLV325,
FISHER FVHP420, 510, 520, 530, 615, 618, 620,	(4 HEAD) 2200p VT530 2050p	NV8050, NV8051 2800p NATIONAL PANASONIC	SV6700, SV8710, SV8750 1500p 623N, SV6800, SV6900, SV8850, SV8870,	SLV335 1600p SLV210, SLV212, SLV270, SLV273,
622, 710, 711, 715, 716, 720, FVHP721, 722, 730, 830, 905, 906, 907,	VT522, VTM212, 620, 622, 720, 722, 822, 922, 925	AG1000, 1050, NV250, 260, 280, 450, 460, 465, 470, 480, 650 AG6010, AG6015 1600p 2500p	SV8970 1750p SV88110, SV8910 2650p 823N, SV8920 3500p	SLV285, SLV300 1150p SLV125, 213, 225, 252, 255, 262, 280,
908, 910, 911, 915, 916, 918, FVHP5000, 5001, 5005, 5050, 5075 1100p	VT660E 2600p VT570, VT575, VT580, VT585, VT588,	AG6840 2400p NV100, NV200, NV370, NV380,	923N 4500p SV8600, SV8700 1550p	SLVX1, 20, 3 1750p SLV363, SLV416, SLVX50, SLVX55 2750p
VBS3500, 7100, 7500, 7600, 9900, VBR330 1800p	VT540, 545, 546, 548, VTD660, 665,	NV630 725p NVD80, NVH65 3400p	SV8420 2400p SV8620 2100p	SLVX75, SLVX90, SLVX95 SLV282, SLVX30, SLVX35 3000p 2025p
VBS7000, VBS7100, VBS9000 2000p FVHP500, 711, 715, 721, 722, 730, 830, 5100, FVHD720 1100p	1 VTM730, 731, 735, 736, 740, 745, 746,	AG5150, AG5250, NVF65, NVH75, NVH77 3200p NVF51 4200p	SV9300 2500p SV8830 2200p	SLHF100P, SLHF100UB 3850p SLVE7, SLVE8, SLVE9 5150p
5100, FVHD720 1100p FVHP725, FVHP830, FVHP980 2500p FVHP990 2700p	VTF770, 774, 775, 860, 861,	NVGI9 2300p NVJ30, NVHJ33, NVL10, 20, NVL21,	SV8720 2250 p SV8520 1900 p	SLVE90 5150p SLV615, SLV625, SLVE600, SLVE700,
FVHP975 2400 p FVHD407, FVHD140, FVHP1, FVHP10,	865 4100p VT85, VT86, VT88 2600p VTF780, VTF785 4800p	NVG30, 31, 40, 130, NVJ37, 40, 42, NVSD30, 10EE, 11, 2, 30, 35 1450p	SAMSUNG SV8500 1500p SVX301, VB900, 910, VVT510, VT320,	TOSHIBA
FVHP20 1150p FVHD230, FVHP1100, 1200, 130, 1340,	VTF180, VTF185, VTF280 8500p VTF350, VTF351 5150p	NVJ35, NVG46 1700p NVM1, NVM3, NVM5 4200p AG2100, AG2200 700p	5600, VX510, 511, 520.616, VX626, 627, 717, 614, 619, 629, 710, 712, 720, 730, 970, 971, 972, SV716, 717, SVX303, 305,	V9680 3400p V8600, V8650, V8700 3000p
1410, 2000, 200, 210, 300, FVHP310, 410, 420 FVHD250, 270, 370, FVHP1500, FVHP250	VTM220, VTM220E, VTM220UK 5150p 5150p	NV430, NV431, NV433, NVSD2, NVSD22, NVSD25, NVSD3 1000p	970, 971, 972, SV716, 717, SVX303, 305, VB510, 520, 610, 616, 617, 619, 620, 626, 627, 629, 710, 971, V1520, 616, 621, 626,	V21, V31, V32, V33, V50, V51, V52, V53, V9600 1450p
2700 p FVHP132, 1400, 1440, 320,	HR2200, 3300, 3320, 3330, 3350, 3360,	NV730, NV730F, NV770 4 HFAD 1450p	900, 910, 1200p SVX319, VB770, V1710, 730, 731, 735,	V55, V57 700p V71, V73, V74, V75, V77, V80, V81, V82, V83, V841V85, V86, V87,
440, 445 3550 p FVHP470S, FVHP475HV 4800 p	3660, 3750, 3860, 4100 3292, 8900, 8901, 8902, 8903, 8906, 8922, 8928, 3V01, 3V06, 3V22 600p	NV366 1850p NV21 HQ, NV 180, NVD48 2000p NV7881 2500p	750, 751, 770, VB750, VK8220, VX750, VX7330, VK770, VK8225, VR1730, 1735,	V88 1200p DV90, 96, 97, NM3, V108, 109,
FVHP1250, FVHP430S 1950p	- HR3660, 7600, 7610, 7650, 7700, HRD110, 111, 120, 121, 220, 225,	NV810, NV8301 2400p NV850, NV950 2750p	XR20 1900p V11560, VN1560, VN1561, VX1530,	199, 200, 202, 205, 207, 209, 80,
8000 3HSSDB, GHV121, RQ2011, 2031, 2051 1900p GVH51, GVH122, VCP4000, VCP4100,	HRS 100, 8904, 8923, 8924, 8925, 8929, 8935, 8941, 8943, 8944,	NV870, NV890, NV970 3200p AG6024, NVG33, 46, NVL23, 25, 28,	VX1560, VX1561, VX1580 2200p PL30LR, PX3031, 31R, 32R, 990, 992, 991, PXP30, PXR30, VX 1260, SVX503,	V5470, V5480 1300p V600 2350p V880MS 2600p
VCP4200 1100p GHV1232, 1233, 1241, 1242, 1243, 1244,	RR1600 HRD140, 141, 142, 143, 150, 152,	NVJ47, 49, 700PX, NVSD20EE, 400, 44, 45 1450p	SX3230, 3231, 3260, 3261, VK30, 300, 1230, 1260, 1261,	V700G 3700p V500G, V509G 2500p
1245, 1246, 1266, 1290, 1291 GHV1295, 1296, 1891, 8210, 8215, 1221,	156, 157, 158, 160, 5101 HR\$10, 8947, 8948, 3V42, 3V44, 3V45,	NVG10, 11, 12, 14, 16, 120, NV250, 280, 450, 465 1500p	VK30R, 31R, 32R, VXK300, 301, 306, 320, 321, 326, 336 1900p S11230, 1240, SVX600, SX1230, 1231,	V9680 V300G, V301, V305, V306,
1240, 1241, 1247, 1248, 2145 VCP400, VCP4130, 4300, 4301, 4305, 4306, 4310, 4311, 4315, 4316,	3V46, 3V47, 3V52, 3V54, 3V55, 3V56, 3V57 1150p	NVG18 1800p NVG20, 21, 22, 25, 28, 200,	1260, 1261, 7120, 7121, 7220, SX7221, 7230, 7301 1900p	V309G 2550p V61, V63 1700p V110, V120, V130, V140, V210, V211,
VCP4320, 4321, 4325, 4326 1100 F C211, GHV1392P, 1393P, 19OOP, 1290,	HRD 154, 170, 171, 210, 211, 217, 310, 320, 321, 350, 521, 522, 525, 526. HRD 527, 540, 550, 560, 590, 770,	NVD48 1700p NVG50, NVG300 2000p NVG45 1450p	SANYO VTC5000 5400, 600, 6000, 6010, 6500,	V212, V220, V221, V222 1500 p
1291PQ, 12931Q, 1295P, GSE1295PQ, GSE1296, 1297, 1891, 1910,	HRDX20, HRDX22, 8950, 8951, 3V64, 3V65, FV10, FVII, FV20, FV21, FV26	NVH70 3600p	I VPR5000, VTC 1500, VTCM 10, 11, 20, 21	V711, V880 3850p VCPB1E, VCP2C2 1200p
20005, 2000, GSEC200, GSEC205, 211, 2301, GSEG2301, GSEQ12, 204, 20, 22, P416P, P500P	HRD565, HRD566, 3V48 2200p	NV600 1050p AG6800, AH6810, AG6820 2600p	V1C5350, 5370, V1CNX10, V1CNX15, 20,	V65, V66, V6 1250p V312, V322, V412 2600p
QUISY22, QUISY24, RC205P, RG11P, RG20, RG2001, RQ20,	HRD725, HRD755, 3V43, 3V53 8930, 8931, 8933, 8940, 3V29,	AG6100, AG6200, AG6300 2600p NVG7, NVG9, NV230 1050p	VTC5500, 5550, 9100, 9300, 9350, 9355, 9455, 9500 1900p	V609, V610V610B, V610UK, V611, V659F, V660, V660F 3200p
RQ204HP, RQ241, VCP100P,	1 00/E 2/100n	NVG 15, NVG400 2600p NVM7, NVMC20 3800p	VHR1110 VHR1150 VHR1300 VHR1700	V312, V403T, V413G 9200 p V703W, V813G 5200 p
GHV4400, 4400, GSE-Q404P, QUISY40, RC405P 2350g	8922	NVF70 5200p NVJ45, NVJ47 2000p	VHR3200, 3270, 3100, 3110, 3150, 3300, 3400, 3310, VHRD500 1500p	V95G 8000p
GSEQ121, RQ2011, RQ2031, RQ2051 1950	FV37, FV43H, HRD860 3100p BR7000E, BR7000S, BR7030,	NVSD40 2250p NVF75, NVF77 4750p	VHR1500, VHR2500, VHR3330 2100p VHR2700 2450p	II COANDATAITD
G.E.C. 4000H, 4001H, 4002H V4001H, V4004, V4100 1200	BR7030/40H, BR7040 2600p HR7200, 7300, 7350, 2650, BR6200 700p	NVF55 4000p NVFS200, NVFS88, NVSF90, NW8000 4600p	VHR7900 3000p VHR5700, VHR7700E, VHRD4710 2700p	
V4005H 1500j	HRD455 2000p HRD520 1400p	NVHD90, NVHD 100, NV HD 101, NVHF 100 3100p	VHR150E, 153, 154, 1501R, 240, 250, 251, 27, 350, 474, 5350E, 7500, VHR7530,	FAX: 0181-903 6126
CSI, DS2 1600; VHSAH1 1100;	HRD300, 400, 580, 600, 620,	NVSD1 1400p AG7330, AG7350, AG7355,	6550 3850p	TAX. 0101-303 0120
VHSAH3 2400	HR4100 1000p	AG7450 5000 p	TLS1000P, TLS1001P,	

ALL TV & VIDEO PARTS SOLD ARE REPLACEMENT PARTS

	V	CR BELT KIT	S	No.
Model Price	Model Price	Model Price	Model Price	Model Price
AKAI VP7100, VS9300, VS9500, VS9700, VS9800	TX3650, VCR3000, VCR3002, VCR9500 75p	406, 407, 4092, 410, GV411, 412, 414, 415, 416, 417, 4192, 4200, 420, 430, 434, 435,	N.E.C. N830, N831, N832, N833 100p	V1710, 730, 750, 970, VX710, 712, 720, 730, 970, 971, 972
120p	FISHER	GV437, 440, 450, 4592, 460, 464, 470, 500,	N895 80p	VX9880 110p
VS1, VS2, VS3, VS5, VS12, VS15, VP88 70p VS10 65p		501, 5050, 5095, GV5105, 511, 530, 5395, 540, 560, 5695,	PVC2300, PVC2400 180p DX1000, 1600, 1800, 2000, 3000, N9012, 9013.	SX7121 95p SANYO
VSX9, VS105, 112, 115, 116, 120, 125, 126,	FVHP520, FVHP530, FVHP420 60p	MV4005, 4105, SE4100, 4104, 4120, 5102, 5104, 5106, TVR37001 70p	9014, 9016, N9033, 9034, 9053, 9054, 9055, 9056, 9066, 9096, 9110, 9120,	VTC5000, 5150, 6000, 6500, VTCM10, 11, 20,
155, 165, 205, 220, VS24, 240, 244, 245, 247, 248, 250, 512, 515,	FVHP615, 618, 620, 622, 710, 711, 715, 720, 721, 722, 725, 730,	HINARI	N9510, 9520, 9530, 9610 80p	21, 30, 31, 50 65p VTC5300, VTC5350, VTC5400,
516 200p VS22, VS23, VS25, VS35, VS37, VS38, VS53,	FVHP830, 840 60p	VXL2 80p VXL7, VXL8, VXL9, VXL10, VXL11, VXL19,	NATIONAL PANASONIC NV300, NV330PX, NV332, NV333 NV340,	VPR5800 80p VTC5500 70p
VS55, VS66 80p	FVHP905, 906, 907, 908, 910, 911, 915, 916, 918 75p	VXL90, VCR34, VTV 100,	NV366 100p	VTC9100, VTC9300 140p
VS4, VS6, VS8, VS9 95p VSA77 120p	VBR330, VBS7500, VBS7600,	VXL4, VXL35, VTV300 70p	NV2000, NV2010, NV3000 80p	VTC1100, 1300, 1500, VHR1100, 1110, 1150, 1200, 1300,
VSS99 105p	VBS3500 75p	VXL5, VXL6 100p VXL3, VXL20 90p	NV7000, NV7200, NV7800 75p NV8600, NV8610, NV862 145p	VHR1500, 2370, MVR220 80p VHR2100, VHR2300, VHR2500,
ALBA VCR40000 130p	FVHD140, FVHD40, FVHD55, FVHP1, FVHP10, FVHP20 110p	HITACHI	NV230, 250, 280, 430, 431, 433, 450, 460, 465, 470, 650, 730, NV770, 810, 870, 890, 970, AG	VHR2700 100p VHR3100, 3110, 3150, 3300, 3310, 3400, 3500, 3700.
VCR5000, VCR6000 105p	FVHD230, 250, 270, 370, FVHP1100, 1200,	VT11, 14, 16, 17, 19, 33, 330, 34, 35, 350, 38, 39, 88, 165, 5030 75p	1000, 1050 85p	3800, VHRD500, 700, TLS1000, TLS1001 65p
VCR161, VCR222 100p VCR3000X, VCR4000, VCR4000X 75p	1250, 130, 132, FVHP1340, 1400, 1410, 1440, 1500, 2000, 200,	VT5000, VT5500, VT18 120p	NV370, NV380, NV480, NV630, NV780, NV830, NV850 70p	VHR120, 130, 14, 141, 143, 14, 150, 151, 153, 154, 15, 16, 171, VHR194, 220, 23, 235, 240.
VCR7000, VCR7800, VCR8000, VCR8800 110p <u>VTV10</u> 105p	210, 250, 3, 300, 310, 320, 2000, 410, 420, 430, 440, 445, 470,	VT7000, VT8000, VT8030, VT8040, VT8300, VT8500, 8700 60p	NV600, NV688, AG6010, AG6015 85p NVG7, 9, 10, 11, 12, 14, 15, 16, 18, 30, 130,	244, 250, 251, 274, 297, 310, 330,VHR335, 390, 4100, 4105, 4150, 4200, 430, 4300, 4350, 474,
AMSTRAD	475, FVSD2905 85p	VT680, VT6500, VT6800, VT9300, VT9500, VT9700, 9900 75p	400, NVH70 50p	VHR4770, 5080, 5100, 5200, 5300, 5350, 5700.
TVR123, VCR4600, VCR4700,	FVHP5000, 5005, 5050, 5075, 5100, 975, 980, 990 95p	VT52, VT57, VT61, VT62, VT63, 64, 65, 85, 86,	NVFV1, NVM10, 3000, 3300, 40, 7, 9000, 9900, NVMS1, 4 70p	6850, 7100, VHR7200 7250, 7260, 7300, 7400, 7500, 7520, 7530, 7530, VHR7540, 7700, 774,
VCR5200 80p VCR7000 80p	G.E.C.	VT3000 120p	NVM 1, NVM3, NVM5 70p	7800, 7810, 8000, 8100, 8200, 8250, 8500,VHR8800, 8801, VHRD4400, 4410, 4500,
VCR1000, 2000, 6000, 6100, 6200, 8600, 8602, 8603, 8604.	4005 150p V4004 100p	VT100, 110, 111, 113, 115, 118, 120, 125, 128, 130, 135, 138.	VR6460, VR6920 170p	4600, VHRD4610, 4710, 4890, 6700 60p
VCR8700, 8704, 8714, 8800, 8804, 9000, 9005,	V4007 80p	VT145, 150, 168, i70, 175, 220, 225, 250, 255,	VR6540 100p VR6442, VR6542 70p	VTR1000 70p
9244, 9340, DD8900, DD8904, TVR4 100p	GOLDSTAR GHV1221, 1232, 1233, 1240, 1241, 1242, 1243,	258, 260, VTL30 60p VM500 VM600 90p	VR2025, VR2580 100p DV186, 190, 286, 291, 292, 468, 471, 562, 571.	VTC6010 75p SHARP
TX3650, UF20, 22 24, VCR3000, 3002, 4000,	1244, 1245,	J.V.C. HR3300, HR3330, HR3360, HR3660,	761, VR201, 202, 203, 211, 2115, 212, 213, 223,	VC200, 381, 384, 385, 386, 388, 390, 393, 838,
9500 75 p VS1004 105 p	GHV1246, 1247, 1248, 1250, 1266, 51, 8000, 8200, 8210, 8215,	HR4100 130p	311, 312, 313, 3210, 3219, 322, 32, 29, 323, 535, VR20DV1, 20DV2, 20RW7, 21DV1, 21DV2.	9100, 9300, 9500, VC9700 80p VC7300, VC7700, VC7750, VC7800,
BLAUPUNKT	VCP4100, VCP4130 80p GHV1290, 1291, 1295, 1296, VCP4000, 4200,	HR7200, HR7300 50p HR7350, HR7600, HR7610, HR7650.	21D, V3, 25BO1, 25BO2, 11, 12, 302, 303, 305, 31DVI, 31DV2, 31D, V3, 3SB11, 3SB12, 3SB13,	VC8000 110p VC8300 115p
RTV100 200p RTV200, RTV222, RTV224 90p	4300, 4301,	HR7655 50p	72SB8, VR30DV2, 35BO2, 35BO3, 635B7, 715B4, 715B5, 715B8, VR865B2, 915B2.	VC300, 387, 471, 473, 481, 482, 483, 486, 488,
RTV202, RTX200 150p RTV322, RTV248 100p	VCP4305, 4306, 4310, 4311, 4315, 4320, 4321, 4325, 4326 120p	HRD110, 111, 120, 121, 220, 225,	925B3, VR6180, 6182, 6185, 6285,	VC402, 500, 571, 573, 581, 582, 583, 584, 585,
RTV306, 307, 309, 310, 311, 312, 328, 414,	GRANADA	BP5000 60p HRD140, 141, 143, 150, 152, 157, 158, 160,	6290VR6291, VR6293, 6362, 6367, VR6390, 6391, 6393, 6467, 6468, 6470, 6561.	VCSF3, VC8581 80p VC108, 405, 408, 550, 600, 651, 674, 681, 682,
434, 444, 707 135p RTV211, RTV214 140p	VHSH1, VHSAH3 100p VHSVH4, VHSWH1, VHSXH1 60p	190, 250, 257, 310, HRD455, 565, 566, 725, 755, HRP50 45p	6570, 6581, 6670, VR6676, 6710, 6760, 6761, 6762, 6870, 6970, 6975, VR68SB4, 86SBI,	682, 684, 685, 693 VC700, 750, 783, VC6F3, VC6V3 70p
RTV324, RTV32565p RTV315, RTV316, RTV319, RTV320,	VHSYH2 50p VHSBH1, VHSCH 1 150p	HRD170, 171, 180, 210, 21 1, 217, 230, 300,	92SB3 75p VR445B9, VR445B920, VR445B922, VR6443	VC208, 671, 772, 779, 780, 781, 782, 785, 786.
RTV317 50p	VHSBP1 135p	320, 321, 330, 337, HRD350, 370, 400, 430, 440, 44 1, 500, 530, 700, 750,950,	6843, 6843, VR6943 100p	787, 793, 800,VC7810, 7822, VCA100, 102, 103, 104, 131, 140, 170, 202, 03, VCA234, 501,
RTV301, RTV333, RTV338, RTV404, RTV424 85p	VHSAN3 110p VHSDS2 125p	HRS5000, 5500, 8000, 9000, BR9060, BRS600, 605, 920, 925 45p	VR3260, 6349, 6448, 6449, 6548, 6648, 49SB620, 644869S, 49SB6 110p	502, 602, 5011, VCB311, 361, VCD801, 802, VCH851, 852, 882, VCM73, VCT72 66p
FERGUSON	VHSAY3 125p VHSBY3 100p	HRD227, 520, 52 1, 522, 527, 600, 610, 620,	VKR6850, VKR6855 70p VR501 110p	VCA10, 103, 105, 106, 113, 11613, 211, 234, 244, 254, 30, 33, 35, VCA36, 37, 40, 43, 454,
3292, 3V00, 3V01, 3V16, 3v22, 8900, 8901, 8902, 8903, 8904,	VHSEY1, VHSEY2 70p	637, 641, 650, 830, HRD840, HRDX20, 22, HRJ200, 205, 300, 305,	VKR6800, VKR6810, VKR6820 70p	48, 50, 505, 51, 52, 53, 54, 55, 56, 57, 58,
8906, 8909, 8912, 8922 120p	VHSCC1 100p	SR330, HRS10 125p HRD840, 550, 560, 580, 590, 640, 660, 670,	SE4104, VR231, 2310, 2319, 231, 232, 2329, 237, 23, 241, 2410, 2419, 242, 243, 245, 2469,	VCA60, 605, 615, 67, 68, 1031, VCB320, VCBS97, VCD805, VCD806, 810, 815, VCH80,
3V23, 8923, 8924, 8929 50p 3V29, 3V30, 8930, 8931, 8933,	VHSDP1, VHSFV2 80p VHSTJ1, VHSTJ2 150p	720, 730, 740, 770, HRD820, 860, 870, 880, 910, 960, 980, HRDX20, 25, HRJ2 10,	247, 2479, 251, 252, 256, 257, 258, 33, 19, 332, 3329, 333, 337, 339, 3419, 342, 343, 3469, 347,	81, 85, 865, 910, VC51000, VCT212, 310, 410, 610, VCT1314, VCTS312,
8940 65p 3V31, 3V32, 8941, 8942 60p	VHSTJ3 65p	HRJ215, 315, 316, 318, 400, 405, 407, 410,	3479, 35, 1, 352, 357, 358, 422, 4229, 432, 437, 442, 4229, 432, 437, 442, 44, 5, 4469, 447.	313, VC790ET 80p
3V35, 3V36, 3V38, 3V39, 3V49, 8943,	VHSWJ1, VHSWJ2 120p VHSXJ3 85p	411, 415, 416, 507, HRJ6 10, 615, 715, 97, HRS4700, 5800, SR3200, SRS368E 60p	4479, 451, 452, 457, 458, 459, 512, 522, 5229,	VCC10 70p SONY
8944 60p 3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54,	VHSYJ2 80p VHSFJ2 140p	HRJ600 40p	6379, 642, 647, 722, 7229, 723, 7379, 747, 8389, 948, 9489 70p	SLC6, SLJ10, SLT6ME 140p SLC5, SLC7, SLJ7, SLJ9, SLT7ME 140p
3V55, 3V57,	VHSFS1, VHSFS2 130p VHSFG1, VHSFG2, VHSFG3,	LOGIK VR955 180p	SAISHO	SLC9, SL8000, SL8080, SLT50 165p
8945, 8947, 8948 45p 3V58, 3V43, 3V44, 3V59, 3V64, 3V65, 8950,	VHSFG4, VHSF63 180p	MATSUI VX600, 730, 735, 750, 755, 765, 850, 6000.	VR3800, 3200, 3300, 3500, 3600, 3650,	SL8000E, SL8080E, SL8200, SL8600 175p SLV255, 125, 213, 225, 262, SLVX1,
8951, FV10, FV11, FV12, FV13, FV14, FV20, FV21, FV22, FV26, FV32, FV39, VC141L 45p	GRUNDIG MVS400, 440, VS400, 410, 415, 435, 440, 441.	VS888 75p	VRS4400, 5000 75p VR3400 100p	Z0, 3 95p TOSHIBA
FV31R 110p	450, 456, 460 55p VS180, 200, 220, 226, 262, 265, 267, 2X40800,	VX1000, VX2000, VX2500, VX3000, VX6000 80p	SAMSUNG	V55, V57 85p
FV61L, FV62, FV67, FV68, FV70, FV71, FV72, FV74, FV77 50p	0850, 0880,	VX800 70p	SV716, 717, V1616, V~621, V1626, VX616, VX617, VX619, X626, VX627, VX629,	V33, V31, V32, V51, V52, V53, V9600, V9680 85p
FV43H, FV44L, FV46T, FV57H 125p FV37H 80p	1600, 2000, 2080, 2200, 2280, MVS200RC 90p	MITSUBISHI HS200 200p	VX714 75p VB520, 510, 610, 616, 617, 619, 620, 626, 627,	V61, V63, V65, V66, V67 150p DV80B, DV80D, V71, 73, 74, 75, 77, 81, 83, 85,
3V52 55p	VS150 160p VS310, 311, 315, 320, 326, 340, 345, 380, 385,	HS300, 301, 302, 307, 310, 337, 338, 347, 349, 411, 412, 421, 480, HSB10, 20, 30, HSE10, 20,	629, V1510, 520, V1611, 616, 621, 626, VX510, 511, 520, VT320, 5600 80p	86 80p
FV41R, FV42L 100p FIDELITY	445 85p	30, 70 80p	VB900, VB910, V1900, V1910 110p	V108, 109, 110, 120, 130, 140, i99, 209, 210, 211, 220, 221, 411, V421, 609, 610, 611, 659,
HQS200, VCR1000, 2000, 600, 6000,	LC290N, LC295SN, SVS 180, VS 170 70p	HS303, HS304, HS306, HS307, HS330, HS400, HS700 110p	PX980, 981, 982, SE9001, SV9001, SVX307, 319, 322, VB750, 770, 8220, 8225, V1770, 790,	660, 711, 880 120p V91 G, V95G 115p
6100 180p VCR100 160p	VS 160, BARCELONA, FLORENZ, GV4000, 4000, 4001,	HS318, HS319, HS410 110p HSM1000, 16, HSM23, 25, 33, 34, 35, 37, 54,	8220, 8225, VK8220, VPX31, VX750, VX770, 790, 8220, 8225, SE9000, 9001 90p	V212, 213, 22-2, 3i2, 322, 403, 412, 413, 610, 703, 813
VTR1000, VTR1001 100p	GV4002, 400, 401, 4010, 402, 403, 404, 405,	55, 57, 58, 59, 68 55 p	SVX301, 303, 305, SX7301, VB710, 971,	VCPB1E 110p
	REPLACEM	ENT IDLERS	& PULLEYS	

	Models	Description	Make	Models	Description
		FF Rew Idler 6886792	Ferguson	3V39, 3V30, 3V31, 3V32, 3V353V36, 3V38, 3V39, 3V49, 8930, 8931, 8933, 8940, 8941, 8942, 8943, 8944	Take Up Clutch PU 51380
Order Code: Hitachi Order Code:	VT680, 6500, 6800, 9300, 9500VT9700, 9900	Price 100p Play Idler 6861482 6861481 Price: 180p	J.V.C.	HR7200, 7600, 7650, 7655, 7300, 7350, 7610	Take Up Clutch PU 53462A PU 51380
Blaupunkt	RTV301, 306, 307, 309, 311, 312, 315, 316, 317, 319, 320, 404, 414, 424, 434, 444, 478, 707	ldler	Order Code: Philips	DB532, VR6520, 6843, 644	Price: 200p Reel Idler
	GHV1221, 1232, 1240, 1241, 1242, 1243, 1244, 1245, 1246, 1247, GHV1248, 8000, 8200, 8210, 8215, GVHP51, VCP4100, 4130		Sharp	VC600, 651, 681, 682, 684, 685, 693, 699, 700, 783, 6FR, 6V3, 6F3	Idler Assembly NPLYV0107GEZZ
lational	NY230, 250, 260, 280, 370, 380, NY430, 431, 433, 450, 460, 465, 470, 480, 630, 650, 730, 780, NV810, 830, 850, 870, 890, NY67, 9, 10, 11, 12, 14, 15, 16, 18, 30, 130, 400, AG1000, AG1050, 1200 1500, 1810, AG2100, 2200, NVH65, 70		Order Code: Philips Sharp	VR6843, 6943, 44SB9, VR44SB920, 44SB922, 6943 VC772, 780, 781, 782, 785, 786, VC787, 800, 793, 799, 7810, 7822, VCA100, 102, 104, VCA131, 140, 170, 202, 203, 234, 501,	Price: 615p Reel Drive Unit Idler NPLTV0111GEZZ
Philips Order Code:	VR6460, VR6520, VR6920 IDL08	Idler Arm 40340162 Price 100p		VCA602, 5011, VCD801, 802, VCH851, 852, VCH882, VCM73, VCT72, VC782MK11	
harp	VC200, 381, 383, 384, 385, 386, VC388, 390, 393, 3300, 8381, 9100, 9300, 9500, 9700	Idler 150280 Idler NIDL0005GEZZ Price: 100p	Order Code: N.E.C.	IDL90 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	Price: 700p
harp	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: Philips	IDL245 DV186, 190, VR211, 2115, 212, 213, 223, 286, 291, 292, 311, 312, 313, 3210, 3219, 322, 3229, 323, 535BO, VR486, 471, 562,	Idler Arm Assembly Price: 270p Pressure Roller Assembly PS403-40205
kai erguson	VS10 3V23, 3V29, 3V30, 3V31, 3V323V35, 8923, 8924, 8929, 8930, 8931, 8940, 8941, 8942	Price: 100p Reel Idler Reel Idler PU48967		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, 8681, 635817, 68584, 71584, 71585,	
order Code:	IDL20	Reel Idler PU48967 Price: 175p		72SB8, 72SB8, 92SB31, 20DV1, 20DV2, 20RW7, 21DV1, 21DV2, 2SB01, 2SB02, 2SB11, 2SB12, 30DV2, 31DV1, 31DV2, 31DV,	
.v.c.	3V39, 3V30, 3V31, 3V32, 3V353V36, 3V38, 3V39, 3V49, 8930, 8931, 8933, 8940, 8941, 8942, 8943, 8944 HR7200, 7600, 7650, 7655, 7300, 7350, 7610, HRD110, 111, 120, 121, 225	Take Up Idler PU 51402 Take Up Idler PU 51402A	Toshiba	33SB02, 3SB03, 3SB05, 3SB11, 3SB12, 3SB13 V91, V95	Pressure Roller Assembly PS403-40205

Akai	M32773	IT01	Ferguson	PU51380	ITAT		V/VD0 400	(TAE	
MKai			rerguson		1T07		VXP0433	IT15	
	MZ366960J2	IT02		PU51402A	1T08		VXP0463	IT16	Price:
Goldstar	VXP0521	IT17		PU55373	IT09		VXP0521	IT 17	20p each
Hitachi	6861471	IT03		PU55374	IT10		VXP0581	IT18	16p each pack of 5
	6861482	IT04	National	VXP0329	IT11	Sanyo	1430662T15620	!T19	13p each pack of 10
	6886971	IT05	Panasonic	VXP0343	IT12	Sharp	NIDL0005GEZZ	IT20	
JVC	PU48697B	IT06		VXP0344	IT13	-	NIDL0006GEZZ	IT21	Packs are for each mode
				VXP0401	IT14		NPLY0107GEZZ	IT22	Packs are for each mode



	DI	NCH DOLLEI	OS.	
		NCH ROLLEI		
Model Price	Model Price FVHP615, 618, 620, 622, 710, 711, 715, 716,	Model Price BRS600, 605, 747, 777, 920, 925 140p	Model Price NS7000 140p	Model Price 681, 682, 684, 685, 693,
VS10, VS9300, VS9500, VS9700, VS9800, VP7100, VP77 140p	720, 721, 722, 725, 730, FVHP810, 830, 840 140p	HRS10 140p BP5000, HRD110, 111, 120, 220, 225,	ORION VH1, VH2 140p	VC699, 700, 772, 750, 779, 780, 781, 7810, 782, 782MK2, 7822, 783,
VS1, VS2, VS3, VS4, VS5, VS6, VS8, VS9,	FVHP905, 906, 907, 908, 910, 911, 915, 916,	455 1100p PINCH ROLLER ASSEMBLY	VC150, 180, VH3, 33, 200, 201, 205, 212, 250,	VC785, 786, 787, 793, 800, 7810, 7822, VCT72,
VS12, VS15 140p VS105, 112, 115, 116, 120, 125,	918, 970, 975, 980, 990, FVHP 5000, 5005, 5050, 5075, 5100 140p	HRD140, 141, 142, 143, 150, 152, 157, 158,	254, 288, 300, 303, 312, VH404, 555, 700, 704, 712, 770, 780, 844, 900,	VC6F3, VC6V3, VCA 100, 102, 104, 131, 140, 170, 202, 203, 211, 234, 303, 501, 502,
126, 155, 165, 205, 220, 240, 244, 245, VS247, 248, 250, 512, VS515, 516,	VBR330, VBS3500, 7000, 7100, 7500, 7600, 9000, 9900 140p	160, 565, 566, 725, 755, HRP50 1350p	1000, 2948, 3030, 3312 VHF2A, VP2948 140p	VCA602, 5011, VCD801, 802, 851, 852, 881, 882, VCM73, VCT73, VCT72,
VSX9 140p VS201, 301, 303, 304, 603, 606, 607, VSP8,	FVHD230, 250, 270, 370, 2000D, FVHP3, 210, 250, 300, 310, 1100,	PINCH ROLLER ASSEMBLY HRD1520, 510, 520, 521, 522, 525, 527, 560,	COMB 15000, 16000, HV03, LVH50, NEVH, NEVHM, NEVHML,	VCB361 140p VC220 140p
VSP82, VP58, VP82 140p VS125, VS155, VS165, VS220, VS240, VS250,	FVHP1200, 1250, 130, 132, 1340, 1340, 1400, 1410, 1440, 1500, 200,	600, 610, 620, 637, 641, HRD650, 720, 830, 840, 910, HRJ205,	TVP230RC, VCP, VH04, 30, 103, 300, 358, 360, 362, 400, 416, 512,	VCA10, 30G, 60, 103, 105, 106, 111, 113, 131,
VS512 140p VS22, 23, 25, 35, 37, 38, 53, 66, 75, 422, 425,	FVHP320410, 420, 430, 440, 445, 470, 475, FVSP290S, 495, 2905 140p	HRS5800 350p PINCH ROLLER ASSEMBLY	VH530, 532, 535, 536, 600, 630, 635, 640, 666, 730, 735, 744, 774, 790	211, 244, 254, 33, 35, 36, VCA37, 39, 40, 42, 454, 46, 47, 48, 50, 505, 51,
426, 427, 462, 465, 467, VS485, 765, 766, 767, 768, 865, 867, 965, 967,	FVHD140, FVHD40, FVHD55, FVHP1, FVHP10, FVHP20 140p	BR7030, BRS600, HRD160, 170, 171, 180, 190, 210, 211, 217, 227,	VH800, 820, 850, 888, 893, 900, 930, 940, 942,	52, 53, 54, 55, 57, 58, 505, VCA60, 605, 615, 62, 63, 67, 68, 1031, 11613,
VSA77, VSA650,	FVHD140, 40, 55, FVHP1, 10, 25, 30, 40, 4000,	HRD230, 271, 300, 310, 320, 321, 330, 337,	974, 1012, 1040, 1050, VH1060, 1070, VH1100, 1120, 1204, 1440,	VCB311, 320, VCBS97, VCD805, 806, 810, 815,
VSF10, 11, 12, 15, 180, 190, 200, 210, 220, 221, 222, 230, 240, 30, 33	FVHS10, 30 1350p PINCH ROLLER ASSEMBLY	350, 400, 430, 440, 441, HRD470, 500, 530, 700, 750, 950, HRS5000,	1500, 1660, 1800, 2004, VH2151, 2308, 22042400, 2500, 2600, 2700,	VCH80, 81, 865, 910, VCS 1000, VCT310, VCT410, 610, VCT 1314, 5313, VC790 140p
VSF330, 4, 500, 550, VSP88, VSR100, VSX400, 450, 470 140p	GOLDSTAR GHV51, 1221, 1232, 1233, 1240, 1241, 1242,	5500, 9000 875p PINCH ROLLER ASSEMBLY	VH2960, 2970, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015,	VC780, 790, VCA10, 103, 1031, 105, 106, 211, 244, 254, 255, 30, 35,
VSF260, 261, 262, 265, 270, 274, 275, 280, 290, 340, 350, 410, 420, 43C	1243, 1244, 1245, 1246,140p GHV1247, 1248, 1250, 1266, 1290, 1291, 1295,	HRD540, HRD550, HRD580, HRD660, HRD860, HRD960 700p	4020, 4300, 5020, VP 10, 200, 220, 225, 245, VR821, 925, 1032,	VCA340, 43, 47, 50, 60, 605, 615, VCD806, 815, VCH80, 81, 83, 85,
VSF441, 440, 450, 455, 480, 490, 497, 510, 560, 580, 590, 599, 600,	1296, 1392, 1393, GHV1891, 1900, 2145, 3000, 3010, 4400, 4410,	PINCH ROLLER ASSEMBLY HRJ600, HRJ605, HRJ815,	2949, 2959, 2957, 2966, 2979, 2980, VTV300, VXL20, 25, 30 140p	VCH865, 87, 910, VCS 1000, VCT212, 310, 410,
VSG20, 21, 23, 24, 25, 30, 33, 34, 35, 51, 54, 55, 60, 64, 65, 70, 73, 74, 75,	51, 8000, 8200, GHV8210, 8215, 8430 GHVP1240, 1241, 1247, 1248, 1290, 1291,	HRS9200 875p	PHILIPS	510, 610, VCTl314, VCTS313 525p
VSP110, VSX560, VSX580 140p	GHVP1295, 1296, VCP4000, 4100, 4130, 4200,	MATSUI VX6000, 730, 735, 750, 755, 765, 800, 850,	VR6460 VR6920 140p VR2020, VR2021, VR2022, VR2023,	PINCH ROLLER ASSEMBLY
VS17, 20, 22, 23, 24, 25, 26, 27, 35, 37, 38, 53, 55, VSA77 775p	4300, 4301, 4305, VCP4306, 4310, 4311, 4315, 4316, 4320, 4321, 4325, 4326, 4350, GSE1290,	VS888 VX1000, VX2000, VX2500, VX3000,	VR2024 140p VR6711 140p	SAISHO VHL3, VR1000, 2000, 2500, 3200, 3300, 3500.
PINCH ROLLER ASSEMBLY VS422, 425, 426, 427, 462, 465, 467, 485, 498,	1291, 1295, 1296, 1297, 1891, 1910, 20005, 2000 140p	VX6000A 140p MITSUBISHI	VR6540 140p DV856, 586, VR702, 703, 6485, 6585, 6589,	3600, 3650, 3800, VRS4400, VRS5000 140p VR3400 140p
765, 766, 767, 768, 865, 867, 965, 967, VSA650, VSF10, 11, 12, 14, 15,	HITACHI VT7, 11, 14, 16, 17, 18, 19, 33, 34, 35, 350, 38,	HS12, 5300, 5424, 5600, HSB11, 12, 16, 21, 27, 31, 32, 41, 51, 52, 82,	6785, 6880, 6948 140p VR445, VR6442, VR6542, VR6643, VR6843,	SAMSUNG
180, 190, 200, 210, 220, 221, 222, 230, 240, 30, 300, 301, 310, 320, 33,	39, 88, 330, 680, 4200, VT5000, 5030, 5500, 6500, 6800, 7000, 8000,	HSE12, 16, 17, 21, 22, 27, 31, 32, 41, 51, 52, 82, HSM1000, 110, 120, 15	VR6943, 44SB9 140p	SV716, 717, VB510, 520, 610, 616, 617, 619, 620, 626, 627, 629, 900,
330, 4, 500, 510, 600, VSR110, VSX100, 400, 450, 470 800p	8300, 8500, 8700, 930, VT9500, 9700, 9900, VM600 140p	0, 16, 170, 190, 210, 23, 25, 250, 27, 33, 34, 35,	DV464, 662, VR2220, 2300, 2324, 2330, 2334, 2340, 2350, 2414, VR2480, 2485, 2486, 2489, 2400, 2409, 2840, 6462, 6462, 6462, 6464, 6560	V910, V1510, 520, 611, 616, 621, 626, 900, 910, VX510, 520, 616,
PINCH ROLLER ASSEMBLY VSS99 140p	VT8, 52, 57, 61, 62, 63, 64, 65, 85, 86, 88, 100,	36, 37, 370, 380, 45, 450, 5 4, 55, 555, 57, 58, 59, 68, HSMS2, 9, HSS11,	2490, 2498, 2840, 6462, 6463, 6464, 6560, VR6660, 6860, 6861, 6862, 6863 140p	VX617, 619, 626, 627, 629 140p
ALBA	110, 111, 113, 115, 118, VT120, 122, 125, 128, 130, 135, 138, 145, 150,	14, 15, 17, 19, 25, 5600, HV F125, 150, 303, 85, SV8900, 8930 750p	N-1700, VR2870 140p VR2025, VR6580, VR6581 140p	SVX301, 303, 305, 307, 319, 322, VB710, 713, 750, 770, 971, 8220, VB8225, V1710, 730, 750,
VCR3000X, VCR4000 140p VCR5000, VCR6000 140p	168, 170, 175, 220, 225. VT250, 255, 258, 260, 400, 405, 410, 413, 414,	PINCH ROLLER ASSEMBLY PART NO: 948D020010	49SB6, VR3260, 6349, 6448, 6449, 6548, 6648 140p	770, 790, 8220, 8225, 970, VX710, 712, VX720, 730, 750, 770, 790, 825, 8225, 970,
VCR161, VCR222 140p VCR7000, VCR7800, VCR8000,	415, 416, 418, 420, 425 VT426, 428, 430, 431, 435, 438, 450, 498, 510,	HSE11, 12, 16, 17, 21, 22, 27, 31, 32, 41, 51, 52, 5300, 5424, 5600, HSB11, 12, 16, 21, 27,	PRESSURE ROLLER ASSEMBLY PS403-40205 DV186, 190, VR211, 2115, 212, 213, 223, 286,	971, 972, 8220, PX980, 981, 982, SE9000,
VCR8800 140p VTV10 140p	515, 517, 518, 520, 525, VT526, 530, 535, 536; 540, 545, 546, 548, 570,	31, 32, 41, 51, 52, 82, HSM1000, 110, 120, 150, HSM16, 170, 18, 190, 210, 23, 25, 250, 27, 30,	291, 292, 311, 312, 313, VR3210, 3219, 322, 3229, 323, 535BO, 486,	9001, SX7120, 7121, 7220, 7221, 7230, SX7301, VK8220,
AMSTRAD	575, 576, 580, 585, 588 VT640, 830, VTF660, 665, 70, 770, 774, 775,	33, 34, 35, 36, 37, 370, 38, HSM380, 40, 45,	471, 562, 582, 571, 761,	VPX31 140p VX9880 140p
VCR1000, 2000, 4500, 4600, 4700, 5200, 6000, 6100, 6200, 8600,	780, 785, 860, 861, 865,	450, 50, 54, 55, 555, 57, 58, 59, 60, 68, HSMS2, 9, HSMX1, 18, 19, 2, HSS11, 12, 14,	VR201, 202, VR203, 302, 303, 305, 6180, 6182, 6185, 6285, 6290,	PX31 R, 32R, PXR30, SV80, SX3230, 3231,
VCR8602, 8603, 8604, 8700, 8704, 8714, 8800, 8804, 9000, 9005,	VTL30, 1000, 2000, VTLC50, VTM598, 620, 622, 625, 626, 630, 635	15, 17, 19, 21, 25, 5600, HVF125, HVF150, 303, 85, SV8900, 8930 140p	VR6291, 6293, 6362, 6367, 6390, 6391, 6393, 6467, 6468, 6470, 6561	3260, 3261, VS390, VX30, 31, 32, 3560, 3561, 370, 375, 380, VXK300, 301, 306, 307, 320,
VCR9244, 9340, DD8900, 8904, TVR1, 2, 3, 4 140p	VTM636, 640, 645, 646, 720, 722, 725, 726, 727, 728, 730, 731, 735,	HS200, HS300, HS301, HS302, HS303, HS304, HS310, HS320, HS330, HS360,	VR6570, 6581VR6670, 6676, 6710, 6760, 6761, 6762, 6870, 6970,	VXK321, 326, 330, 331, 336, 337, 350, 351, 356 140p
VCR7000 140p DD8900, DD8904, VCR6000, 6100, 6200, 8600,	VTM736, 740, 745, 746, 748, 753, 754, 820, 821, 822, 825, 830, 831,	HS700 140p HS306, HS307, HS318, HS319, HS337, HS338,	VR6975, 86Bi, 63SB7, 68SB4, 71SB4, 71SB5, 72SB8, 72SB8, 92SB31, 20DV1, 20DV2,	PX990, 991, 992, S11230, 1240, SVX4000, 503, 504, 600, SX1230,
8602, 8603, 8604, VCR8700, 8800, 900>9, 9140, 9244,	VTM835, 838, 840, 841, 845, 920, 921, 922, 925, 930, 931, 935,	HS347, HS349, HS400, HS410, HS411, HS412, HS421, HS480, HS710, HSB 10, HSB20, 30,	20RW7, 21DVI, 21DV2, 2SB01, 2SB02, 2SB11, 2SB12, 30DV2, 31DVI, 31DV2, 31DV33SB02,	SX1231, 1260, 1261, 1566, V11560, VPK43, VX1230, 1260, 1261, VX1560, 1561,
9340 700p PINCH ROLLER ASSEMBLY PART NO: 153148	VTS80, 85, 890, 895VM200, 2300, 2380, 3200, 3280, 500, VMS7200 140p	HSE 10, 20, 30, 70 140p	3SB03, 3SB05 3SB11 3SB12 3SB13 280p	1850 140p
TX3650, UF20, VCR3000, VCR3002, VCR4000,	VT3000 140p VT410, 420, 428, 430, 450, 498, 518, 520, 522,	NATIONAL PANASONIC	VR231, 232, 332, 422, 4229, 512, 5229, 722,	SONY SLC5, 6, 7, SL3000, 8000, 8080, 8200, SLJ 10,
PINCH ROLLER ASSEMBLY PART NO:	530, VTF770, 780,	NV100, 180, 300, 330PX, 332, 333, 340, 366, 600, 688, 777, 788, 3321,	7229, 723 140p VR501 PR38 140p	SLT6ME, SLT7ME 140p
2554966 DD9900, 9904, TX3650, UF20, 22, 24,	VTM598, 622, 722, 740, 748, 753 650p PINCH ROLLER ASSEMBLY	AG6010, 6015, 6100, 6200, 6400, 6800, 7450 140p	SANYO VHR1100, 1110, 1150, 1200, 1300, 1500, 2100,	SLC9, 20, 24, 30, 33, 44, SLHF100, SLF1, 11, 20, 25, 30, 35, 60, 100,
VCR3000, 3002, 9500 140p VS1004 VS1104 140p	VTF150, 155, 180, 185, 250, 255, 260, 265, 280, 285, 350, 351, 355,	NV230, 250, 260, 280, 370, 380, 430, 431, 433, 450, 460, 465, 470, 480	2300, 2370, 2500, VHR2700, 3330, MVR220 140p	SLF200, SLF60PS, SLF90E, SLFH150, 850, SLK88, 95, SLT20ME, SLT30ME,
FERGUSON	VTF360, 365, VTM140, 141, 145, 145, 210, 211, 212, 215, 220, 221,	NV630, 650, 730, 770, 780, 810, 830, 850, 870, 890, 2000, 2010, 3000,	VTC5000, 5150, 5300, 5350, 5400, 5500, 6000, 6010, 6500, 9100,	SLT50ME 140p
3V00, 3V01, 3V16, 3V22, 3V23, 3V24, 3292, 8900, 8901, 8902, 8903, 8904, 8906, 8909,	VTM230, 231, 235, 284, VTS390 140p	NV7000, 7200, 7800, 8050, 8150, 8170, 8200,	VTC9300, VTCM10, 20, 11, 21, 30, 31, 40, 50,	BMC 100, BMC200, BMC500 140p SLV201, 202, 301, 302, 401, 402, 801,
8912, 8922, 8923, 8924, 8925, 8929 140p 3V29, 3V30, 3V31, 3V32, 3V52, 8930, 8931,	HINARI V20H, VXL5, VXL6, VXL7, 8, 9, 10, 11, 19, 90,	8300, 8400, 8500, 8600 NV8610, 8620, NVG11, 14, 16, NVG7, 10, 12,	VPR5800 140p VHR3100.3300, 3310, 3400, 3500, 3700, 3800,	802 140p
8933, 8940, 8941, 8942 140p 3V35, 3V36, 3V38, 3V39, 3V42, 3V43, 3V44,	H13V, VTV100, 200 140p VXL2, VXL3 140p	15, 18, 30, 130, 400, AG 1000, 1050, 1200, 1500, 2100, 2200, 6500,	VHRD500, 700 140p VTC3000 140p	SLV210, 270, 273, 275, 300, 353, 373, 410, 415, 474, 656, 715 300p
3V45, 3V48, 3V49, 3V53, 3V54, 3V55, 3V56, 3V57, 3V58, 3V59, 3V65, FV10, FVII, FV12,	VXL4, VXL20, VXL35 140p VTV100, VXL10, VXL11, VLX9,	6810, 7500, 7510, NVH70 140p	VHR120, 130, 14, 141, 143, 14, 150, 151, 153, 154, 15, 16, 171, 194, 22	SLV757, 777 140p SLV255 140p
FV14, 8943, 8944, 8945, 8947, 8948 140p 3V52 140p	VXL90 700p PINCH ROLLER ASSEMBLY	NVG9, NVG120 140p AG6840, 6720, 7150, 7330, 7350,	0VHR23, 235, 240, 244, 250, 251, 274, 27, 297, 310, 330, 335, 350, 390, VHR4100, 4105, 4150,	SLV275, 282, 315, 325, 353, 363, 373, 410, 415, 416, 474, 625, 656, SLV715, 725, 727, 757, 777,
8950, 8951, FV10B, 11R, 13H, 14T, 20B, 21R, 22L, 26D, 31R, 32L, FV33H, 39S, 41R, 42L, 50B,	V20H, VXL5, VXL6 MOD KIT 275p J.V.C.	7355, 7650, NVH65, 75, NVJ30, NVL20, 23, 25, 28, NVG300, NVF65, NVF70, NVFS1 NVFS	4200, 430, 4300, 4350, 4400, 474, 4770, 5080, VHR5100, 5200, 5300, 5350, 5600, 5700, 6850,	815, 825, SLVX30, 50, 55 140p
51R, 52L, VC141L 140p FV37H, FV44L, FV46T, FV43H,	HR2200, 3300, 3330, 3360, 3660, 4100,	100, NVG 19, 20, 25, 33, 40, 50, NVV8000 140p	7100, 7200, 7250, VHR7260, 7300, 7400, 7440, 7500, 7520, 7530, 7540, 7700, 774, 780,	SLV125, 213, 225, 252, 255, 262, SLVXI, 20, 3 140p
FV57H 140p 3V35, 3V36, 3V38, 3V39, 3V49, 8943.	7700 140p HR2650, 7200, 7300, 7350, 7600, 7610, 7650,	NVD48, NVD80, NVG21 NVG45 140p NVJ700PX 140p	0VHR7810, 8000, 8070, 8100, 8200, 8250, 8500, 8800, VHRD4400, 4410, 4500, 4600,	SLV215, 216EE, 275, 282, 315, 325, 353, 363EE, 373, 393, 410, 415,
8944 1100р	7655 140p HRD110, 111, 120, 121, 140, 141, 142, 143,	NVHD100, NVHD101, NCHD90, NVSD30,	4610, 4710, 4890, 6700, VHRS700 140p	SLV416EE, 474, 494EE, 555UC, 559, 575UC, 579, 585HF, 595HF, SLV60W, 615, 625, 656,
PINCH ROLLER ASSEMBLY 3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54,	150, 152, 156, 157, 158, HRD160, 220, 225, 250, 257, 445, 455, 565, 566, 725, 755, HRP50, BP5000, BR7000,	NVSD40 1125p PINCH ROLLER ASSEMBLY	VCR100 140p VHR120, 135, 150, 190, 4150, 416ú, 4350,	676UC, 686HF, 696HF, 715, 725, 727, 757,
3V55, 3V56, 3V57, 8945, 8947, 8948 1350p PINCH ROLLER ASSEMBLY	BRS611, 811 140p	AG5150, 5250, 5700, 6024, NVD38, 48, 80, NVF55, 65, 70, 75, 77,	5200, 5240, 5350, 7200, 7250, 7260, 7700, VHRD4410, 4610, 4710, 4890, 5450,	SLV767B, 777, 815, 825, SLVE7, 8, 9SLVX30AS,
FV37, FV57, FV58 350p PINCH ROLLER ASSEMBLY	HRD520, 540, 550, 560, 580, 600, 610, 620, 637, 640, 641, 650, 660,	NVFS1, 100, 200, 88, 90, NVG 19, 20, 21, 22, 25, 28, 300, 33, 40, 45, 46,	VHRS700 975p PINCH ROLLER ASSEMBLY	SLVX35AF, SLVX50AS, SLVX55DH, SLVX65BR, SVO140, 160 1250p
FV31R 140p FV41L, FV42L 925p	HRD670, 720, 730, 740, 770, 820, 830, 840, 860, 870, 880, 910, 960,	NVG50, NVH65, 75, 77, NVJ30, 33, 35, 37, 40, 42, 45, 47,	VHR3100, 3200, 3300, 3310, 3400, 3700, 3800, VHRD500, 7000 1350p	PINCH ROLLER ASSEMBLY PART NO: X37277701
PINCH ROLLER ASSEMBLY 3V58, 3V59, 3V64, 3V65, FV10, 11, 12, 13, 14,	HRD980, HRDX20, 22, 25, HRJ200, 205, 210, 215, 300, 315, 316, 318	NVL20, 23, 25, 28, NVW 1 300p PINCH ROLLER ASSEMBLY	PINCH ROLLER ASSEMBLY SHARP	SLV210, 212, 270, 273, 275, 285, 300, 310, 335,
20, 21, 22, 26, 30, 32, 33 FV39, VC141L 875p	HRJ400, 405, 407, 410, 411, 415, 416, 507,	N.E.C.	VC200, 381, 383, 384, 385, 386, 388, 390, 393,	425, 427 350p PINCH ROLLER ASSEMBLY
PINCH ROLLER ASSEMBLY FV43H, FV44L, FV45X, FV46T 700p	600, 605, 610, 615, 715, 815 HRJ97, HRS4700, 5800, 5900, 6800, 6900,	N830, 831, 832, 833, 895 140p PVC2300, 2400, 740, 744, 746, 760, 764,	800, 2300, 3300, 6000, VC6200, 6300, 7300, 7700, 7750, 7800, 8300,	SV6700.8750, 9700, VHR3100, 3200, 3300, 3310, 3400, 3700, 3800, VHRD500, 700 1350p
PINCH ROLLER ASSEMBLY	SR3200, 330, 368 140p HRD170, 171, 180, 210, 211, 217, 230, 300,	766 140p DX1000, 1600, 1800, 2000, 3000, N9012, 9013,	838, 9100, 9300, 9400, VC9500, 9600, 9700, 9800 140p	PINCH ROLLER ASSEMBLY
FV61, FV62, FV67, FV68, FV70, FV71, FV72, FV74, FV77 775p	320, 321, 330, 337, 350, HRD370, 400, 430, 440, 441, 470, 500, 530,	9014, 9016, 9033 N9034, 9053, 9054, 9055, 9056, 9066, 9096,	VC300, 387, 402, 471, 473, 477, 481, 482, 483, 486, 488, 496, 500, 571,	SL100, 200, SLC20, 30, 33, 34, 40, 44, 80, 88, 9, SLF1, 20, 25, 30, 35, 45, SLF60, 65, 73, 90,
PINCH ROLLER ASSEMBLY FISHER	700, 750, 950, HRS5000, 5500, 8000, 9000, BR7030, 7040,	9110, 9120, 9510, 9520, N9530, 9610, PX 1200 140p	573, 581, 582, 583, 584, 585, 8481, VC5F3, VC5W20E, VCA1031 140p	SLHF100, 150, 950, SLK85, 95, SLO1700, SLS550, SLT0, 30, 50 300p
FVHP420, 520, 530 140p	9060,	DS6000G, DX4000, N9077	VC108, 208, 405, 408, 550, 600, 651, 671, 674,	PINCH ROLLER ASSEMBLY
		VIDEO LAMPS	3	

Models & Description C	Order Code	Price	Models & Description	Order Code	Price	Models & Description O	der Code	Price	Models & Description	Order Code	Price
UNIVERSAL VIDEO LAMP 9V	VL01	25p			100p	AKAI, GRANADA (VHSTJ2),	VL01	25p	AUTHENTIC (N850), DECCA	VL07	40p
80mV (310mm WIRES)	10.00		BLAUPUNKT, FERGUSON, FIDI FISHER, FUJITSU, FUNAI, G.E.			HITACHI (VT3000), ITT (VR3912, VRP3833), JVC (HR2200, 3300,			(VR8300), GRANADA (VHSTJ3,		
PANASONIC VIDEO LAMPS	VL02	30p	GOLDSTAR, GRANADA, GRUN	IDIG,		3330, 3660), MITSUBISHI (HS200),			WJ1, WJ3), ITT (VR3913, 3914,		
SHARP VIDEO LAMPS HITACHI 5381682 (VT63, VT64)	VL02 VL04	30p 135p	HINARI, HITACHI, ITT, JVC (HRI SERIES), MATSUI, MITSUBISH			TELEFUNKEN (VR510, 519, 610), THOMSON (VK300, 305, 306, 3301			3963) JVC (HT7200, 7300, 7350,		
VIDEO LAMPS	VL04	issp	NEC, ORION, NATIONAL,	',		FERGUSON (3V00, 16, 22, 24, 3292					
AKAI (VS10).GRANADA	VL06	40p	PHILIPS, SAISHO, SALORA, SAMSUNG, SANYO, SHARP,			8900, 8901, 8902, 8903, 8909, 5912 8922, 8925)	• 1		7700) TELEFUNKEN (VR450, 52	0,	
(VHSXJ3), TT (VR3993,3994), JVC			SIEMEN, SONY, TELEFUNKEN,				111.00		529, 540, 549, 620, 640, 920, 192	20),	
(HR2650, 7600, 7610, 7650, 7655), TELEFUNKEN (VR530, 535, 539, 5			THOMSON,TOSHIBA			BLAUPUNKT, ORION (VH1, 2A), NATIONAL (NV200,2010, 3000.	VL02	30p	THOMSON (V4100, VK308, 309,	312,	
630, 650), THOMSON (V309, 316,	.357,		GRANADA (VHSAY3),SHARP	VL08	45p	7000, 8150, 8200, 8400, 8600, 8610			410), FERGUSON (3V23, 29, 30,		
VK309, 411,TX8000), FERGUSON (3V31, 8941, 8942)			(VC200, 381, 384, 385, 386, 388 390, 393, 9300, 9500, 9700)	,		8620), SHARP (VC2300, 6000, 6200 6300, 7300, 7700, 8300)),		8923, 8924, 8929, 8930, 8931, 89	940)	

VIDEO SERVICE KITS AMSTRAD HITACH NV600/NV688 Economy Kit Contents BELT SET, PINCH ROLLER PLAY IDLER TYRE. FF/REW VCR700 Contents BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Contents BELT SET, PINCH ROLLER BELT SET. PINCH ROLLER. REEL IDLER. VIDEO LAMP PLAY IDLER, FF/REW IDLER, TENSION BAND IDLER TYRE Order Code: SK25 £12.00 Order Code: SK26 VT11A/T33 FERGUSON & JVC Economy Kit Contents BELT SET. PINCH ROLLER. FF/REW IDLER TYRE. T/UP REEL TABLE TYRE. SUPPLY REEL TABLE TYRE 3V42/43 HRD455/HRD725 Contents BELT SET. T/UP REEL TABLE TYRE. SUPPLY REEL TABLE TYRE. PINCH ROLLER. FF/REW IDLER. CLUTCH PLATE. TENSION BAND MV/720/MV/770 Economy Kit Contents SLOT IN BELT. LOADING BELT. Contents SLOT IN BELT. LOADING BELT PINCH ROLLER. IDLER UNIT. Economy Kit Contents BELT SET, PINCH ROLLER SUPPLY CLUTCH, TAKE UP COMEMS BELT SET, PINCH ROLLER, CLUTCH MECHANISM, TENSION BAND PINCH ROLLER, IDLER TYRE TENSION BAND CLUTCH Order Code: SK19 F5 50 Order Code: SK20 Order Code: SK45 £13.00 Order Code: \$K46 Order Code: SK37 £16.00 Order Code: SK38 £9.00 NV370/NV380/480/630/780/830/850/AG2100PK/AG2200PK VT52/61/62/63/64/65/85/86/640 3V/58/59/64/65 Economy Kit Contents BELT SET, PINCH ROLLER FF/REW IDLER Economy Kit Contents BELT SET, PINCH ROLLER Contents BELT SET, PINCH ROLLER, HRD 170/180/210/230/300/320/370/400/430/530/700/750 BELT SET. PINCH ROLLER. FF/REW ARM, CLUTCH PLATE IDLER TENSION BAND INLER TYRE Contents BELT SET, PINCH ROLLER, IDLER ARM, TENSION BAND TENSION BAND Order Code: SK21 £5.00 Order Code: SK22 Order Cade: SKA9 £14.00 Order Code: SKED £3.00 Order Code: SK44 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 Economy Kit Contents BELT SET, PINCH ROLLER Contents BELT SET, PINCH ROLLER, 3//30/3//30 HR7200/7300/7350 IDLER UNIT. TENSION BAND INLER TYRE CONTENTS TIMING BELT. PINCH ROLLER. FF/REW ARM. CLUTCH BASE. TENSION BAND Order Code: SK52 Contents BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK17 £6.00 Order Code: SK18 SHARP VC381 £9.75 Order Code: SK05 £5.00 Economy Kit Contents BELT SET. PINCH ROLLER VT100/110/111/113/115/118/120/125/128/130/135/138/145/150/ 175/220/225/250/255/258/260/VTL30 3V35/36 38/39/49 BELT SET. PINCH ROLLER. 3433/05, 36/35/45 HRD110/111/120/225 Contents BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES REEL IDLER, TENSION BAND REEL IDLER TYRE Contents BELT SET, PINCH ROLLER, FF/REW ARM, CLUTCH PLATE. VIDEO LAMP Order Code: SK47 £5.00 Order Code: SK51 VC500/VC571/VC581/VC582/VC583/VC584/VC5F3 3V31/3V42 HR7600/7610/7650/7655 PANASONIC NY2000/NY2010NY7000/NY7200/NY7800 Contents Economy Kit Contents BELT SET. PINCH ROLLER. TENSION BAND. IDLER TYRES Order Code: SK03 £5.00 Order Code: SK03 Economy Kit Contents BELT SET. PINCH ROLLER REEL IDLER £9.50 Order Code: SK61 BELT SET PINCH ROLLER REEL IDLER. TENSION BAND Order Code: SK60 Contents BELT SET, T/U REEL TABLE Economy Kit Contents BELT SET, T/U REEL TABLE TYRE. PINCH ROLLER. REEL IDLER. T/U CLUTCH, T/U IDLER. TENSION BAND. VIDEO LAMP Order Code: SK33 E11.00 DECT SEY, 1/O REE TYRE. PINCH ROL IDLER TYRE. T/U ICLTCH T/U CLUTCH Order Code: SK33 TYRE, PINCH ROLLER, REEL IDLER TYRE, T/U IDLER TYRE. £5.00 VC781A/C7810A/C7822A/C785A/C786A/C793A/C800/ VCA100/VCA102/VCA104/VCA202 NV300/NV330/NV333/NV340/NV366 Contents BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRE BELT SET, PINCH ROLLER REEL DRIVE UNIT. TENSION BAND 3V35/36/38/39/49 REEL DRIVE UNIT TYRE HRD110/111/120/121/225 £5.00 Economy Kit Contents BELT SET. T/U REEL TABLE TYRE. SUPPLY REEL TABLE TYRE. PINCH ROLLER. T/U Order Code: SK64 £13.50 Order Code: SK65 BELT SET. T/U REEL TABLE TYRE. SUPPLY REEL TABLE NV2000/NV2010 VC681/VC682/VC684/VC685/VC693/VC699/VC6F3/VC700 ECONTENTS BELT SET. PINCH ROLLER. FF IDLER. PLAY IDLER. TENSION BAND. VIDEO LAMP Order Code: SK13 TYRE, PINCH ROLLER, T/U Economy Kit Contents BELT SET. PINCH ROLLER *Contents* BELT SET. PINCH ROLLER. CLUTCH, T/U IDLER, REEL CLUTCH, T/U IDLER TYRE, REEL IDI FR. TENSION BAND INI FR TYRE REEL DRIVE UNIT, TENSION REEL DRIVE UNIT TYRE £6.00 Order Code: SK14 £3.50 Order Code: SK35 £10.00 Order Code: SK36 RAND Order Code: SK62 £13.50 Order Code: SK63 NV7000/NV7200/NV7800 3V29/3V30 HR07200/7300/7350 Economy Kit Contents BELT SET, PINCH ROLLER IDLER TYRE. CLUTCH TYRE Contents BELT SET, PINCH ROLLER, IDLER UNIT. PLAY IDLER. Economy Kit Contents BELT SET. T/U REEL IDLER TYRE. SUPPLY REEL TABLE TYRE. PINCH ROLLER. REEL FOR MORE DETAILS OF OVER 500 BELT SET. T/U REEL TABLE BELT SET. 1/JU REEL TABLE TYRE. SUPPLY REEL TABLE TYRE. PINCH ROLLER. REEL IDLER. 1/JU CLUTCH. T/JU IDLER. IDLER 1/JU CLUTCH. T/JU IDLER TKNSION BAND. VIDEO LAMP Order Code: SK31 ### STORY OF THE PROPERTY TENSION BAND TYPES OF SERVICE KITS ... Order Code: SK11 £8.50 Order Code: SK12 £3.25 PLEASE RING US! NV300/NV330/NV333/NV340/NV366 Economy Kit Contents BELT SET PINCH ROLLER *Contents* Belt set. Pinch Roli er. £5.00 IDLER UNIT. PLAY IDLER 3V44/45/48/53/54/55/57 TENSION BAND HRP50/HRD140/150/158/160 £3.25 HRD250/257/565/566/755 NVG7/NVG9/NVG10/NVG11/NVG12/NVG14/NVG15/NVG16/ NVG18/NVG30/NVG120/NVG130/NVG400/NVH65 (PX/AC)/ AG1810 (P/K) Economy Kit Contents BELT SET. PINCH ROLLER Contents BELT SET. PINCH ROLLER, CLUTCH MECHANISM. TENSION Economy Kit Contents LOADING BELT. CAPSTAN BELT. PINCH ROLLER. IDLER. CONTENTS LOADING BELT. CAPSTAN BELT. PINCH ROLLER. IDLER TENSION BAND Order Code: SK27 BAND Order Code: SK39 £15.00 Order Code: SK40 FISHER £6.00 Order Code: SK28 VHP905/906/907/908/910/911/916/918 £3.00 Economy Kit Contents BELT SET. PINCH ROLLER. Contents BELT SET. PINCH ROLLER. NV332 Contents BELT SET, PINCH ROLLER, Economy Kit Contents BELT SET, PINCH ROLLER PLAY IDLER TYRE, FF/REW IDLER TYRE IDLER, GEAR IDLER UNIT. IDLER TYRE TENSION BANO PLAY IDLER. FF/REW IOLER. TENSION BAND. FF/REW TYRE Order Code: SK57 £13.00 Order Code: SK58 Order Code: SK29 £12.00 Order Code: SK30 £5.10 FVHP615/618/620/622/710/711/715/716/720/721/722/725/ 730/830/840 NV230/250/260/280/430/450/460/470/650/810/890/ AG1200PK/AG1500PK Contents Economy Kit Contents BELT SET. PINCH ROLLER. BELT SET, PINCH ROLLER. Contents BELT SET, PINCH ROLLER, IDLER. TENSION BAND Order Code: SK23 IDLER GEAR IOLER LINIT

	REPLA	ACE	CM	ENT VI	DEO CASS	ET	TŁ	HOUS	INGS	443	
Name	Models	Code	Price	Name	Models	Code	Price	Name	Models	Code	Price
AKAI	VS35, VS53, V\$55,				FV31R	CH19	4300p		VCA103, 103GV, 106, 106GVM,		
	VS56, VS75	CH18	3200p		HRD515, 520, 527, 540, 550, 580,				254GVM	CH23	2500p
GRANADA	VHSDP1	CH05	1100p		600, 610, 620, 660, 670, HRO830,				VCS211, 244, 5055, 605, VCB230,		
	VHSYJ2	CH01	2800p	i .	840, 850, 860, 4050, 6600, FV37H	CH20	2200p		VCD806G, 810G, VCT212, 310,		
GOLDSTAR	GHV1290P, 1291P, 1295P, 9400,				HRD540, 580, 830, 860, 910, 960,				410G, 610	CH24	2500p
	73401, GSE1295P, GSE1891P,				HRD970, HRDX20,			TELEFUNKEN	VR2970	CH02	2800p
	20001Q, 20051Q, VCP4200, 4300,			FERGUSON	FV57H	CH27	2400p	THOMSON	V320, 321, 323, 326, 4200, 4300	CH01	2800p
	4301, 4305, VCP4306, 4311, 4315,			I.T.T.	VR3605, VR3905	CH01	2800p		V342, 343, 352, 353, 360, 364, 368,		
	4316, 4320, 4321, 4325	CH25	2000p	1	VR3916, 3926, 3946, 3948, 3976,				4210, 4230, 4260, 4400, V5500,		
	GHV51, 1221, 1232, 1240, 1241,				3986, 3995, 3997, 6948	CH02	2800p		6000, 8540	CH02	2800p
	1242, 1244, 1246, 1248, GHV8000,				VR3916, 3926, 3946, 3948, 3976,			TOSHIBA	V55, V57	CHOI	2800p
	8200	CH26	2900p		3986, 3995, 3997, 6948	CH02	2800p		V65, V66	CH02	2800p
FERGUSON & J.V.C.	3V38, 3V39, 8943, 8944, 8951,			NATIONAL PANASONIC	NV730	CH06	4300p				
	3V35, 3V36, 3V49, HRD 110, 111,			N.E.C.	N830EG, N831EG, N831EG, N832,			A A A A A	**	A A -	<u> </u>
	120, 121, 225	CH01	2800p		N833EG	CH01	2800p	MMMM		MM	XX
	3V42, 3V43, 3V44, 3V45, 3V48,				N895	CH02	2800p	★ AMS'	TRAD MOD		*
İ	3V53, 3V54, 3V55, 3V57, 8945,			PHILIPS	CASSETTE LIFT ASSEMBLY (691203	366)		W AIVID	I KAD MOD		- 4
	8947, 8948, HRD 140,				DV186, 190, 286, 471, 562, 761,			*			*
	141, 150, 157, 158, <mark>160,</mark> 250,				VR6180, 6182, 6185, 6285, VR6290,						
	HRD257, 455, 565, 566, 725, 755	CH02	2800p		6291, 6293, 6362, 6367, 6393, 6467,			FITS:			*
	8948, 8950, FV10B, 12L, 13H, 14T,				6468, 6470, VR6561, 6670, 6760,				600,4700,5200,TVR	1,2,3	
	20B, 21R, 22L, 26, 395, HRD230,				6761, 6870, 6970	CH05	1100p	*			*
	430, 530	CH03	2800p	1	VR6443	CH22	2900p		T		
	3V58, 3V59, 3V64, 3V65, FV11R,				VR6448	CH23	2500p	☆ PRIC	E: £2.75 + VAT e	ach	*
	8950, 8 <mark>951</mark> , HRD170, HRD180,				49SB6	CH24	2500p	A A A A	-A-A-A-A-A	A A	A A
	HR0370	CH04	2800p	SHARP	VCA100, VCH851, VCH852	CH22	2900p	KKKKK	农会会会会会	TOT	なな

£6.00 Order Code: SK24

£3.25

TENSION BAND

£11.00 Order Code: SK69

es no

£3.00

£2.75

£4.00

£3.25

£5.00

£3.75

£5.00

NV2000, 2010, 7000, 7200, 7800 (VS50048

NV230, 260, 430, 810, 870, 2300, 4300

(VSS0110)

NV830 (VSS0091)

NV300, 333, 340, 366, 688, 777, 778

(VSS0060

NVG21, 25, NVH65, NVD80 (VSS0175A)

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

AMSTRAD ORIGINAL NO: 153134

£3.50

£2.25

£2.10

£3.75

Used on: AMSTRAD DD8900, 8904, VCR2000, 6000, 6100, 8600, 8602, 8603, VCR8604, 8700, 8704, 8714, 8800, 9005, 8244 Also fits: ANTECH, BONDSTEC, CASIO, CROWN, FIDELITY, GOLD HAND, GRANADA, HINARI, MARQUANT, OMEGE, PROFEX, SCHNEI-DER, SEG, SENTRA, SHINTOM, TASHIKO, TATUNG, TOWADA ORDER CODE: AH02

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
VDD013E		625n

SET OF 8 ALLEN KEYS

0.90mm

1.50mm

2.00mm

3.00mm

Price: 90p

0.77mm

1.27mm

1.60mm

2,40mm

VIDEO TOOLS

VIDEO CLEANING STICKS

Price 17p each 15p each pack of 10pcs 13b 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

JDIO CONTROL HEADS

CONTAINS: SET OF 7 HEAD & TAPE PATH ALIGNERS

• RCA TYPE AUDIO & CONTROL HEAD POSITIONING TOOL

- RCA ADJUSTMENT TOOL FOR TAPE GUIDE POSTS RCA TYPE BACK TENSION TOOL
- TENSION ADJUSTMENT TOOL FOR VARIOUS USES

VCR ADJUSTMENT TOOL

3 REVERSIBLE SCREWDRIVERS SPRING HOOK

CIRCLIP PLIERS MICRO SCREWDRIVER

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

TRANSPARENT REPAIR/ADJUSTMENT CASSETTE

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

Order code: TOOL 23, Price 500p

BACK UP BAT TERIES

PHILIPS

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

Order Code: BB01

Part Nos: 138 - 10229, 2.4v 100mAH

Order Code: BB02

Price: 75p

Price: 135p

FERGUSON Part No: 00E6 - 067 - 001 1.2V 100mAH

Order Code: BB03

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

Price: 150p Order Code: BB04

SATELLITES

MAKE & MODEL	CODE	PRICE
PACE PRD800, PRD900	SATPSU1_	600p
PACE SS9000, 9200, 9010, 9210, 9220	SATPSU2	550p
AMSTRAD SRD510, SRD520	SATPSU3	600p
AMSTRAD SRD500	SATPSU4	600p
AMSTRAD SRX340, SRX345, SRX350	SATPSU5	600p
PACE D100/150	SATPSU6	650p
CHURCHILL D2MAC	SATPSU7	650p
PACE MSS100	SATPSU8	730p

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

MAKE & MODEL	CODE	PRICE
PACE MSS200/300 APPOLL	SATPSU9	900p
PACE MSS500/1000	SATPSU10	1230p
FERGUSON SRD4	SATPSU11	650p
ECHOSTAR SR5500	SATPSU12	1 <u>6</u> 00p
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

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
- * Max. input signal: -10 DBM

*Detection Range: -60 to -10 DBM

ORDER CODE: TOOL22 PRICE: 8500p

REPLACEMENT

GRUNDIG

PART No: 29703, 29102 USED ON:

C7500, C8500. C8502, C8712 . . .ETC Order Code: SW1 Price: 140p

PHILIPS

USED ON: K30, K35, K40, KT3, KT4 Order Code: SW13

Price: 95p

SONY

USED ON: KV1612, KB1612, KV1614, KV2052, V2056 KV2062, KV2067, KV2212 . . .ETC

Order Code: SW5 Price: 150p

KV1400, KV1440, KV2040, KV2060 (POWER SWITCH 26mm)

Order Code: SW12

Price: 125p

SONY

USED ON:

(POWER SWITCH 21mm +Remote)

Order Code: SW6 Price: 200p

SONY 2 PIN FUNCTION SWITCH

Price: 35p Order Code: SW9

		FUSES		
	TIME LAG (20mm)		QUICK BLOW (20mm)	
CURRENT RATING	ORDER CODE	PRICE	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

FUSE46

FUSE47

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

VOLTAGE TESTER

20A

A terminal screwdriver incorporating continuity & voltage with Euroslot

ORDER CODE: TOOL11

PRICE: 220p

210p

20mm CERAMIC TIME LAG CURRENT RATING 6.3A FUSE38 FUSE39 100p 10A FUSE40 100p FUSE41 85p 4A FUSE42 85p FUSE43 85p

38mm CER	AMIC TIME	E LAG
CURRENT RATING	ORDER CODE	PRICE
10A	FUSE48	825n

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

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 6

Lists more than 8,450 faults with 460 pages covering 58 different brands
Price: 1600p only – no VAT. Order Code: BOOK02

Satellite Repair Manual Edition 4

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

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

SEMICONDUCTOR COMPARISONS 1997/8 Listing more than 31,600 Semiconductors with suitable alternative complete with descriptions and base information.

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

SEMICONDUCTOR COMPARISONS 1997
The new 1997 Jaeger Semiconductor with 952
pages packed with information on over 80,000
semiconductors in much greater detail plus marketing data on SMD devices and a separate
generic table of all type designations.
Price: £40.00 only – No VAT (+ £5 Postage).

Order Code: BOOK06

SERVICE AIDS

VIDEO HEAD CLEANER 75ML SP01 12 SWITCH CLEANER 176ML SP02 14 SILICONE GREASE 200ML SP03 17 FREEZE IT 170ML SP04 28 FREEZE IT 400ML SP05 15 FOAM CLEANER 400ML SP05 15 ANTI-STATIC 150ML SP06 15 AEROKLEANE 135ML SP07 18 AERO DUSTER 150ML SP08 29 AERO DUSTER 400ML SP17 55 PLASTIC SEAL 200ML SP09 23 GLASS CLEANER 250ML SP10 15 COLOKLENE 250ML SP10 15 COLOKLENE 250ML SP18 14 ADHESIVE 120 400ML SP19 19 LABEL REMDVER 130 200ML SP20 24 TUBE SILICON GREASE 50 GRAMMES SP11 20 TUBE SILICON SEALANT CLEAR 75ML SP22 <th></th> <th></th> <th></th> <th></th>				
SWITCH CLEANER 176ML SP02 14	DESCRIPTION	VOLUME	CODE	PRICE
SWITCH CLEANER 176ML SP02 148	VIDEO HEAD CLEANER	75ML	SP01	125p
SILICONE GREASE 200ML SP03 17 FREEZE IT 170ML SP04 28 FREEZE IT 400ML SP16 57 FREEZE IT 400ML SP05 57 57 57 57 57 57 57	SWITCH CLEANER	176ML	SP02	140p
FREEZE IT	SILICONE GREASE	200ML	SP03	170p
FREEZE IT	FREEZE IT	170ML	SP04	280p
ANTI-STATIC 150ML SP06 15 AEROKLEANE 135ML SP07 18 AERO DUSTER 150ML SP08 29 AERO DUSTER 400ML SP17 55 PLASTIC SEAL 200ML SP09 23 GLASS CLEANER 250ML SP10 15 COLOKLENE 250ML SP13 22 EXCEL POLISH 80 250ML SP18 14 ADHESIVE 120 400ML SP19 19 LABEL REMOVER 130 200ML SP20 24 REFURB 140 400ML SP10 15 TUBE SILICON GREASE 50 GRAMMES SP11 20 TUBE SILICON SEALANT WHITE 75ML SP22 25 TUBE SILICON SEALANT WHITE 75ML SP23 25 TUBE HEAT SINK COMPOUND 25 GRAMMES SP12 14 DRIVE CLEANER 200ML SP24 13 SCREEN CLEANER 200ML SP24 13	FREEZE IT	400ML	SP16	570p
AEROKLEANE 135ML SP07 18 AERO OUSTER 150ML SP08 29 AERO OUSTER 400ML SP17 55 PLASTIC SEAL 200ML SP09 23 GLASS CLEANER 250ML SP10 15 COLOKLENE 250ML SP18 14 ADHESIVE 120 400ML SP18 19 ADHESIVE 120 400ML SP19 19 LABEL REMOVER 130 200ML SP20 24 REFURB 140 400ML SP21 24 TUBE SILICON GREASE 50 GRAMMES SP11 20 TUBE SILICON SEALANT WHITE 75ML SP22 25 TUBE SILICON SEALANT CLEAR 75ML SP22 25 TUBE HEAT SINK COMPOUND 25 GRAMMES SP12 14 ORIVE CLEANER 200ML SP24 13 SCREEN CLEANER 200ML SP25 14	FOAM CLEANER	400ML	SP05	155p
AEROKLEANE 135ML SP07 18 AERO DUSTER 150ML SP08 29 AERO DUSTER 400ML SP17 55 PLASTIC SEAL 200ML SP09 23 GLASS CLEANER 250ML SP10 15 COLOKLENE 250ML SP13 22 EXCEL POLISH 80 250ML SP18 14 ADHESIVE 120 400ML SP19 19 LABEL REMOVER 130 200ML SP20 24 REFURB 140 400ML SP19 19 TUBE SILICON GREASE 50 GRAMMES SP11 20 TUBE SILICON SEALANT WHITE 75ML SP22 25 TUBE SILICON SEALANT WHITE 75ML SP23 25 TUBE HEAT SINK COMPOUND 25 GRAMMES SP12 14 DRIVE CLEANER 200ML SP24 13 SCREEN CLEANER 200ML SP24 13	ANTI-STATIC	150ML	SP06	155p
AERO DUSTER 400ML SP17 55 PLASTIC SEAL 200ML SP09 23 GLASS CLEANER 250ML SP10 15 COLOKLENE 250ML SP13 22 EXCEL PDLISH 80 250ML SP18 14 AOHESIVE 120 400ML SP19 19 LABEL REMDVER 130 200ML SP20 24 REFURB 140 400ML SP21 24 TUBE SILICON GREASE 50 GRAMMES SP11 20 TUBE SILICON SEALANT WHITE 75ML SP22 25 TUBE SILICON SEALANT CLEAR 75ML SP23 25 TUBE HEAT SINK COMPOUND 25 GRAMMES SP12 14 DRIVE CLEANER 200ML SP24 13 SCREEN CLEANER 200ML SP25 14	AEROKLEANE	135ML	SP07	185p
PLASTIC SEAL 200ML SP09 23	AERO DUSTER	150ML	SP08	290p
GLASS CLEANER 250ML SP10 15	AERO DUSTER	400ML	SP17	550p
COLOKLENE 250ML SP13 22 EXCEL POLISH 80 250ML SP18 14 ADHESIVE 120 400ML SP19 19 LABEL REMOVER 130 200ML SP20 24 REFURB 140 400ML SP21 22 TUBE SILICON GREASE 50 GRAMMES SP11 20 TUBE SILICON SEALANT WHITE 75ML SP22 25 TUBE SILICON SEALANT CLEAR 75ML SP23 25 TUBE HEAT SINK COMPOUND 25 GRAMMES SP12 14 DRIVE CLEANER 200ML SP24 13 SCREEN CLEANER 200ML SP25 14	PLASTIC SEAL	200ML	SP09	230p
EXCEL POLISH 80 250ML SP18 14 ADHESIVE 120 400ML SP19 19 LABEL REMDVER 130 200ML SP20 24 REFURB 140 400ML SP21 24 TUBE SILICON GREASE 50 GRAMMES SP11 20 TUBE SILICON SEALANT WHITE 75ML SP22 25 TUBE SILICON SEALANT CLEAR 75ML SP23 25 TUBE HEAT SINK COMPOUND 25 GRAMMES SP12 14 DRIVE CLEANER 200ML SP24 13 SCREEN CLEANER 200ML SP25 14	GLASS CLEANER	250ML	SP10	155p
ADHESIVE 120 400ML SP19 19 LABEL REMOVER 130 200ML SP20 24 REFURB 140 400ML SP21 24 TUBE SILICON GREASE 50 GRAMMES SP11 20 TUBE SILICON SEALANT WHITE 75ML SP22 25 TUBE SILICON SEALANT CLEAR 75ML SP23 25 TUBE HEAT SINK COMPOUNO 25 GRAMMES SP12 14 ORIVE CLEANER 200ML SP24 13 SCREEN CLEANER 200ML SP25 14	COLOKLENE	250ML	SP13	225p
LABEL REMDVER 130 200ML SP 20 24 REFURB 140 400ML SP21 24 TUBE SILICON GREASE 50 GRAMMES SP11 20 TUBE SILICON SEALANT WHITE 75ML SP22 25 TUBE SILICON SEALANT CLEAR 75ML SP23 25 TUBE HEAT SINK COMPOUNO 25 GRAMMES SP12 14 DRIVE CLEANER 200ML SP24 13 SCREEN CLEANER 200ML SP25 14	EXCEL POLISH 80	250ML	SP18	145p
REFURB 140 400ML SP21 24 TUBE SILICON GREASE 50 GRAMMES SP11 20 TUBE SILICON SEALANT WHITE 75ML SP22 25 TUBE SILICON SEALANT CLEAR 75ML SP23 25 TUBE HEAT SINK COMPOUNO 25 GRAMMES SP12 14 DRIVE CLEANER 200ML SP24 13 SCREEN CLEANER 200ML SP25 14	ADHESIVE 120	400ML	SP19	190p
TUBE SILICON GREASE 50 GRAMMES SP11 20 TUBE SILICON SEALANT WHITE 75ML SP22 25 TUBE SILICON SEALANT CLEAR 75ML SP23 25 TUBE HEAT SINK COMPOUND 25 GRAMMES SP12 14 DRIVE CLEANER 200ML SP24 13 SCREEN CLEANER 200ML SP25 14	LABEL REMOVER 130	200ML	SP20	240p
TUBE SILICON SEALANT WHITE 75ML SP22 25 TUBE SILICON SEALANT CLEAR 75ML SP23 25 TUBE HEAT SINK COMPOUND 25 GRAMMES SP12 14 ORIVE CLEANER 200ML SP24 13 SCREEN CLEANER 200ML SP25 14	REFURB 140	400ML	SP21	240p
TUBE SILICON SEALANT CLEAR 75ML SP23 25 TUBE HEAT SINK COMPOUND 25 GRAMMES SP12 14 DRIVE CLEANER 200ML SP24 13 SCREEN CLEANER 200ML SP25 14	TUBE SILICON GREASE	50 GRAMMES	SP11	200p
TUBE HEAT SINK COMPOUND 25 GRAMMES SP12 14 DRIVE CLEANER 200ML SP24 13 SCREEN CLEANER 200ML SP25 14	TUBE SILICON SEALANT WHITE	75ML	SP22	250p
ORIVE CLEANER 200ML SP24 13 SCREEN CLEANER 200ML SP25 14	TUBE SILICON SEALANT CLEAR	75ML	SP23	250p
SCREEN CLEANER 200ML SP25 14	TUBE HEAT SINK COMPOUND	25 GRAMMES	SP12	140p
	DRIVE CLEANER	200ML	SP24	130p
	SCREEN CLEANER	200ML	SP25	145p
COMPUTER CARE KIT – SP26 210	COMPUTER CARE KIT	_	SP26	2100p

All the above items are manufactured by Servisol
If you purchase more than one Servisol Product, postage
& package will be charged as follows:

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

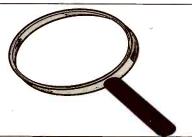
SOLDERING ACCESSORIES

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

I.C. PROTECTORS

ICPF10, ICPF15, ICPF20, ICPF25, ICPF38, ICPF50, ICPF75 ICPN5, ICPN10, ICPN15, ICPN20, ICPN25, ICPN 38, ICPN50, ICPN75

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170p 170p 170p 170p 290p

CASSETTE TAPE HEADS

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

CD PICK UPS

	CD	PI
Models & Description	Order Code	Price
AIWA XC007	KSSS151A	1900p
DX-990A, DX-DIA	KSS151A	1600p
CXL60, CXL66G, CXL80, CXN3100, CXN320, CXN3300, CXN360, CXN400, CXN430, CXN540,	ROUTUER	ТОООР
CXN550G, CXN990, CXN999, CXNV20, CXSL70, DXZ9100M, FDN636, FDN6636, FDN939,		
LCX60, LCX66G, LCX70M, LCX80, M7400, M75, NSX320, NSX360, NSX400, NSX430,		
NXS990, NSX992, NSX999, NSXD636, NSXD939, NSXV20, SXFN550, SXFN520, XC300, XC550, XC750, XC900, XC950, XCN992, XG320, XG360, XG400, XG990, ZD3000M, ZD3100M	VCCATCA	4000
CXAP1, CXL7, CXL8G, CXLC50P, CXZ58, DXM740, DXM75, DXM76, DXM77, LCX50, LCX7.	KSS152A	1600p
LCX8G, LCXAP1, XC002, XC004, XC005, XC777	KSS210B	2000p
XP31, XP33, XP55, XP80G	K\$220A	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	1800p
DENON		
DCD1500II, DCD1520, DCDE3520	KSS151A	1900p
DCD1400, DCD600, DCD800	KS152A	1600p
DCD1420, DCD520, DCD610, DCD620, DCD660, DCD810, DCD820, DCD860, DCD910, DCD920 DCD1015, DCD1290, DCD2060, DCD2060G, DCD315, DCD480, DCD580, DCD615, DCD715.	KSS210A	1800p
DCD825, DCD890, DCD895, DN2000F	KSS240A	1900p
GOLDSTAR	KOOZ40A	Тэоор
CD952A, CD952AJ, CD952LJ, CD952SJ, FFH101KL, FFH101WL, FFH222A/L, FFH272L,		
FFH333L, FFH373K, FJ606, FR606L	KSS210A	1800p
CD320A/L, CD630S/L, FFH212A/L, FFH212E	KSS210B	2000p
GRUNDIG		
CD360, CD435	НОРМ3	2150p
CCD300, CD101MCD904, MC10, NEW ORLEANS CD	KSS210A	1800p
(RCD100, RR1900CD, RR3100CD, RR4000CD, RR610CD, RR700CD	KSS210B	2000p
CDP60, CDP90	KSS220A	2500p
DP65	KSS331A	3400p
	OPTIMA5	3000p
HTACHI DAW560	нормз	
X-10	KSS210A	2150p 1800p
AXC10	KSS210B	2000p
I.V.C.	11002100	посор
1990-1992, LATE 1987-1988 – XLE300BK, XLE31BK, XLE51BK, XLE900BK, XLME91BK, XLV101BK,		
KLV211BK, XLV222BK, XLV311BK, XLV333BK, X:Z1010TN, XLZ411BK, XLZ444BK, XLZ555BK, XLZ611BK	OPTIMA3	4000p
CDRADIO CASSETTE, MINI SYSTEMS - MODELS 1990-1992	OPTIMA4S	5000p
CA-C33, CA-MX30BK, CA-MX33BK, UX-A5, UX-A6, XL-M309, XL-M403BK, XL-M408, XL-M409,		
(L-M504BK, XL-M505TN, XL-M508, XL-M509, XL-M705TN, XL-V131BK, XL-V151TN, XL-V221BK,		
(L-V241TN, XL-242BK, XL-V251TN, XL-V252BK, XL-Z1050TN, XL-Z551TN, XL-Z552BK 1994 ONWARDS - CAE48BK, CAMCG7, CAMXG9, CAS20BK, CAS30BK, VAS50, CAS60RBK,	OPTIMA5	3000p
MXS20, MXS30, MXS60, PCX105, PCX130, PCX95, RCX230, RCX320, RCX520, RCX620,		
RCX720, UXA4, UXA5, UXA55, UXC7, UXT1, UXT3, XLF115, XLF116, XLF215, XLF216,		
KLMC100/M, XLMXG7, XLMXG9, XLV163TN, XLV164BK, XLV174, XLV263TN, XLV264BK,		
KLV274BK, XLZ463TN, XLZ464BK, XLZ574, XLZ674, XTMXG7, XTMXG9, XT\$60	OPTIMA6S	3300p
(ENWOOD		
P47, DP660SG, DP8020, DP87, L1000D	KSS152A	1600p
P1030, DP1510, DP2010, DP2030, DP3010, DP3030, DP3050, DP4030, DP491, DP5010, DP5030,		
P5040, DP520, DP7030, DP7040, DP7050, DP730, DP920, DP930, DP950, DPM650, DPM6630,		
PM7730, DPM850, DPM991, DX6620, M225, M25, M450, M850, PD3030, PDM991, RDX25,		
IXDC3, RXDC3L, UD202, UD302 DPC42, DPC72, DPC77, DPC80, DPC92	KSS210A	1800p
P1050, DP2050, DP3060, DP501, DP5060, DP722, DP76, DPB5, DPB9, M77A, PD3060.	KSS220A	2500p
JD502, UD70, UD701, UD90, XE5	KSS240A	1900p
PC321, DPC521, DPC531, DPC631K, DPC721, DPC731	KSS331A	3400p
P 1060, DP2060. PART No: RCTRH8136AFZZ	RH8136A	4500p
PANASONIC		
SLP177A, SLP202A, SLP212A, SLP222A, SLP277A, SLP377A, SLP477AK, SLP477A,		
LPG100A, SLPG200A, SLPG400A, SLPG500AK, SLPG500AS, SLPJ24A, SLPJ26A,		
SLPJ27A, SLPJ28A, SLPJ325A, SLPJ325A, SLPJ37A, SLPJ38A, SLPJ46A	691-30209	5500P

Models & Description	Order Code	Price
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	2350
PHILIPS		
AZ8304, CD070, CD080, 690, 910, 920. PART NO. 4822-691-20768	4822-691	3100
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	5500
AS440, AS445, AS540, AS640, AZ8048, AZ8640, CD070, CD080, CD091, CD163, CD165,		
CD690, CD710, CD720, CD732, CD740, CD750, CD910, CD920, CD935, FW17, FW21, FW26, FW36, FW36, FW360, FW3801, FW40, FW41, FW46, FW56, FW66, FW68	CDM111	4000
CD1210/40	CDM12.1 CDM12.4	1800
AZ8006	KSS210B	2000
FW11	OPTIMA6S	3300
PIONEER	OI TIMINOO	0000
PDM400, PDM410, PDM500, PDM510, PDM600, PDM610, PDM700, PDM710, PDM730,		
PDT303, PDT403, PDT503, PDX940M, PDX950M. PDZ560T, PDZ72T, PDZ73T, PDZ81M, PDZ82M, PDZ83M, PDZ960M, XDZ53T, XDZ54T	VCC4F1A	4000
N32, N90M, ,PD101, PD290M, XD2331, XD2341 N32, N90M, ,PD101, PD201, PD32, PD41, PD4500, PD4700, PD52PD5700, PD65,I PD6500, PD6700,	KSS151A	1900
PD7700, PD8700, PD970, PDCP420, PDCP520M, PDCP520T, PDJ400T, PDJ500T, PDJ800M, PDJ900M,		
PDM430, PDM450, PDM550, PDM630, PDM650, PDM750, PDM901, PDP710T, PDP720T, PD9910M,		
PDP920M, PDS501, PDS601, PDS701, PDS701G, PDS901, PDT310, PDT510, PDZ, PDZ570T, PDZ74T,		
PDZ84M, PDZ970M, PXA1349, S125CDT, S135CDT, S303CDM, S303CDT, S505DM, S505DT, S707DM,		
S707DTM, S909DM, S909DT, XCP410M, XCP410T, XDZ54T, XDZ55T, XDZ564M, XDZ84T, XRP310, XRP320	PEA1030	4400;
PDM400, PDM410, PDM500, PDM510, PDM600, PDM610, PDM700, PDM710, PDM730,	FEATUSU	4400)
PDT303, PDT403, PDT503, PDX940M, PDX950M, PDZ560T, PDZ72T, PDZ73T, PDZ81M,		
PDZ82M, PDZ83M, PDZ960M, XDZ53T, XDZ54T, XDZ55T, XDZ62, XDZ62M, XDZ630, XRZ82	PWY1009	4800
SAMSUNG	1 1111000	4000
CD20	нормз	2150
CD1200, CD1310, SCM-6000, SCM6900	KSS210A	1800
RCD1200, RCD1300, RCD1350, RCD1600, RCD2600, RCD990, RCD995, SCM6900	SOH90T4N	3600
SANYO	30/13/14/4	3000
DCFS3, DCT55, DCX502, DCX701, DCX702, DCX802, DCX891, DCX891N, MCDZ10. PART No. 6142186855	614010	3200-
DCFS5, MCD450K, 660K, MCDZ30L, 60F. PART No. 6142205006	614218 614220	2300
DCX1000MD, DCX1003, DCX900MD, DCX903, DCX915	KSS210A	5600p
DCD10, DCD11U, DCD20, DCD30, DCD30AT, DCD6, DCD8U, DCMS1, DCX110, DCX120,	NOOZ IUA	TOUUE
DCX210, DCX220, DCX993, DCX994, MCDMS40L, MCDMS50L, MCDMS660L, MCDZ1L,		
MCDZ2L, MCDZ3L. PART No. 6142391303	614239	3300p
DCD12. PART No. 6450055966	645005	3700
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	2900
DXR-840B, PART No. RCTTRH8130AFZZ	RH8130AF	2900p
CDS360E, 360H, 370, 450H/E, CMS150CDH, CMSR400CDH, CP150, CPR400, CPS360, 370.		
PART No. RCTRH8136AFZZ	RH8136AF	4500p
SONY		
(\$S240A	KSS240A	1900;
(SS121A	KSS121A	3500p
KSS151A	KSS151A	1900p
(SS210A	KSS210A	1800
SS210B	KSS210B	2000g
(SS220A	KSS220A	2500p
K\$\$331A	KSS331A	3400p
KSS360A	KSS360A	2600p
TECHNICS		2000p
SLP200, SLP230, SLP250, SLP333, SLP555, SLP777, SLP999,SLPA10, SLPC20, SLPJ25.		
SLP345, SLP3700, SLP3900	SOAD70A	2350p
50 940, 50 0700, 50 5300	SUADIUA	2300p

REMOTE CONTROLS

						CONTROLS					
Description	Code	Price	Description	Code	Price	Description	Code	Price	Description	Code	Price
AKAI			A512120/230	RC900	650p	PANASONIC			SONY		
RC-V10A	RC876	650p	A514790	RC901	650p	EUR51200	RC200	650p	RM604, RM605, RM606	RC140	650p
RCV 37 B V25A	RC891 RC896	650p	A5088470 A518612	RC902	650p	TC2200 VSQ 0357/NV730	RC204 RC202	650p	32 CHANNEL	RC140	650p
	NC030	650p	SCL002	RC903 RC904	650p 650p	TNQ1621	RC203	650p 650p	RM613	RC141	650p
DECCA	00004	CEO-	C2096	RC905	650p	PHILIPS	1102 00	озор	RM632, RM636	RC160	600p
RC70	RC894	650p	A511940	RC906	650p	RC5002,5154	RC134	650p	TATUNG		
FISHER			655602H	RC1920	650p	KT3 NON TEXT	RC135	650p	FXA	RC877	650p
RC905B	RC879	650p	Ιπ		•	69117032	RC178	650p	RC70	RC883	650p
GRANADA			IFB13, 14, 15	RC143	650p	69117194	RC180	650p	FX70 FASTTEXT	RC894	650p
UNIVERSAL TEXT	RC309	650p	FS4	RC148	650p	RC5991-UNIV	RC300	550p	TELEFUNKEN FB632	RC632S	T CEA
MK4 TEXT, 70155G, 70115G, 70133G 95288E	RC880 RC882	650p 650p	RG305	RC305	650p	RC38 KT3 TEXT	RC301 RC5301	650p 650p	FB639	RC639	650p
94490D	RC884	650p	RG306	RC306	650p	RC5352	RC5352		THORN/FERGUSON	ncoss	озор
GRUNDIG	110004	озор	FS9/1-10/1 VS5 RUK	RC307 RC308	650p 650p	RC5375	RC5375		3V35-42	RC342	600p
TP160E	RC107	650p	VS3 RUK VS4-1	RC308	650p	RC5 STANDARD	RC300	550p	3V31-32	RC344	650p
TP200, TP300	RC380	650p	MULTICONTROL (17C20)	RC311	650p	RC5903	RC5903	650p	3V57-58	RC628	650p
TP400	RC401	600p	LOEWE	110011	ооор	SALORA			TX10 TEXT	RC732	575p
TP590-600	RC600	650p	DC11	RC146	650p	SERIES L	RC190	650p	TX10 STEREO TEXT	RC738	575p
TP390, TP610	RC610	650p	MATSUI	110140	озор	86173 SANYO	RC882	650p	TC9-90-100	RC740	600p
TP621	RC612	650p	010270601	RC889	650p	RC218, RC222, RC228, RC238	RC140	650p	3V55, FV11	RC783	650p
TP630, TP650	RC650	650p	VX770	RC892	650p	JXGE	RC878	650p	TX100 FASTTEXT	RC789	650p
TP666 TP661	RC660	650p	NOKIA	1,0002	озор	JXDE	RC884	650p	TX100 ST, FASTTEXT	RC789	650p
	RC661	650p	SATELLITE	RC550	650p	VHR2300	RC890	650p	PROFESSIONAL	RC790	650p
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CLE800-CLE830 A617402/655602	RC140 RC1920	650p 650p	ORION RC53	RC892	CEO-	SHARP	DO 140	CEO-	CT937	RC950	650p
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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: MAB8440P-D014 microcontroller chip for the Panasonic Model TX2636, or a complete front board (M). Also require any data/circuits for the Taylor Model 94A TV waveform and alignment generator (405 lines). Have a working Decca dual-standard monochrome receiver free to a good home. Tony Blakemore, Fowlers Ltd., 7-9 Oxford Street, Ripley, Derbyshire DE5 3AG. 01773 743 124.

Wanted: Circuit diagram for the Advance OS2200 oscilloscope. Ian Robinson, 60 Moor Street, Spondon, Derby DE21 7EB. 01332 873 990.

Wanted: Nicam board for the Philips Model 25PT532A/05 (GR2.2AA chassis). Will pay all costs involved. Phone Bob on 01296 421 070.

Wanted: TACS control board (PC1223-002) for the Ferguson Model 66H3 (TX100 chassis). J. Southwell, Aquarius Electronics, 125 Honeysuckle Road, Bassett, Southampton, Hants SO16 3BT. 01703 396 567/346 942.

Wanted: Circuit diagram and any other information for the Mullard type E7600/3 valve tester. Peter Hill, 63 Harpur Avenue, Littleover, Derby DE23 7EL. 01332 606 979.

Wanted: Information on how to fit text board no. 1-610 989 21 to the Sony Model KV2752UB. Also operating instructions for the Salora 5902 or Nokia 1200 satellite receiver. H. Foyne, 7 Ennerdale, Tanhouse, Skelmersdale, Lancs WN8 6AG.

Wanted: Loan of a service manual or a photocopy of it for the Ferguson Model 3857 (1691 series chassis). In particular need to know the equivalents for the field output transistors VT23 and VT24 which are both faulty. A. Watson, 2 Masefield Avenue, Padiham, Burnley, Lancs BB12

Wanted: Circuit diagram for a 15in. SVGA monitor that bears the name Superview 1280 at the front and Model TE1654M on the nameplate at the back. It was made in Taiwan for Highmead Fountain. Am also looking for a working Philips V2000 type machine for transfer of existing tapes to the VHS format. Ken Clarkstone, 18 Eltham Park Gardens, London SE9 1AW. 0181 850 2864.

Wanted: Service manual or circuit diagram for the Polatech monitor type Polar E.B., which was made in Switzerland. It is used on a Polar 115 guillotine. Len E. Fleming, 72 Eastway, London E9 5JH. 0181 985 8659.

Wanted: Service sheet (photocopy OK) for the Britannia Model B1014R television receiver. Len Orwell, 21 Chilcot Close, Poplar, London E14 6AN. 0171 987 1504.

Wanted: New tapes for the V2000 VCR system, preferably VCC480 or VCC360 types. Paul Hardy, 43 Sheridan Avenue, Caversham, Reading RG4 7QB. 01189 475 869.

Wanted: CD cover or complete top for the Hitachi MX-W50 Opus HiFi system. Would consider buying complete nonworking system if case is tidy. Stuart Fletcher, 131 Walsh Avenue, Hengrove, Bristol BS14 9SQ. 01275 891 893.

Wanted: LOPT for the ITT Model CD752/P (CVC30 chassis). P.T. McKeever, 4 Castleview Park, Derry BT48 8DL. 01504 353 613.

Wanted: TUV-C PCB (part no. BK2001F01002A) for the Amstrad Model DD8900. Joe Thomas, JD Electronics, 35 Northgate, Canterbury, Kent CT1 1BL. 01227 458 903 (0900-1700 Tuesdays to Saturdays).

Wanted: Information on the following ICs: C1251 (NEC), T2333 and T2563 (both Toshiba) – or where can I obtain this information? The ICs are used in the pre-heat timer of a Diahatsu 4WD. Reg Fullerton, 5 Shilgrove Place, Castledawson, Co. Londonderry, BT45

Castledawson, Co. Londonderry BT45 8AL. 01648 468 477.

For sale: Service manuals for Panasonic/Technics models covering the last eight years. All in mint condition. Includes camcorders, Hi-Fi, Walkmans, in-car equipment, microwaves, vacuum cleaners and TV sets (including the Euro, Alpha and Z chassis) but no VCRs. James Burch, 9 Groveland Road, Beckenham, Kent BR3 3PU. 0410 626 002.

Wanted: Service manual (photocopy OK) for the Sony CCDF335E camcorder. George Stephens, 69 Oldfield Estate, Tewkesbury, Glos GL20 5QT. 01684 296 216.

Wanted: VHF channel-change knob for

the Sony 9-306. Tube for the JVC CX610GB. Sony 9-90UB with front cover in good condition. C.D. Evans-Fleming, 3 Walton Road, Clacton-on-Sea, Essex CO15 6DV, 01255 423 551. For disposal: Satoki talking watch £20. Hilka soldering kit £10 – soldering gun, soldering iron, helping hands, solder pump, holder, solder and scraper, as new. Sanyo Sportster Walkman with anti-roll mechanism and new headphones £10. Shiva Fastpth 4 10BASE2 Ethernet/802.3 auto data switch with BNC/AUI and Appletalk sockets £30. Crosstalk for Windows communication software v2.0.1E rev. A £27 – includes Prestel, Minitel 2 and BTX/CEPT-1 emulations, boxed in mint condition. Julian Bohan, 30 Stanley Street, Lincoln LN5 8NG. 01522 871 926. Wanted: Can anyone tell me the correct 22in. tube type for the ITT Digi 3 110° chassis (Model TX3447)? Require scan panel assembly board 3 (index 82929) for the Rediffusion Mk. 4 chassis, 8 rotary tuner unit (55-332) for the ITT Model C20WK1/B, and a tube base for the Decca 130 chassis (A56-X540 tube). R. Bruce, 11 New Zealand Way, Rainham, Essex RM13 8JP.

Wanted: Circuit diagram/service manual or any parts for the Hi-Beam CRT video projector Model HB250. Will accept reverse charges on 01449 723 009 or write to R. Gifford, 4 Gipsy Lane, Needham Market IP6 8DY.

Wanted: £1 coin-operated TV meters, any quantity, preferably working though

non-workers considered, electronic or manual, free-standing or fixed, with keys. G.H. Jones, Einion Electrics, Bridge Street, Llanfair Caereinion, Welshpool, Powys SY21 0RZ. 01938 810 539. For disposal: Two Philips VR2020 VCRs, one with remote control. Complete but just stopped working. Twenty tapes, mostly four-hour. With instruction and service manuals. Buyer collects. A.W. Hankin, 32 Brae Court, Kingston Hill, Kingston-on-Thames KT2 7QQ. 0181 546 3662.

Wanted: Service manual (photocopy OK) for the Telequipment type S51B serviscope, and probes if possible. B. Marsden, 25 St. Georges Road, Newquay, Cornwall TR7 1RE.



Reports from
Philip Blundell, AMIEEIE
Robert Marshall
Ronnie Boag
Pete Gurney, LCGI
Adrian Farnborough
Brian Storm and
Maurice Kerry

Toshiba V423

The sound would mute and field sync would be lost when there was a lot of white in the picture being played back. A scope check at pin 1 of the mute chip showed that with the pictures concerned the video signal had no sync pulses. When I traced back along the circuit to find the source of this input I came to an AN3248 luminance processing chip. To cut a long story short, I eventually found that the associated 3·3µF electrolytic capacitor CN09 had fallen in value. **P.B.**

Philips VR727

A tape would sometimes jam in this machine, with the loading motor in operation but unable to fulfil its purpose. A replacement drive belt seemed to cure the problem, but the fault recurred. With the power off, the loading cycle could be performed without any problems, but insert a cassette and there was lock up.

The cause of the trouble was eventually traced to a wonderful Philips innovation, the 'intermediate lever'. It sits under the arm mechanism, controlling the tape in the capstan and audio/control head area. You see it as a flat bit of plastic (item 32 in the Philips diagram) that goes over part of the main timing gear. Take it out and look at its underside. There's but a

VCR Clinic

single tooth – in this machine half a tooth. Philips, which is always "Years Ahead", is ready for you with Service Kit F. It contains parts 29 to 32. **R.M.**

Sony SLV425

This machine was playing dead – it couldn't be switched on. The operate switch had no LED indication, but the drum was twitching. Suspicion fell on the power supply, where C5030 had fallen in value. It should be 47µF but read only 2µF. R.M.

Ferguson 3V43/JVC HRD725

Playback picture dropouts appeared on the screen in exaggerated form instead of being filled by the dropout compensator. IC8 in the dropout compensator circuit switches between the main (pin 12) and delayed (pin 6) signals. When a dropout is recognised, IC4 generates a switching command (at pin 15) which is sent to pin 14 of IC8. The delayed signal is produced by IC9 (type TL8704P), using charge-coupling techniques. There was an input at pin 11 of this chip but no output at pin 7. So IC8 had been switching to nothing instead of the delayed dropout fillin signal. A new TL8704P chip from Willow Vale cured the problem. R.M.

Samsung VIK350

When this VCR was powered the supply reel would turn for a few seconds, the lift would shuffle then the machine would go to standby. The problem was cured by replacing the lift side chassis and attending to dry-joints on the LED tower. **R.B.**

JVC HRD820

Tape spilled from the spool in the reverse search mode. There was no

further trouble once we'd replaced the mode state switch. **R.B.**

Daewoo V2000

The customer complained about wow with the playback sound. A new back-tension band cured the wow. **R.B.**

Nikkai J2

The 800mA fuse in the power supply had blown and there was a hum bar in the E-E mode. Normal operation was restored by replacing the fuse and the 100µF, 50V electrolytic capacitor in the power supply. **R.B.**

Philips VR2547

This machine would shut down after three seconds in play. It uses a permutation of the deck mechanics originally designed for JVC 540/560 series VCRs. In this case the cause of the trouble was a faulty take-up sensor, something that's quite common with the earlier JVC machines.

Note that in this machine the tape-end stop sensors are mounted on the deck PCB, not on the cassette lift, with two plastic light guides for coupling. To prevent the sensors operating and causing additional, misleading symptoms, shield the deck from strong light while working with the lid off. **P.G.**

Mitsubishi HS621V

It was not possible to load a cassette and, under certain lighting conditions, the cassette housing (more correctly the 'bottom unit') would shuttle forwards and back – reminiscent of something useful in the cotton industry a couple of hundred years ago!

After a time spent delving amongst the many optical devices used on this deck I found that D5B5 was faulty. It's a LED-type

device, part no. SLR-932C-20-AB-T1. A.F.

Mitsubishi M16

This machine would accept a cassette but the loading arms would arrive at the V blocks with the tape left behind. In addition the pinch roller didn't engage with the capstan. Feeling fairly perplexed, I replaced the mode switch. This didn't make any difference. Checks were then carried out around the M37420M6-490SP microcontroller chip IC5A0. It appeared to be at fault and a replacement cured the problem. A.F.

Panasonic NVHS1000

Poor slow-tracking performance was the complaint with this machine: random noise bars would appear in the pause and slow jog modes. Everything else worked perfectly. Having had trouble with the capstan motor in other K mechanism machines I tried a new capstan stator (part no. VEK5927). Fortunately this cured the fault. **B.S.**

Panasonic NVHD605

There was no loading motor operation. Even when the test modes were accessed the motor stubbornly refused to rotate. Checks around the loading motor drive chip IC2001 showed that there was no voltage at pin 7, where the loading motor drive torque is controlled. The cause of this was C6002 which was short-circuit. It's an $0.22\mu F$ surface-mounted electrolytic.

I subsequently had a similar machine with weak loading motor drive. C6002 was again the cause, but this time it had developed an unhealthy leak. **B.S.**

Panasonic NVSD200

One of these VCRs permanently displayed fault code F06 at the front. On investigation I found that the main right-hand side carriage loading arm had bent away from the carriage and become jammed against a metal guard. The reason for the distortion became apparent when a new loading shaft assembly (part no. VXP1339-1L) had been installed.

When a cassette is inserted, Q7 lurks beneath the nylon loading arm. In fact it almost touches the arm – and it gets very, very hot! The replacement loading shaft assembly is an improved version, but it is still made of nylon and Q7

still gets very, very hot. I judiciously tilted Q7 away from its original position and hoped for the best. **B.S.**

Panasonic NVHD605

There was no display and the drum was rotating at a very high speed. The 2SD1330 transistor Q1004 in the power supply had failed. **B.S.**

Panasonic NVFS100

In the S-VHS mode this machine recorded a blank picture, though playback was perfectly good. I hooked up an oscilloscope to trace the signal through the congested luminance and chrominance pack and found that it faltered at the ceramic module IC303, where a corroded capacitor told its own sorry tale. The module is available under part no. VCR0389. A replacement restored the S-VHS recording facility. **B.S.**

Panasonic NVHD660

This machine's on-screen menus and tuning signal were incorrectly coloured and rolled down the screen. I suspected IC7705, which is the PAL encoder for the OSD information. But the culprit turned out to be the surface-mounted capacitor C7703 (0·22µF), which is connected to pin 12 of IC7705. It was badly leaky. **B.S.**

Panasonic NVHD605

This machine would accept a cassette then eject it almost immediately. The cause of the rejection was a problem in the capstan motor circuit. The motor rotated at high speed but failed to tell the system control circuitry that it was working: at this point the tape was ejected. C2043 (0.47µF), a surface-mounted capacitor in the FG feed circuitry, was eventually found to be short-circuit. **B.S.**

Panasonic NVSD410

This VCR wouldn't complete the auto-tune operation, though stations could be tuned in by using the manual method. After much tearing of hair and grinding of teeth I eventually found that C7708 (0·1µF), which is connected to pin 7 of the teletext processor chip IC7708, was leaky. It's a surface-mounted capacitor. **B.S.**

Panasonic NVJ35

Standard-speed recordings were played back as though they had been recorded in the long-play mode – with no colour in the trick modes and wide noise bars in cue

and review. After much chasing around in the servo circuitry I found that the surface-mounted, $1.5k\Omega$ resistor R2302 was opencircuit. It had developed a hairline crack at one end. **B.S.**

Panasonic NVHD660

The E-E picture was too light and crushed while the playback picture had no colour. The TDA9725 luminance and chrominance signal processor chip IC302 was faulty. **B.S.**

Daewoo V50

The customer had complained about a "poor picture". We found that the drum speed was erratic and that when it did manage to lock the picture the colour was noisy and the picture jittered from side to side. In the stop mode the drum ran but was unstable: this could be heard as a pulsating buzz on E-E sound.

A scope check on the 12V motor supply showed that bursts of HF were superimposed on it. Replacement of C853 (47µF, 25V) cured the fault. It's as well to check C855 in the same area. M.K.

Maxell VR2100 (Sanyo deck)

Tapes were being chewed because the supply brake was on in the playback mode. The brake pivot shaft had broken at its base. To repair it we inserted a thin screw from below through the base into the pivot shaft, thus securing it. This cured the fault. M.K.

Ferguson FV71LV (R3000 Chassis)

Two power supply faults took us a little time to track down. When the VCR first came in it had a tape stuck inside and there were no functions. Checks in the power supply showed that it was tripping. The power supply can be run outside the machine. When we tried this it was still tripping. The overcurrent sensing resistor RP18 $(1.5\Omega, \text{ safety type})$ was eventually found to be the cause. It tested OK, but a replacement cured the fault.

The machine came back again later with the complaint that it was dead. This was not true. The display went out when the VCR was put into standby. When it was brought out of standby the display came on. The cause of this was CP41 (220µF, 10V) which supplies the display filament. It had gone low in value. M.K.

Monitor Servicing The Tatung Y2/Y2V Chassis

Monitors incorporate various features that you won't find in a TV set. Russ Phillips takes a look at the circuitry used in this popular monitor chassis and the faults that can arise.

The Tatung Y2 VGA/SVGA monitor chassis is basically similar to the Y chassis, and many of the notes in this article apply to the earlier chassis. The Y2 chassis is used in 3401 series monitors and in some Apricot monitors, including the XJ52178.

The Y2V chassis, used in 3401V series monitors, incorporates changes to comply with the MPRII radiation standard. Foremost amongst these changes is a new CRT, part no. 18-1021-9.

The Y2 and Y2V chassis have five operating modes, with line frequencies of 31·5-38kHz and frame frequencies of 55-87Hz. Depending on the mode, the line and the frame sync pulse inputs may be either positive- or negative-going.

We'll start by looking at the power supply circuit, which is shown in Fig. 1.

The Power Supply

The chopper power supply used in this chassis is based on a UC3842AN controller chip (IC801) which drives the MTP3N60 chopper FET (Q801) directly. The duty cycle of the drive waveform is varied to regulate the outputs from the power supply. Fig. 2 shows a block diagram of the UC3842AN chip.

IC801 requires a start-up voltage of around 17V at pin 7. This is supplied via R805 and D820, which charge CE813. Once the power supply is running, thyristor D821 (TICP106D) is switched on to disable the start-up circuit. This ensures that the power supply will not attempt to restart should a fault condition have shut it down. When the power supply is running the voltage at pin 7 of IC801 is maintained at 12.5V by the rectifier circuit D810, R820, CE813.

If the monitor appears to have no start-up, disconnect D821. If the power supply keeps trying to start up with D821 disconnected there is probably a short-circuit across one of the outputs. As with most TV sets, the most likely candidates are the BU2508AF line output transistor

TR407 or the line output transformer T402.

The secondary windings on chopper transformer T801 provide outputs at pins 15, 12 and 16. Pin 15 feeds the HT rectifier D813 (BYW96D) which produces 110V across its reservoir capacitor CE819. This supply is protected by the clamp network D822, C826 and R835. Pin 12 feeds rectifier D814 (BYW96D) which produces 21V across its reservoir capacitor CE820. This supply is also fed to the 78M12 regulator IC803 which produces a regulated 12V output. Pin 16 feeds rectifier D815 (SB140) which produces a 6V supply across CE821 for the CRT heaters.

The regulation circuit monitors the HT voltage and is based on the TL431CLP variable-voltage zener diode IC804 and the TLP731-LF2 optocoupler IC802. The emitter of the phototransistor in IC802 produces an output across R825 to feed the error voltage pin 2 of IC801. The supply for its collector is obtained from pin 8 of IC801 – this 5V supply is also used to switch D821 on.

Excess current protection is provided by monitoring the voltage across Q801's source resistor R808. This point is linked to pin 3 (current sensing) of IC801 via R823, with C825 for filtering. The supply shuts down in the event of excess current being detected, for example because of a short across one of the outputs on the secondary side of the circuit.

To set the HT voltage (RV832), the monitor should be provided with a blank raster signal with negative-going sync pulses at 31.5kHz and 60Hz. Set the contrast and brightness controls at mid-point, then use RV832 to set the voltage across CE819 to $110V \pm 1V$.

R806 (0·33 Ω , 0·5W flameproof) provides protection should Q801 go short-circuit. Overvoltage protection is provided by zener diode D809, which conducts when the supply provided by the rectifier circuit D812/CE803 exceeds 16V. This fires thyristor D805 which latches on, removing the supply to IC801. CE804 is included to ensure that D805 is not triggered by spurious spikes.

If the chopper transistor Q801 has failed, D806, D807,

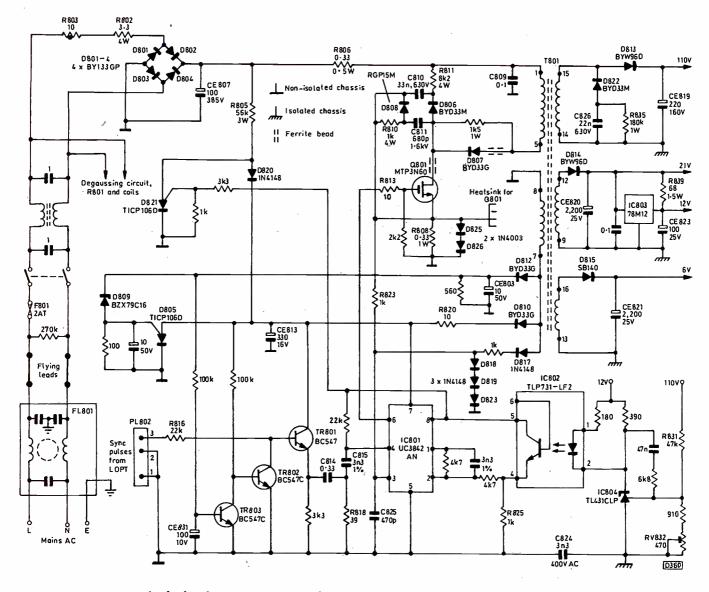


Fig. 1: The chopper power supply circuit used in the Tatung Y2/Y2V chassis.

D808, R806 and R808 should also be checked.

Pulses from the line output transformer synchronise the operation of the power supply and the line output stage. These pulses are picked up by a single turn of wire around the transformer's core and are connected to the power supply by plug PL802. They then pass via R816, TR801 and C814 to the junction of R818 and C815 which form part of the oscillator circuit in IC801 (pin 4). This oscillator and the error amplifier connected to pin 2 provide the two inputs to the pulse-width modulator within IC801. This in turn generates the drive waveform for Q801.

B+ Regulation

The B+ voltage which is applied to the line scan coils via the primary winding of the line output transformer varies between 84V and 105V depending on the line frequency: higher frequencies require higher voltages.

When the line frequency is at its lowest, i.e. 31.5kHz, the B+ supply is 84V: it's derived from the 110V HT supply via R509 with transistor TR504 in parallel (along with R508 and R514) – see Fig. 3. When a higher B+ supply is required, the forward bias applied to TR504 increases so that it conducts more heavily, reducing the voltage across R509 and the parallel network R508/R514/TR504.

Negative pulses at an amplitude of about -280V are taken from pin 5 of the line output transformer and recti-

fied by D501/R501 and C502, providing feedback to the B+ regulator circuit to stabilise the width and the EHT supply.

To check the B+ voltage, set up the monitor as for HT voltage adjustment and measure the voltage across CE425. At the line frequency of 31-5kHz the reading

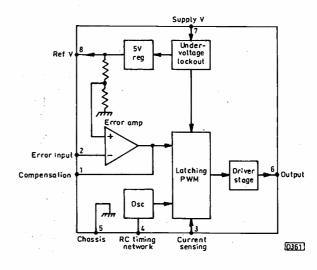


Fig. 2: Block diagram of the UC3842AN chopper control chip. 3842 series chips are widely used in monitor power supplies.

1100

Fig. 3: The B+ regulator circuit.

R508 R514 TR504

115 8-2 TIP31E

TR503 R507

TR503 R507

TR503 R507

TR504

TR503 R507

TR505

100 220k 27/

TR501

TR502

R507

TR501

TR502

R501

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A70

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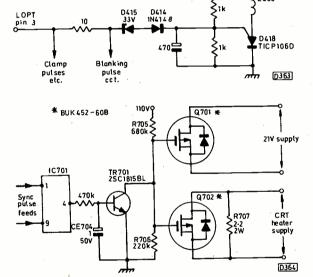
Pulses from pin 5

of the LOPT

Excess current trip (from TR 420)

Fig. 4: The excess EHT voltage protection circuit. There is also protection against excess beam current - TR420 monitors the voltage developed by the beam current flowing through R460.

Fig. 5: This power management circuit is incorporated in some monitors that use the Y2/Y2V chassis.



should be 84V ±0.5V (85V ±0.5V with the Y2V chassis). RV503 is provided for adjustment.

D502 provides protection should a short-circuit occur across the B+ supply. In this event it will conduct heavily, shorting the 21V supply to chassis and thus forcing the power supply to shut down.

R501 (220Ω , 0.5W flameproof) is included to provide protection in the event of failure of D501 or C502.

Synchronisation

The incoming sync pulses vary in frequency and polarity. They are fed to the sync decoding logic section of the monitor where three 74 series logic chips are used, IC401 (74LS86) which is a quad two-input exclusive-or gate, IC402 (74LS123) which is a dual retriggable monostable and IC403 (74LS156) which is a dual two-to-four line decoder with open-collector outputs.

IC401 is used to ensure that only positive-going pulses are fed to the line and frame oscillators. IC401 is also

used, with IC402, for mode detection. IC403 uses the mode detection signals from these chips to provide automatic height adjustment in the VGA modes, with RV422 providing correction. In the SVGA mode the user sets the height with RV409.

For SVGA operation pin 13 of IC402 is held high. TR417 switches on and TR405 switches off, enabling the line phase control to adjust the line frequency between 35.5kHz and 38kHz. For VGA operation pin 13 of IC402 is held low, switching TR417 off and TR405 on. This sets the line frequency at 31.5kHz.

The Frame Timebase

A TDA1675 chip (IC301) is used as the field generator and output stage. Positive-going frame sync pulses from pin 11 of IC401 are fed via R301 to pin 5 of IC301. C311, C312 and TR403 ensure that the amplitude of the field output waveform at pin 1 is correct. R307 (0-68 Ω) in the field scan current path is the source of feedback which is fed to pin 12 of IC301.

TR301 controls the vertical centring. RV313 is provided as a user adjustment to centre the image.

The Line Timebase

An LM1391N chip (IC404) is used as the line generator. It incorporates a phase-locked loop. The line sync pulses are fed to pin 3. In the VGA mode TR405 is switched on and the frequency is set by RV429, R428 and C410. In the SVGA mode TR405 is switched off, adding RV433 and and R493 to the circuit. This enables the oscillator to operate in the 35-38kHz region.

The line drive output from pin 1 of IC404 is fed to the base of a 2SD667AG transistor (TR406) which forms part of a conventional line driver stage, with transformer coupling (T401) to the base of the BU2508AF line output transistor TR407. There's a conventional EW modulator arrangement to tune the output stage, the diodes being D402 (BY328) and D403 (BYD73F) and the parallel capacitors C420 (4·7nF, 1·6kV) and C421 (15nF, 630V) respectively, with C422 (680pF, 1·6kV) to provide fine tuning. The voltage developed across C423 (3·3µF) in the EW modulator driver stage is used for EW and width control. There's also a DC potential for horizontal shift: this is controlled by plug and socket PL/SK403.

There's a fairly straightforward beam current limiting circuit which is connected to pin 8 of the line output transformer – this is the earthy end of the diode-split EHT winding. If the beam current exceeds 0.5mA the BC557 (pnp) transistor TR411 will switch on, reducing the voltage at the wiper of the contrast control RV211.

An excess EHT protection circuit (see Fig. 4) is connected to pin 3 of the line output transformer. If the pulses here exceed about 33V, zener diode D415 (BZX79-C33) and the 1N4148 diode D414 conduct, triggering the TICP106D thyristor D418. This will short out the 21V line and shut down the power supply.

The pulses at pin 3 are also used for line blanking and video clamping. The clamp pulses are fed via pin 6 of SK202 and plug PL202 to pin 15 of IC201 on the video panel. Mixed blanking pulses are fed to the video panel via pin 5 of this plug and socket.

Pin 9 of the line output transformer feeds the rectifier circuit D411 (BYG33G), R467 ($1k\Omega$) and CE428 (10μ F, 100V) which produces a -64V supply for the brightness control circuit. The voltage at the slider of the control (RV469) is also fed to the video panel via pin 5 of SK202/PL202.

Pin 4 of the line output transformer feeds the rectifier circuit R472 (4· Ω , 0·5W), D410 (BYD33G) and CE429 (100 μ F, 25V) which produces a –15V bias supply for the

RGB output stages. This is fed to the video panel via pin 8 of SK202/PL202.

Video Circuitry

The incoming RGB analogue video signals are terminated by 75Ω resistors and fed via 100μF coupling capacitors to pins 3, 7 and 11 respectively of the M51387P chip IC201 on the video panel. This IC provides gain control, cut-off control and DC restoration.

The RGB outputs appear at pins 29, 25 and 21 respectively of IC202. They are fed to the RGB output stages which are of the cascode type. Those familiar with Decca/Tatung chassis will know that this type of output stage has been favoured for many years. Each output stage has a 2SD1610C transistor (top) and a 2SD468C transistor (bottom) to which the input is fed. The output stages receive their supply from the 110V line and use relatively low-value load resistors (two 680Ω, 3W resistors in series in each stage) with a series peaking coil. The drive to the tube's cathodes varies between 93V (black level) and 40V.

Power Management Circuit

Some monitors fitted with the Y2/Y2V chassis incorporate a power management PCB. The circuitry on this panel reduces the monitor's power consumption when either the line or the frame pulses are absent for more than about a second, enabling the monitor to take advantage of PC video boards that are compatible with the VESA display power management system (DPMS).

Fig. 5 shows the basic circuit. Line and frame sync pulses are fed to the 74LS123 dual retriggable monostable chip IC701. Provided both sets of sync pulses are present, the output at pin 4 remains low. This output is fed to TR701, which is thus switched off. With TR701 off, Q701 and Q702 are biased on by the potential divider R705 and R706 and the 21V supply to the line driver stage is maintained.

If one or both sets of sync pulses is missing, pin 4 of IC701 goes high and TR701 switches on. The gates of Q701 and Q702 will thus be at chassis potential and they will switch off. There will be no 21V supply to the line driver stage, and the monitor's power consumption will be reduced to less than 30W. With Q702 switched off, R707 is added in series with the tube's heater supply, which is thus reduced.

CE704 is included to prevent the circuit operating when the monitor is first switched on.

Conclusion

From my experience these chassis have proved to be reasonably reliable. Most of the faults I've encountered have been straightforward, but one is worth special mention.

The monitor had a blank screen. When the first anode voltage was turned up (at the line output transformer) a blank raster appeared. Oscilloscope checks around IC201 showed that the inputs were healthy, but there was nothing but blanking pulses at its outputs. Naturally I fitted a new (and expensive) M51387P IC. The cause of the fault however was TR411 in the beam limiter network. This BC557 transistor was short-circuit. Since the first occasion I've had the same fault with several other monitors.

A quick way to check this out is to remove plug PL204 from socket SK204 on the main panel. If the picture comes up, TR411 is probably faulty. A BC307 can be used as a replacement – it has the same pin connections.

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This time J. LeJeune describes the modulation techniques used for digital TV transmission and the reasons for employing different systems for satellite, terrestrial offair and cable broadcasting

Introduction to Digital TV

t is often said that there is nothing new under the sun, which in many cases is true. Take the transmission of digital signals for example. The first Marconi wireless transmissions were digital in nature, using on/off signalling and the Morse Code. The transmitter was manually keyed by using the Morse key, the carrier being on to signal a dot or dash.

Forms of Modulation

This is a kind of amplitude modulation, as the carrier is made to vary between zero and 100 per cent by the code characters. The actual term given to this mode of transmission is CW (continuous wave) – which it clearly isn't because the carrier is transmitted only when the Morse dots and dashes are being sent! With the key in its up position, there is no transmission. The method is slow and requires two operators, one at each end, to encode and decode the messages ('traffic').

Message transmission was speeded up with the advent of the teleprinter, using the 7-bit Gray Code. It could also be automated. A better method of transmitting the teleprinter signals ('RTTY') was sought: it was felt that there should be a positive indication of the off (space) as well as the on (mark) state of the code. This led to the use of Frequency Shift Keying: one or other of two closely-spaced radio frequencies is transmitted, one to indicate a mark and the other a space. In essence this is a form of frequency modulation.

Either amplitude or frequency modulation can and still is used for music and speech in analogue form. FM requires a greater bandwidth, and as a result is used in the higher broadcast bands.

A third form of modulation has come into use for both analogue and digital signal transmission – phase modulation. With an analogue signal, the phase of the carrier varies in sympathy with the modulating signal, the reference point being the unmodulated carrier phase. It is often necessary to incorporate a reference oscillator in the receiver to obtain accurate demodulation. Synchronous demodulation (as in a PAL decoder) or the phase-locked loop principle can be used.

Quadrature Phase Shift Keying (QPSK)

Nicam sound, which is digital, uses a variant of simple

phase modulation called QPSK – Quadrature Phase Shift Keying. Two carriers at the same frequency but with a 90° phase difference between them are used. The carriers are referred to as I and Q (In-phase and Quadrature). By shifting one or both carriers by 180°, you get four different phasors as shown in Fig. 1. These can be used to denote the four possible states (00, 01, 10, 11) of a two-bit binary code. Each state is referred to as a 'symbol'.

The three most common methods of digital TV signal delivery, terrestrial off-air, satellite and cable, will all use MPEG-2 compression in the UK. The chief differences between them will be in the modulation method employed. This is chosen to match the characteristics of the transmission medium.

Satellite Digital TV

Satellite digital TV is to use QPSK. The arrangement shown in Fig. 1 is the basis of what is called a "phase constellation map", in which phasor end points rather than the actual phasors are shown – see Fig. 2. Satellite transmission involves the use of low transmitter powers and high-gain aerial systems at the transmitting and receiving end to provide noise-free gain. The noise floor with a satellite transmission is not very low however, which is why QPSK was chosen. With a digital transmission noise tends to move, confusing the phase constellation points. With only four phasors, there is plenty of room to move before the decoding system fails to recognise what is being transmitted.

With QPSK the I and Q carriers are always at 90° with respect to each other and their amplitude is constant. This makes it fairly easy for the demodulator to recover the original modulation, particularly in the presence of noise.

Because there is no phase reference built into the receiver, it might seem to be necessary to transmit a reference to enable the I and Q carriers to be identified. Each phase change (symbol) takes a certain time to transmit. A form of QPSK in which successive phase changes are made in relation to that of the previous symbol can be used. This system, known as 'differential coding', removes the need to transmit a reference.

The transponders used for satellite transmissions are

also able to handle analogue signals sent using FM. Thus the on-board transmitters are essentially non-linear. The transmission path is noisy but is not subject to reflections (multi-path reception) and is largely free from interference. This makes QPSK the ideal choice. Down here on Earth however the situation is different.

Cable TV - 64-QAM

It is worth considering briefly the requirements with cable TV. Traditionally CATV networks have used coaxial cable for local distribution with high-quality optical-fibre transmission for the trunk networks. The weakest link in the chain determines the overall performance of the system, and the modulation method chosen for cable has to be suited to this.

Noise is not a serious problem with a modern cable network. Low-noise amplifiers are readily available and operate linearly when within their recommended ratings. The cables pass amongst buildings of all sorts and conditions however, picking up electrical interference. This is at a low level, and need not seriously impair the service. Narrow-band amplifiers are used in places to provide automatic level control of individual channels. Because of the traffic density with a modern CATV system, the channel limits are maintained closely, both in level and bandwidth.

The digital modulation system that has been chosen for cable TV is known as 64-QAM. Quadrature Amplitude Modulation (QAM) is a variant of QPSK: it employs both amplitude and phase modulation of I and Q carriers, giving in all a total of 64 combinations of phase and amplitude. These combinations are referred to as 'symbols'. The I and Q carriers retain their quadrature relationship, but there are more phase states than the simple 180° changes with OPSK

states than the simple 180° changes with QPSK. Fig. 3 shows the phase/amplitude constellation for 64-QAM. The provision of more points in the constellation means that more data can be packed into a symbol period. But because the points in the constellation are closer together, the tolerance of 64-QAM to a noisy environment is much less than that of simple QPSK. This is not a serious consideration for cable TV. Reflections caused by impedance mismatches within the system are a problem however, and to compensate for this and for interference heavy (and expensive) coding of the signal is used. It provides comprehensive error correction.

For digital cable TV a single carrier is used for 64-QAM.

Terrestrial Digital TV - COFDM

64-QAM also forms the basis of digital terrestrial offair TV transmissions. But the environment is much less benign than with cable. Terrestrial reception is subject to flat fading, frequency-selective fading, reflections and interference of various kinds. Frequency-selective fading is often caused by multipath effects. If the main and the reflected signals have a phase difference of 180° they will tend to cancel out.

All these problems affect an analogue signal transmission and cause some degradation of the picture and sound quality, but the nature of the analogue system is such that a picture of some sort can be obtained. Careful aerial alignment can be used to minimise the effects. With digital transmissions data loss is a more serious problem.

Although 64-QAM is the basis of terrestrial digital TV, it is not – as with cable TV – used with a single carrier. Instead, a modulation system called Coded Orthogonal Frequency Division Multiplexing

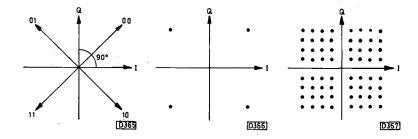


Fig. 1 (left): The QPSK modulation technique. Two carriers at the same frequency but with a 90° phase difference between them can each be shifted through 180°, giving four possible phasors each able to convey a two-digit combination (known as a symbol). Fig. 2 (centre): This way of depicting the conditions shown in Fig. 1 is called a constellation map. Fig. 3 (right): Constellation map for 64-QAM, which has 64 possible phase/amplitude states.

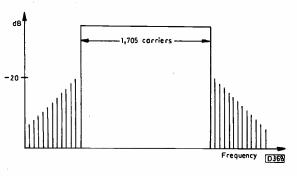


Fig. 4 (left):
Spectrum of the
2K COFDM signal to be used
for terrestrial
off-air digital TV
transmissions in
the UK.

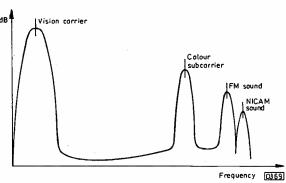


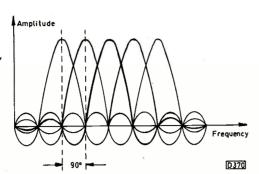
Fig. 5: For comparison, the RF energy distribution in an analogue TV channel.

(COFDM) is used. The frequency division multiplex implies a multi-carrier system; orthogonal means at right angles, so the carriers are in quadrature; coded means that some frequency interleaving and other error avoidance measures are employed to ensure a rugged transmission.

In the UK, the modulation will be split amongst 1,705 carriers. This is referred to as the 2K option: continental European broadcasters may adopt the 8K option, which uses 6,817 carriers. With the 2K option each carrier has to transport about two-thousandth the symbol rate with 64-QAM. The coding interleaves the data in time and frequency to provide enhanced error correction possibilities.

Fig. 4 shows the spectrum with 2K COFDM. The arrangement enables the 8MHz channel bandwidth to be fully used – contrast this with the analogue channel signal spectrum shown in Fig. 5. You can see that the system makes more efficient use of spectrum space.

Fig. 6: Carriers with orthogonal frequency spacing - the carriers are 90° apart and don't interfere with each other.



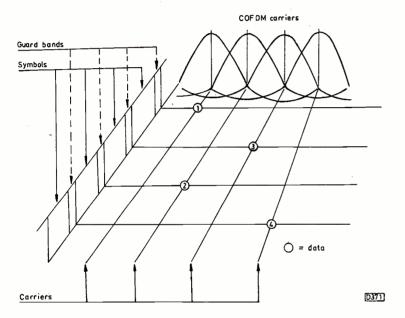


Fig. 7: Three-dimensional representation of a COFDM signal. 1-4 interleaved data.

Because of their orthogonal frequency spacing, the COFDM carriers do not interfere with each other – see Fig. 6.

Since each carrier's data rate is low, the symbol rate per carrier is much longer than with QPSK and QAM. This provides tolerance to multi-path effects. To enhance this tolerance, a guard band is added to each symbol period to lengthen it. Echoes that occur within the symbol period cause a flat signal fade. Those that occur outside it, in the guard interval, produce the effect of a phase sum and difference: the result is frequency-selective fading. The guard interval also prevents inter-symbol interference, which could present two symbols to the demodulator simultaneously – one of which would be the correct one!

Fig. 7 shows a three-dimensional representation of a COFDM signal, in time, frequency and amplitude. It also shows the interleaved data. In the event of a strong frequency-selective fade some carriers will be boosted while others are attenuated. An efficient coding system is used to identify and retrieve data lost as a result of such conditions. The coding cross-references data bits, enabling bits mutilated by fading or interference to be recovered. It is a very intricate process that's called convolutional coding – an apt description! In fact it actually makes use of echoes to improve the signal-tonoise ratio of the received signal.

Advantages of COFDM

Because of its coding and the guard interval which is added to each symbol, COFDM is very tolerant of multi-path reception. This would make it possible to use a single-frequency network (SFN) for a national broadcast service. With the same channel in use by all the transmitters that broadcast the same service, signals from distant transmitters would appear as long-delay echoes. The actual minimum separation between transmitters would be somewhere in the region of 45 miles. Because there is not a free frequency for the purpose, it is not an option in the UK at present.

The power-filled COFDM spectrum enables much lower transmitter ERPs to be used. Typically, a 5kW station in south London could cover the area from Basildon to Bracknell and Hitchin to Reigate. Much of the reception in this area would be possible using a simple set-top Yagi aerial.

Any fill-in stations required with an SFN system would again use the same frequency, making life simpler for the aerial industry and for installers. Thus the change to digital transmission could make life easier for everybody.

Analogue and digital services will have to coexist for a number of years however. It could be that the analogue services will close down as the transmitters show signs of becoming unserviceable: by that time the majority of viewers could be expected to have obtained digital receivers.

Obtaining Signals

Signal seeking and aerial alignment will call for techniques different from those used for analogue transmissions. If you recall the early days of satellite TV, colour or even VHF radio, you will appreciate that we will have to go through the same learning process with digital TV.

Some digital satellite receivers have a menu page that shows a signal-strength bar graph. This assists with dish alignment, and enables the viewer to judge whether the signal has deteriorated since the dish was installed. The system works by reading the Bit Error Rate (BER), which is checked in the receiver by the error-correction circuitry. The higher the BER, the shorter the bar-graph column.

Ideally a spectrum analyser should be used for dish or terrestrial aerial alignment, as it enables optimum signal-to-noise ratios to be determined visually and accurately. To rely on the BER for aerial alignment will not always result in the best reception conditions. COFDM is capable of producing excellent pictures using a set-top aerial, but there will still be black spots – as there are with analogue services. Despite this, the digital network should provide excellent coverage throughout the country.

Summary

The coming of digital TV will change things for ever. For the viewer it will mean vastly improved facilities, with an electronic programme guide and superior quality pictures. For the service engineer it will mean a change of thinking because of the computer-like processing of the image and sound. Things will never be the same – they could even be better!

In the concluding instalment next month we'll take a look at satellite digital receiver servicing techniques. *Is looking for* . . .

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Long-distance Television

Terrestrial DX conditions and reception, satellite TV sightings and news, and the saga of planning permission for a second dish.

Roger Bunney reports

eptember means the start of autumn, when the nights become colder and longer. It should also mean improved tropospheric reception. September 29-30th probably produced the best opening so far this year. At the time of writing it's too early for any reports to have come in, but I can report on the situation here at Romsey, Hants and nearby.

Band III and the UHF spectrum were both full of French stations. As a result, reception from local UHF transmitters was covered with line pairing. Very strong Belgian signals swamped the UHF bands in Dorset. I have been told that at times the local UHF police repeaters became unusable, with French police capturing the inputs!

The cause of all this was a lingering high-pressure system over the UK. It extended across into central Europe. I hope to be able to provide more news of this opening next month.

The Sporadic E situation was very poor. The Italian station TVA

(ch. IA) was received on the 2nd; a minor opening on the 25th produced signals from ARD (Germany) on ch. E2 and LTV (Lithuania) on ch. R2; and SVT-1 (Sweden) ch. E4 was received on the following day. That was it!

Taking a longer-term viewpoint, as the new century approaches we must consider the progress of the present sunspot cycle - number 23. During the summer months there was a rapid increase in sunspot numbers. This suggests that the year 2000 could coincide with the cycle's peak. When solar activity is very high, the MUF (maximum usable frequency) rises. It's then possible for low VHF signals to be propagated over many thousands of miles via F2 layer reflection. Signals have been received in the UK from Australia, New Zealand, China, the USA and the Gulf during past openings. On a more sombre note, with the advent of terrestrial digital TV cycle 23 could be the last opportunity we shall get for F2-layer DX-TV.

Satellite Sightings

James Broughton (Yateley) and Tim McClellan (Christchurch) have both been monitoring the French Telecom satellites at 3°E, 5°W and 8°W. At 5°W La Chaine Info has recently been replaced with promotional material for Canal Satellite – unusually, PAL not SECAM.

PAS-3R (43°W) has been very active with analogue signals recently: Ryder Cup golf in particular including split feeds for Sky Sports. One source I couldn't identify was "JWRC NEWS FD" The successful land speed record attempt in the Colorado desert was rather more dramatic. It was carried live from the 22nd onwards via Intelsat 601 (27.5°E) using

on September 24th - any ideas?

via Intelsat 601 (27.5°E) using Starbird capacity – at 11.497GHz horizontal. It was interesting to see the uplink truck in sandy isolation with its dish focused on to a low-elevation satellite for the first hop.

As of September 15th the dispute between Astra and Eutelsat over the orbital slot at 29°E continues. Hot Bird 3 has been carrying out "evaluation tests" here (at 12·383GHz vertical), with promotional videos etc. In effect this was Eutelsat's way of confirming its claim to the slot prior to the launch of the Astra series 2 digital satellites at 28·5°E.

Paulo Raymundo (Bahia, Brazil) uses a 1.5m dish on the balcony of his eighth floor flat. The azimuth range is restricted but he does have access to Intelsat K at 21.5°W, giving him several Ku-band Reuters/ABC news feeds that use either NTSC or PAL-G. He's hoping for access to Sky digital soon – not the Isleworth offerings but signals from the recently launched PAS-6, which may carry up to 140 channels. Currently DirecTV transmits twenty pay-perview and 33 music channels. Prices of receiver systems have dropped from \$995 to \$700. Incidentally many of the vertical Reuters feeds via K seem to have ceased.

John Rogers (Liverpool) reports receiving analogue ITN news feeds for News at Ten via Eutelsat II F3 in the 10.95-11.7GHz band on the 12th, during the Scottish Assembly

During the recent successful land speed record attempt in Colorado the camera panned over to this SNG uplink truck, which was feeding Intelsat 601 at 27.5°W.



voting period. John uses a Pace MSS500IP receiver with a 1m Lenson dish and an Echostar LNB.

Land-Rover Business Television is a new one on me. It's a corporate affair via Orion 1 (37.5°W). I first saw the transmissions on the evening of September 9th, from the Frankfurt Motor Show – when the new Freelander four-wheel drive vehicle was launched. I was surprised to see a complete breakdown of all Land-Rover sales for the past six months, with sales trends and forthcoming strategies for the period under review. Maybe Land-Rover sales executives across Europe were huddled over their screens, with notebooks to take down the detailed information. Odd that the transmission was an analogue one in the clear – many regular corporate transmissions, e.g. Safeways, Sainsburys and General Motors, are now encrypted. I can recall when I was at TVS some eight years ago working on a Digital Computer's corporate satellite hookup across Europe using encrypted B-MAC: at the end of the transmission all the studio scripts were collected and shredded! But many of the newer computer companies seem happy nowadays to transmit their corporate satellite feeds in the clear. BMC Software for example broadcast an analogue presentation from the USA via Intelsat K on the 9th, at 1600 hours.

Julian Redwood (Christchurch) received a BBC Last Night of the Proms transmission via Telecom 2C (at 12.696GHz) on the 13th in 16:9 format. The programme, from 1930 hours onwards, included an earlier recording of Proms in the Park and various promotional trailers.

There were several SNG uplinks following the rail crash at Southall on the 19th. Orion 1 also carried a UKI 116 BBC feed from the Swansea depot.

Terrestrial News

Germany: The future of several local/regional TV stations is in doubt. FAB-TV, Berlin, has lost nearly \$3.5m since its start-up in 1991. Another Berlin station, PLUS-TV on ch. E5, went into liquidation and was subsequently taken over by Kirch. Other local stations in Nuremberg, Hamburg, Munich and Berlin have failed to break even. Only Hamburg-1, with a regional audience of 3.5m, seems to be a success. Elsewhere in

Germany the NTV transmissions from Bremerhaven (ch. E5) and Bremen (ch. E57) have been closed down. Even satellite broadcaster SAT-1 reported making a loss last. year.

Russia: A new non-commercial national cultural channel is to be established. It will absorb the St. Petersburg Channel 5 which is at present independent.

Hungary: DMG Radio of the UK has made a bid for Radio Danubius, a state-operated VHF-FM network that has a coverage of nearly 70 per cent of the population. There are three rival bids for Danubius, the franchise period running up to the year 2004. An additional non-established network has 80 per cent coverage.

The Netherlands: More transmitter news. The ERP of the ROF Irnsum (Friesland) ch. E28 transmitter is now 150kW (omnidirectional). TV Drenthe's omnidirectional aerial is at 200m on the Smilde mast. TV Flevoland and Omroep Zeeland are now on air. TV Noords (Groningen) will use ch. E36 with an ERP of 150kW via a 100m mast at Hoogezand. TV Gelderland is to open a fourth transmitter at Apeldoorn, using ch. E32 at 10kW ERP: a ch. E40, 50kW ERP transmitter is to be opened shortly at Ruurlo, with a new 130m mast; a ch. E24, 50kW ERP transmitter is to open next year at Tiel.

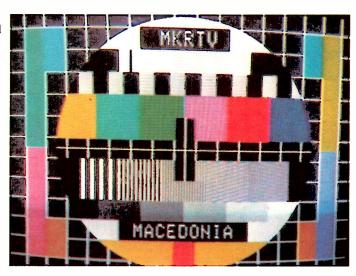
UK: Alan Gale of the SkyWave TV/FM group has provided a list, as follows, of the Band I channels used for radio OB links, e.g. RSL transmissions:

48.4125, 48.4375, 48.4625 and 48.4875MHz all with a 25kHz bandwidth; 48-4250 and 48.4750MHz with a 50kHz bandwidth; and 48.5MHz with 100kHz bandwidth. With all these channels the maximum ERP is 25W, using FM.

52.8265, 52.8626 and 52.8867MHz all with a 25kHz bandwidth; 52.875 and 52.925MHz with a 50kHz bandwidth: 52.9MHz with 100kHz bandwidth. For these channels the maximum ERP is 5W, using FM.

Satellite News

It's forty years since the world's first satellite, the Russian Sputnik-



1, was put into orbit - on October 4th 1957. It used a crude CW type radio downlink at 20MHz. We've come a long way since then, and the next forty years will see even more dramatic development.

The US Iridium group, which is setting up a world-wide communications network using

A beautiful PM5544 test pattern received via Eutelsat II F4 at 7°E.

Aerial Techniques

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A Planning Saga

can now recount the full saga of my recent, successful efforts to gain planning permission for a second dish. Some lessons may be of help to others facing a similar problem.

Most people don't understand aerials, particularly the "different-looking" ones used by enthusiasts. Such aerials tend to be regarded with suspicion, and may be blamed for various problems.

After a recent move to a new estate, I erected various aerials. One neighbour, whose house overlooked my garden, noted these activites with some displeasure. In addition to the domestic TV aerial and Astra black dish, both mounted on the rear wall, the only aerials that projected above the roof ridge were a two-element Band I array and a discone, neither of which was higher than my domestic TV aerial.

My original 1.5m dish was mounted, unused, on a short stand in the garden, backing on to a garage wall. It was held down with breeze blocks, and was below the 6ft fence level. A new, dark green 1.2m dish on a concreted in steel post projected some 15in. above the fence (see photograph alongside).

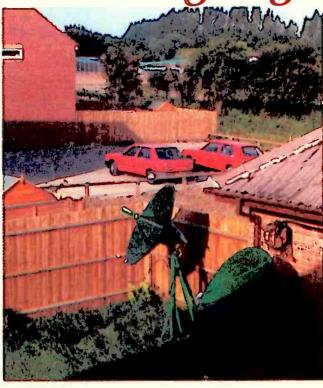
On June 19th I received a visit from the local council planning enforcement officer. He pointed out that I had two dishes in use, though only one dish per dwelling is permitted under the February 1992 DOE guidelines. I would need to apply for retrospective planning permission to retain the green dish in use

dish in use.

Five copies of my planning application with area maps other

application, with area maps, other papers and various photographs supporting my application, also a cheque for £90, were delivered to the local planning office on July 22nd. In exchange, I received a planning notice to display prominently for passers-by to read, and the council would write to those nearby to ask for any objections or comments. I had already written to my neighbours to tell them about the application and invite any queries/concerns about the dish – there weren't any.

During August the ward councillor



(planning) called to see the dish. A demonstration of satellite reception impressed him, and he departed with the comment that the application would have the town council's approval, the decision being passed to the borough council planning department.

At an officer-level meeting the planning department wouldn't make a decision (but recommended approval) because an objection had been received. The application was deferred to the area planning committee, on September 23rd, for consideration and decision. I was told about the objection - a neighbour to the rear "comments on the number of aerials and satellite dishes at the property and queries the need for them, their effect on property values and health and the effect on the appearance of the area". Only the last point was material to consideration of the application. The council noted the number of aerials and dishes at the premises.

Warned about the objection, I prepared a brief with numerous photographs showing the 15in. dish segment that projected above the fence and the general background. The objecting neighbour, who had a 2m high panel fence and another garden between himself and the dish, couldn't

see it from his garden or ground floor rooms. I had previously outlined my activities and needs. Several copies of my application brief were distributed to the committee prior to the meeting. I had also sought and obtained applicant's right to speak to the committee (for an allowed three minutes).

My homework effort paid off. Once the application had been read and the details outlined, the committee moved to approve the application without discussion. In forty seconds permission had been granted – but it had taken three months and four days in total!

What are the lessons? It seems that aerials erected on a house and dish(es) mounted on temporary foundations in the

garden, i.e. not concreted in as a permanent fixture, are exempt from planning requirements. The "array of aerials" complained about is not the concern of planning legislation. Had I lived in a conservation area however, or an area of outstanding natural beauty, I would have had to apply for permission to retain them.

It's wise to supply information in a simple, concise way. Planners are generally not familiar with RF technology, and appreciate guidance. They are also reasonable and helpful when you seek their advice.

I minimised any objections by approaching neighbours at an early stage to explain my activities and point out that the aerials would be used for reception only and would be insured etc. Clearly we need to live in harmony with our neighbours, and a degree of restraint and consideration is necessary – unless the Lottery coughs up and you can buy your own hill estate!

New DOE regulations allow a single 90cm dish at a domestic property without the need for planning permission – unless it's a conservation area/one of natural beauty.

I had to spend three months getting permission. But it worked for me. It should for you!

over sixty low-orbit satellites, has lost one of a recently-launched cluster of five. Fifty or so remain to be launched. The service is expected to start next autumn (1998). Sixteen satellites are in orbit, testing, and beltpack pagers have already received signals.

The Spanish Via Digital service has signed up BBC Prime and BBC World as part of a package via the Hispasat craft at 30°W, using MPEG digital compression. Seventy channels will eventually be available via this satellite. Both Simulcrypt and Multicrypt are to be used for Spanish services, ending a recent standards controversy.

Altair-2, which has replaced Cosmos 2054 at 16°W, may provide MIR downlink signals at times. Check at around 10-825GHz (circular) – at least a 1m dish is required.

Intelsat 802 is now at 174°E, replacing 701 which has moved to 180°E to replace the elderly and very tired 511. These moves have provided greatly improved C band signal quality across the Pacific Rim. Intelsat 803 is to take up position at 21.5°W, replacing 515:

it will provide C band signals at 42.5dBW and Ku band signals at 52.25dBW. 605 at 24.5°W lost telemetry during a recent orbital shuffle. A new series 8 satellite is to be positioned at 27.5°W, when 601 will move to 34.5°W, 603 to 24.5°W and 605 to a parking slot pending a decision on its future. 901 is to be built by Lockheed-Khrunichev Energia and will be launched via a Protom M rocket some time around April/May 2000.

At the Amsterdam IBC SNG operator SISLink uplinked pictures from its show stand camera via a succession of four PanAmSat craft, circling the globe, and received them back for display on a nearby monitor. Also at IBC, Intelsat announced that over 330 hours of transponder time have already been booked for the 1998 Winter



This NY stock exchange report was received via Intelsat K at 21.5°W

Olympics at Nagano, Japan. Much of it consists of short-term leases, using digital transmission.

Obituary

It is with deep regret that I have to report the death of a New Zealand radio DXer, Arthur Cushen. His monitoring skills during the Vietnam conflict gave hope and relief to many families who learnt that their relatives were in captivity rather than "presumed missing". Despite impaired sight, Arthur contributed to several international broadcasts over the years and gave an authoritative and respected face to the hobby of short-wave listening. He will be missed.



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Answer to Test Case 420 - see page 89 -

Two problems this month – in real life they very often come more than two at a time! The initial trouble, patterning with terrestrial TV reception whenever the satellite receiver was powered, is not that uncommon. It's caused by radiation from the satellite receiver being picked up by the UHF interconnection lead. The cure was to fit a replacement lead made from double-screened CT100 satellite cable, with metal coaxial plugs at each end. Cheap UHF interconnection leads have very poor screening. For MSS200/300/500/1000 series receivers there is also an official Pace power supply modification to reduce radiation – see page 5 of the Winter 1996 Service Matters bulletin from Pace.

What about the other business? The surprise that Doc Colin got when he returned with the sat-box was that Mr Greig had been having similar problems with the loan set. He had overcome them by repeating Colin's actions – he'd watched carefully – and by consulting the instruction book. If only he'd told us this! He said that he didn't want to cause any more trouble . . .

There was nothing wrong with either Pace receiver of course, apart from the vulnerability of all such receivers when the mains supply is 'rough'. Surges, glitches and 'outages' play havoc with satellite receiver operation. In this case the cure (touch wood!) was to fit a mains-cleaner plug.

NEXT MONTH IN TELEVISION

Servicing Panasonic NVL20/25/28 VCRs

Brian Storm provides a quick guide to servicing these popular but now middle-aged VCRs. They use the G deck and have super-still video heads, bar-code scanning for the clock and timer and an integrated bar-code scanner in the remote control unit.

TV Sound Systems

For many years manufacturers paid little attention to the audio side of TV. Then Nicam stereo came along, offering true hi-fi with the pictures. Since then we've had Dolby sound with various speaker arrangements and the spatial stereo system. Alan J. Roberts takes a look at the various systems available.

Digital Satellite Receiver Servicing

It's early days yet of course, but digital satellite receivers are around and it is possible to consider what servicing them will involve. The guidance presented by J. LeJeune in the concluding article in his present series relates mainly to Pace's digital satellite receivers, which have been available on the continent for some time now.

Dish Alignment by the Null Method

There are several advantages to the use of the null method instead of a meter for dish alignment. John Pitt-Francis explains the technique and provides details of a modified receiver that can be used for the purpose.

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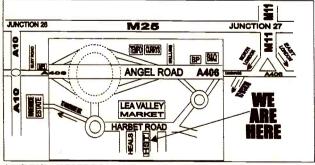
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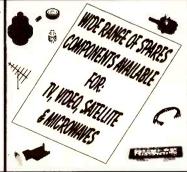
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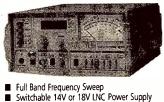
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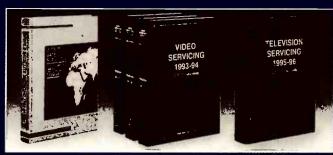
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0-120V-0-120V PRI 0-9V-0-9V SEC TRIPLER BG 2032-642-3002	£1.00 £7.00	ICC5 3112-338-326842	£4.00	PANASONIC SMALL UHF/VHF	£3.00	AT2077/81 DST81N243/472593-00	£15.00
TRIPLER BG 2032-002-3002 TRIPLER BG 2087-642-1005 TRIPLER KT3/K30	£7.00 £4.00	GRUNDIG TRIPLERS BG2032-642-3002	£9.00	SANYO		DST85B235/47328700 & /40153200 EACH DST88N234/400086AD, & /47805200L EACH	£10.00
TRIPLER - UNIVERSAL	£5.00	TRIPLERS BG2087-642-1005 TRIPLER WITH FOCUS POT	£9.00 £7.00	UHF/VHF TDO 124EB SHARP	£4.00	DST88N234/47320041, & /47317590 EACH DST186N243/473058-00	00.012 00.012
TUNERS - SEE SEPARATE LISTING TUNING POTS - 8 WAY	50p	UNIVERSAL TRIPLER - UPRIGHT		TUNER AND IF 1810587 PAT UK TATUNG	£3.00	TFB3035D, TFB3069D, TFB4023AD EACH TFB4039AD, TFB4066AD EACH	£10.00
AMSTRAID		PRINTED CIRCUIT TYPE	£9,00	UNIVERSAL 205 OR EQUIVALENT	ro co	FERGUSON TX9	£4.00
DISPLAY PANEL - LONG CHASSIS - 1992/93 FRONT PANEL FOR ALL 1992 MODELS	£4.00 £4.00	HITACHI DECODER-TELETEXT PC232A5 ~ ISSUE 4	£15,00	WITH AERIAL SOCKET	£8.00	TX10 TX85, TX86 EACH	£6.00
HEAD AND DRUM - 6000 HEAD AND DRUM - NICAM	£12.00 £12.00	HEAD AND DRUM – 620E MAINS SWITCH WITH STAND-BY	£12.00 50p	MOTORS		TX89, TX98, TX99 EACH Y260781	£12.00 £8.00
PANEL-CLOCK DISPLAY = 8,900 PLASTIC FRONT WITH FLAP = 8,900	£5.00 £3.00	MODULATOR No 5587881 OSCILLOSCOPE 20MHZ DOUBLE BEAM –	£5.00	CAPSTAN – ACE G4-B to ACE G40-B MICROWAVE TURN TABLE MOTOR	£10.00 £10.00	FSTY260482	£10.00
POWER SUPPLY-VS 1000-VS 1100 POWER SUPPLY, LONG OR SHORT CHASSIS	£5.00	V212	00.8813 00.013	MATSUI		LOPT BLUE SPOT LOPT RED SPOT	£6.00
1991/1992 MODELS	£3.00	PANEL-TELETEXT PC315-11 - ISSUE 7	£15.00	CAPSTAN VSR1500 I/C NO. M56730 ASP MITSUMI	£15,00	LOPT WHITE SPOT & YELLOW SPOT EACH PANASONIC	00.83
POWER SUPPLY – SWITCH MODE – DOUBLE DECKER	£5.00	PANEL-TEXT-VT753E	£15.00 £20.00	MOD MRF7-UF32 MOD TMUG3-103A	£5.00 £5.00	TC2203, TLF 1456B EACH TLF1457B. TLF701/6 EACH	£15.00
20 OFF MIXED NOKIA FIT.		POWER SUPPLY TV SWITCH MODE STR 4211 ISSUE 10	60.83	MITSUBISHI			£10.00
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7805 20p 2SD1432 £1.00 7806 20p 2SD1453 £1.00 7809 20p 2SD1576 £1.00	BU208A BU208D BU222	\$1.50 BUW\$4 60p BYX38/300 90p BUX39 £1.00 BYX\$5/250 £1.00 BUX84 50p BYX\$5/600 £1.00 BUX\$4AF 50p BYX57/60	25p 10p 10p 20p 10p 5p 3p 50p	ALP-15 13.50		Z COMPONENTS No Credi	
7812 20p 2SD1577 £2.00 7812F 20p 2SD180T03 15p 2SC940 £1.00 2SD1878 £1.00	BU326 BU407 BU508A	£1.00 BUX84AF 50p BYX71/60 40p BUY49 20p BYZ106 90p BY187 5p BZW-C110	20p 10p			IGNTON, SHOEBURYNESS,	
2SC3795 £1.00 AN5521 £1.00 2SC3973B £1.00 AN5551 £1.00	BU508AF BU508D	£1.00 BY208-800 8p BZW83-C20 80p BY228 15p CA3123Q	3p 50p	IR106A 10p		SSEX SS3 8AF.	
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