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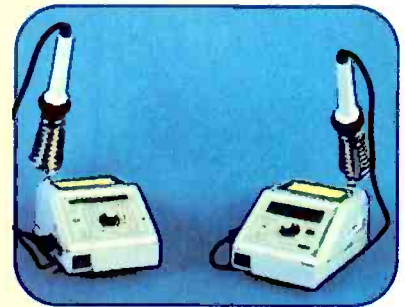
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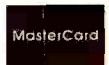
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HDTV: perpetual sideshow?

What is high-definition TV? Back in 1936, at the beginning of the modern TV age, 405 lines qualified. It represented a quantum leap in terms of vertical picture resolution. Just after World War 2 the French adopted an 819-line system. It provided superb monochrome pictures, but was wasteful of bandwidth and was dropped in 1984, a year before the UK's 405-line system came to an end. From 1949 onwards most of Europe adopted the CCIR 625-line standard, which is basically a 50Hz version of the US 525-line system that dates from 1941. In recent years HDTV has tended to mean 1,125/1,250 lines, i.e. double the 525/625-line definition.

Much work on developing a practical HDTV system was done by the Japanese broadcaster NHK, which tested a 1,125-line system via the Yuri experimental satellite in 1980. By 1982 there were public demonstrations, and the whole gamut of studio equipment required had been developed – at enormous cost. But the bandwidth required was excessive, even in satellite terms. MUSE (Multiple Sub-Nyquist Sampling Encoding) was subsequently developed by NHK as an analogue signal compression technique to get the signal into a standard channel bandwidth. It works, but is costly. And in the digital era it has fallen by the wayside.

Digital TV techniques make almost anything possible. If HDTV is really wanted, digital technology can provide it. In fact the MPEG system has been designed to provide HDTV as an option. It's a trade-off situation: HDTV pictures

with fewer channels, or more channels with an acceptable-quality standard-definition picture. For most people a good picture, such as that provided by 625 lines, is perfectly OK and any enhancement of TV provision should be devoted to more channels. Possibly those stuck with 525 lines might be a bit less inclined to agree: the extra 100 make a lot of difference.

Higher definition has always been a goal of TV technologists however. Hence the Japanese MUSE system, which never really took off, and now the US digital, compatible system. The first US HDTV broadcasts, on a limited, experimental basis, have just begun: on November 8th CBS broadcast an American football game live in HDTV form, largely to test its equipment. The extension of HDTV broadcasting in the USA is expected to be slow, because of the cost of equipment. It has been estimated that HDTV sets to the US standard will be about twenty times more expensive than conventional receivers. This is largely because of the cost of the display device technology. So the market is likely to be slow to develop. Stanford Resources, a US market research firm, estimates that HDTV receivers will account for two per cent of the US market by the year 2004 – in comparison its estimate for the Japanese market is ten per cent (always assuming that Japanese consumers have regained some confidence by then).

The bandwidth problem has been largely resolved by digital technology/compression. When TV enhancement was being considered back in the

Fifties/Sixties colour was seen as being far more important to viewers than higher definition. Its introduction probably did much to put back work on HDTV. It is well-known that the human eye is relatively insensitive to colour detail. So once you have a colour picture, resolution matters less. With the use of colour-difference signals, which have been retained for digital TV systems, the colour content of the picture is a sort of over-wash on top of the basic monochrome content. Once this colour has been added, a standard-resolution (i.e. 625-line) picture seems to be perfectly adequate for normal viewing. Signal processing within a TV set, e.g. digital signal crispening circuitry, can do quite a bit to improve the resolution with a standard-definition display.

What it boils down to is this: while MPEG HDTV transmissions now present no technical problems, if the cost of sets, not to mention studio equipment and the rest, is likely to be ten-twenty times more than that of standard-definition equipment there is not going to be any great rush to move to HDTV.

The other factor in the equation is the number of channels. With digital TV you can have say 200 standard-definition channels or a markedly lower number of HDTV channels, not both. No prizes for guessing what most people would prefer. While HDTV does make a difference to the viewing experience, it's not enough of a difference. It seems that for the foreseeable future HDTV is likely to remain something of a sideshow in the TV world.

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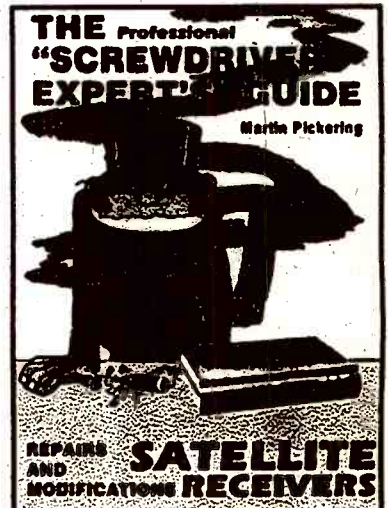
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1N5822	0.98	2SC392A	6.82	AN7190K	11.11	BC846B	0.16	BU2525AF	3.11	CD4094	0.69	PK6E130A	2.57	TBA820M	0.40	TDA8175	4.41
1N914	0.02	2SC3953	0.72	BA157	0.09	BC847C	0.23	BU326A	1.36	CNX62A	1.29	PK6E180A	4.65	TBA920	2.75	TDA8178FS	10.30
2N2222A	0.28	2SC3955	0.81	BA158	0.07	BC848	0.58	BU406	0.69	CNX82A	2.16	R2KL	0.77	TC9154AP	2.99	TDA8180	4.87
2N3055	0.52	2SC3973B	2.57	BA159	0.11	BC848B	0.35	BU426A	0.86	CNX83A	2.55	R2M	0.84	TDA1013A	1.56	TDA8190	3.59
2N3055H	1.29	2SC4231	3.97	BA3910B	6.99	BC848C	0.41	BU500	1.41	CNY17F	0.98	R4050	3.04	TDA1013B	2.57	TDA8190	3.59
2N3440	0.72	2SC4517A	3.14	BA3918	6.41	BC850C	0.25	BU506D	1.80	CNY75B	0.52	RG2	0.64	TDA1015	1.37	TDA8218	4.62
2N3773	1.52	2SC5129	6.27	BA4558	6.69	BC856B	0.21	BU506F29	2.31	D2VREM	16.95	RGPI10G	0.26	TDA1044	1.43	TDA8350Q	3.56
2N3904	0.32	2SC5149	7.69	BA5406	2.14	BC858	0.24	BU508A	1.29	DCREG	13.95	RGPI5G	0.33	TDA1060	2.65	TDA8380	2.53
2N4401	0.11	2SC536	0.30	BA5412	2.48	BC858B	0.21	BU508AF	1.32	DTA114ES	0.31	RGPI5J	0.17	TDA1085C	2.74	TDA8391	7.69
2SA1012	1.17	2SC945	0.11	BA6209	1.18	BC858C	0.19	BU508AF1	1.37	DTC124ES	0.77	RGPI30M	0.30	TDA1170	1.85	TDA9503	2.13
2SA1013	0.35	2SD1138	0.94	BA6209N	1.95	BC859A	0.18	BU508APH	1.00	DTC14EF	0.18	S2000A	2.57	TDA1170N	2.57	TEA1039	2.11
2SA1015	0.11	2SD1207	0.57	BA6219B	1.77	BC875	0.45	BU508D	1.56	DTCL44ES	0.19	S2000AF3	3.59	TDA1170S	2.05	TEA2018A	2.29
2SA1015Y	0.98	2SD1292	0.64	BA6247	3.42	BCY59	0.26	BU508F	1.88	FR605	1.90	S2000AF	1.46	TDA1175	9.40	TEA2029C	7.04
2SA1016	0.26	2SD1330	0.31	BA532L	0.67	BCY71	0.28	BU508V	2.40	FXT749	0.43	S2000N	3.59	TDA1519A	4.87	TEA2029CV	3.56
2SA1020	0.44	2SD1398	2.14	BAT43	0.52	BD131	0.26	BU508Y	1.03	H1000L	5.50	S2055AF	2.24	TDA1521A	2.91	TEA2031A	4.24
2SA1020Y	0.53	2SD1426	3.51	BAT85	0.96	BD132	0.26	BU807	0.60	HA13119	2.09	SAB3035	3.06	TDA1524A	5.25	TEA2164	3.40
2SA1145	0.36	2SD1439	5.86	BAV20	0.26	BD136	0.24	BU908	1.68	HA13150	15.12	SG264A	12.88	TDA1554Q	8.12	TEA2164G	4.39
2SA1302	4.45	2SD1441	5.98	BAV21	0.21	BD139	0.31	BUFA05A	2.99	HA13151	18.24	SGSIF344	10.70	TDA1557Q	4.23	TEA2165A	9.58
2SA562	0.18	2SD1453	3.85	BAV14	0.17	BD140	0.24	BUH515	2.14	HM6251	14.32	SL1431	2.82	TDA1558Q	7.69	TEA2260	3.32
2SA673	0.18	2SD1497	4.74	BC107B	0.20	BD234	0.52	BUH515D	2.14	IRFBC40	2.65	SR2KN	1.29	TDA1675A	3.85	TEA2261	3.68
2SA683	0.36	2SD1541	4.96	BC108	0.24	BD241A	0.38	BUH515	2.14	JCS01	4.86	ST4411C	3.86	TDA1904	1.63	TEA5101A	6.48
2SA684	0.43	2SD1545	6.84	BC108C	0.15	BD243	0.45	BUK444500B	3.47	KA2206	1.37	STK4132H	6.80	TDA2005	1.83	TEA5101B	6.48
2SA733	0.18	2SD1546	7.69	BC109B	0.28	BD243C	0.44	BULL54AR	1.27	KA2206G	2.40	STK4141H	8.44	TDA2006	1.06	TEA5107	2.57
2SA933	0.60	2SD1548	5.95	BC141	0.36	BD244C	0.43	BU111	0.65	KBU602	2.18	STK4142H	9.40	TDA2030H	0.91	TIC106D	0.82
2SA940	0.82	2SD1554	3.25	BC182	0.14	BD317	1.78	BU111A	0.95	KIAG210AH	6.15	STK4152H	10.95	TDA2030V	0.00	TIC2462	1.54
2SA950	0.18	2SD1555	2.65	BC182L	0.14	BD433	0.29	BU111AF	1.18	KSR1004	0.21	STK4192H	15.63	TDA2050	4.56	TICP106D	0.72
2SA952	0.18	2SD1556	5.11	BC184L	0.06	BD434	0.31	BU112A	1.17	LA4282	5.11	STK5332	2.82	TDA2511	1.12	TIP110	0.35
2SA966	0.69	2SD1650	2.48	BC212	0.12	BD435	0.38	BU112AF	1.87	LA4705	6.41	STK5342	4.07	TDA2577A	3.45	TIP111	0.57
2SA970	0.19	2SD1651	2.38	BC212L	0.18	BD436	0.52	BU118AF	1.37	LA6324	3.25	STK5372H	6.84	TDA2578A	3.20	TIP112H	0.77
2SA984	0.38	2SD1761	0.94	BC237	0.12	BD437	0.52	BU156A	1.19	LA7116	1.70	STK5481	8.12	TDA2579A	4.91	TIP120	0.40
2SB1010	0.35	2SD1815	0.86	BC237B	0.19	BD438	0.38	BUW11A	1.54	LA7830	1.88	STK7253	10.51	TDA2581Q	2.57	TIP2955	0.89
2SB1143	0.77	2SD1858	0.43	BC238	0.11	BD839	0.57	BUW12A	2.99	LA7832	2.40	STK730-060	11.65	TDA2593	1.12	TIP29E	0.77
2SB1243	0.69	2SD1877	2.14	BC238B	0.16	BD901	0.52	BUX84	1.03	LA7833	5.98	STK73410H	6.82	TDA2611A	0.84	TIP3055	1.08
2SB560	0.43	2SD1878	2.63	BC239	0.04	BD911	0.52	BUZ71A	1.03	LA7835	3.51	STK7348	5.74	TDA2653A	4.70	TIP31A	0.41
2SB649A	0.77	2SD1879	2.23	BC258	0.09	BD912	0.63	BUZ77B	4.27	LA7837	8.53	STK73907	10.48	TDA2822M	1.37	TIP41C	0.65
2SB688	1.61	2SD1884	3.35	BC307	0.06	BD912	0.60	BUZ80	3.52	LA7838	2.65	STR10006	3.94	TDA3031B	9.12	TIP42A	0.35
2SB774	0.99	2SD1887	3.56	BC307B	0.15	BF199	0.18	BUZ90A	3.40	LA7839	4.70	STR11006	7.37	TDA3550	2.40	TIP42C	0.52
2SB793	1.71	2SD1889	2.14	BC308	0.09	BF240	0.11	BUZ90AF	3.30	LA7839	4.70	STR50020	6.38	TDA3560	6.13	TIPL761A	1.85
2SB892	0.35	2SD2012	0.86	BC309B	0.10	BF245A	0.19	BY127	0.14	LA7839	4.70	STR50103	5.46	TDA3561A	3.85	TIPL791A	2.48
2SC1383	0.32	2SD400	0.34	BC327	0.10	BF258	0.04	BY133	0.08	LA7839	4.70	STR50103A	5.58	TDA3562A	6.62	TLO72CP	1.03
2SC1740	0.16	2SD400F	1.20	BC238	0.14	BF324	0.18	BY184	0.33	LA7839	4.70	STR5142M	13.25	TDA3565	2.74	TLO82	1.04
2SC1740S	0.84	2SD467	0.57	BC337	0.14	BF420	0.21	BY227	0.13	LA7839	4.70	STR54041	5.15	TDA3576H	10.31	TLR731	1.95
2SC1815	0.17	2SD669A	0.79	BC338	0.06	BF421	0.24	BY228	0.26	LA7839	4.70	STR5412	4.52	TDA3592A	4.60	TMP47C432AP8189	21.84
2SC1815Y	0.12	2SD718	1.90	BC368	0.18	BF422	0.19	BY229	1.34	LA7839	4.70	STR58041	3.42	TDA3603P	5.62		
2SC1846	0.52	2SD837B	1.12	BC369	0.18	BF423	0.14	BY255	0.14	LA7839	4.70	STR59041	8.11	TDA3650	9.27		
2SC2023	3.18	2SD856	0.79	BC372	0.53	BF458	0.31	BY298	0.15	LA7839	4.70	STR6020	6.07	TDA3653B	1.54		
2SC2120	0.69	2SD965	0.26	BC546A	0.11	BF459	0.43	BY299	0.18	LA7839	4.70	STR61001	10.86	TDA3653C	2.82	TOP204YA1	4.10
2SC2229	0.35	2SD965R	1.05	BC546B	0.12	BF469	0.35	BY399	0.16	LA7839	4.70	STR64420	11.17	TDA3653CQ	2.57	U2829B	3.49
2SC2230	0.55	2SK1118	3.40	BC547	0.11	BF487	0.57	BY448	0.30	LA7839	4.70	STR66008X	8.66	TDA3654	1.44	U4614B	0.78
2SC2235	0.36	2SK135	11.02	BC547A	0.04	BF494	0.12	BY476	1.00	LA7839	4.70	STR66202	12.89	TDA3654Q	2.82	UC3842	5.74
2SC2236	0.36	2SK1507	5.														

What a Life!

Some test card music takes Donald Bullock on a trip back to the Fifties. Followed by some more up-to-date problems

While listening to the radio recently I heard a programme about a society for the preservation of the music that used to accompany the TV test cards, in the good old days when they were displayed for the best part of the working day. Its leading light was interviewed during the programme, and some of the tunes were played. They seemed to go back no farther than the Sixties however.

My mind floated back to the Fifties, when I worked in the busy TV servicing workshop of Foyles Furnishing at Gloucester. Happy days – in spite of the off-peak heaters, full of firebricks that warmed up all night and gave off their heat next day whether we wanted it or not. In the spring and autumn, when

the days started off nippy but soon became hot, we suffered.

The 405-line sets we worked on at the time had large wooden cabinets and big speakers. Most of them produced excellent quality sound. I can still hear the sprightly melody of Sylvia, one of a lengthy medley of strict-tempo tunes that came on each day to accompany test card C. Does anyone else remember it? I've no idea which orchestra played it, but I'd love to hear those arrangements again. Just the thought of them nowadays conjures up some rose-tinted memories.

Rhoda Roughneck

One of our customers was Rhoda Roughneck, who ran a dockside pub. She had a 14in. Ferguson set. In those days the BBC's Band I transmissions reached us from Birmingham without difficulty. But the ITV signal, in Band III, didn't do so well: we were well into the fringe area and, even with a masthead amplifier on a high rig, poor, fading reception was common.

To deal with this situation many manufacturers, including Ferguson, produced service- and fringe-area models. The latter would incorporate flywheel sync. Mrs Rough-neck's set was one of them, and this compounded the problem. In those days flywheel sync caused us as much trouble as it was supposed to avoid – ask anyone who had to repair a Pye V4.

We would see Rhoda three or four whiskeys into the morning, after her set's line sync had flown off. She would be bawling away and we would creep down to watch as she marched around the showroom, twisting the music racks on the pianos, pummelling the keys and slamming the keyboard lids up and down.

Tenpercent Morris

Then there was Tenpercent Morris, another pub landlord, who boasted

that he never paid for anything in full. He'd come in, choose a couple of TV sets and perhaps a pair of tables, then, when told the total price, remind everyone within earshot that he was a loaded cash customer who was always given a discount.

"Come on, ten per cent off, as usual" he'd declare.

Stan would smile ruefully, shake his head sadly, and do the sums. Then Morris would pay up and walk out, smirking.

After seeing this performance for about the third time, I ventured to ask Stan how he could afford it.

"Easy" he replied, "I always put ten per cent on first."

Sony Stacking System Faults

My oldish Sony stacking system, which lives in Spain, has given me two bits of trouble. Both cassette decks failed and jammed, and the pick-up arm in its Model PSLX50 record deck took to returning only half way back towards its rest position.

The tape deck trouble was, in both cases, caused by the tiny drive tyre cracking apart. We didn't have any replacements, but we did have one tyre that was of exactly the right diameter and thickness but twice the height of the original ones. Son James found an old pen of the right size, slid the tyre on to it, then carefully cut centrally around it with a craft knife to divide it into two.

The result matched the originals and worked. While at it we replaced the belts and cleaned up and lubricated both mechanisms before reassembling them.

The pick-up problem was caused by failure of Q101, a transistor that's associated with the record-size selector. It had become leaky between its collector and base.

Amstrad PCW Problems

I referred recently to my Amstrad PCW8512 word processor's habit of



We would see Rhoda three or four whiskeys into the morning

locking up when booting up. When he did this the red light in the shift lock key lit up. This prompted a detailed letter from Simon Pearson of Chipping Norton, who suggested that I check whether the 5V supply was incorrect or unstable. He also referred to my comment about the printer's ribbons drying out quickly in the Spanish heat. Apparently there used to be an aerosol for re-inking ribbons. Its contents resembled black WD40. You had to raise and remove the ribbon cassette's cover, spray the ribbon inside, then the bit outside before winding it in, and finally leave the cassette for a fortnight to steep. He went on to suggest that ordinary WD40 might do the trick. I didn't have any WD40, but I've sprayed a dry ribbon or two with another make of oil aerosol.

Simon also referred to my difficulties in using with the PCW8512 the mint Commodore MPS1270 ink-jet printer I found. It seems that in addition to a lead I need an "interface" which, I think, is a pair of back-to-back sockets that connect the printer wires to the right places. He also drew my attention to an article on adding such a printer in the January 1994 issue of *Television*.

Fidelity CTV920

While I was back in England recently Miss Pinhead, the traffic warden, strode in with her Fidelity CTV920 TV set. "Is that your car?" she asked, pointing to a Bentley across the road. I gave her a pained look.

"Spluttering and whining" she said.

"I didn't say a word" I protested. She jerked her thumb at the set. "This 'un, I mean."

When she'd departed Steven put the set on his bench and removed the back. The cause of the trouble was easy to see. C171, the 3.3nF, 1kV ceramic disc capacitor in the chopper circuit's snubber network had turned to coke. He fitted a 2kV replacement which did the trick.

A Camcorder

Then Mr Parker came in with an Hitachi camcorder, Model VMC1E.

"Good morning" I said. He just glowered at me. So I picked up the camcorder and looked it over while he watched in silence. "What's its trouble?" I asked. He just shrugged. Two lots of trouble here I thought. Then I shot him a false smile.

"Some time tomorrow?" I asked. He walked out.

I can't even work camcorders let alone mend them. This was clearly

one for Steven. It was completely dead.

He checked the 2A circuit protectors on the power input board below the battery compartment, either of which can go open-circuit to cause the symptom, but they were both OK. He then followed the power input along to the underside of the main PCB, where he spotted C824, a 22 μ F, 6.3V capacitor that was sitting in a little patch of leaked electrolyte. This was clearly the cause of the trouble.

Steven removed the capacitor and set about cleaning the nearby section of print, which supplies pin 8 of the syscon chip IC802 with 5.3V from regulator IC804. It had corroded through at one point. After bridging it and fitting a replacement capacitor all was well.

Next day Mr Parker came in and stood at the counter.

"It's ready" I said, placing the camcorder in front of him. "Fifteen pounds."

He peeled some notes from his wallet, put them down, picked up the camcorder and left.

"Not exactly a gabbler, is he?" commented Steven.

Some Sony TVs

Paul, who is most at home dealing with VCRs, had been working on a Sony Model KVM2151U (BE2A chassis). Instead of a picture it displayed just a few dim patches of colour. The fact that the tube had no first anode supply took him to D806 (GP02-17) which was short-circuit and R812 (1k Ω , 1W) which was open-circuit. After replacing them the set worked well. It's a common fault with this chassis.

Our next caller was Victor Smallpiece, a timid, thin-faced Welshman with a piping accent.

"My Sony tele-viss-ee-on set's in the caah, Mistah Bull-ock" he trilled. "Ac-chew-al-ee my silly wife took it to Gumboils while I was in Way-yells last week."

I went out and brought the set in. It was a KVM2130U (BE1 chassis) and the line output stage was in trouble. In this chassis the line output transistor Q802 must be a BU506DF. Gumboils had fitted a BUT11AF, which isn't up to the job. It doesn't incorporate a diode either, so they'd connected an unmarked, heavy diode from the collector to chassis.

The line output stage is protected by a 1A Wickman fuse (PS802) which blows in the event of a short-circuit. It had been replaced with a 100 Ω , 1W resistor that had gone

open-circuit. Once the correct parts had been fitted the set worked perfectly.

When he called back Victor Smallpiece was delighted to find his set working. "Per-son-all-ee I don't bee-lee-ve Gumboils to be at all com-pett-ent" he observed.

"Victor" I said, "you've got it in one."

Video Faults

Meanwhile our video department Paul was dealing with a Matsui VX755A VCR, which is similar to the Saisho VR3600Z. The fault was reported as no functions, with parallel stripes of test signal displayed in the E-E mode whether the test was on or not.

Paul switched the machine on and the standby light lit. The clock display was all right, but the machine wouldn't accept a tape. He decided to check the STK5332 regulator chip IC501 and found that there was only 3V instead of 5V at pin 1, thus disabling the machine. A replacement restored normal operation. We've had the voltage fall as low as 0V – in this condition the display lights but there are no other functions.

Then he pulled up a Panasonic NV366. It produced a clear picture, but the top half inch was marred by a displaced ghost several inches higher. With a freeze frame the entire picture was clear. The cause of the problem was the head – a replacement from SEME cost £20.

Business

Our last caller that day was a fattish businessman, Mr Hubblewaite. He struggled out of his Jaguar with an old Matsui portable, Model 1402.

"Evening chaps!" he wheezed as he tapped cigar ash about the place. "This belongs to the girl friend." He winked, then formed a series of curves in the air with his podgy hands.

The set was dead. It uses an STR50103 chopper chip (IC650) which had died. The basic cause of the trouble seemed to have been the 100 μ F, 400V mains bridge rectifier's reservoir capacitor C658, which had fallen in value to 1 μ F. The R2M overvoltage protection diode D668 and the 2.7 Ω , 5W surge limiter resistor R655 had also failed.

The set worked well enough once these items had been replaced. Mr Hubblewaite was more than pleased when he called to collect it, with his ladyfriend. "Thank you boys" he said as he departed, propelling her to the door with a finger in her back.

TELETOPICS

SkyDigital's take-off

SkyDigital's services have had a successful launch, with some 100,400 digital satellite TV systems ordered during October, the first month of full operation. Actual installations were about 65,000, as initial demand exceeded expectations and equipment/installation delays developed. SkyDigital should have little difficulty in comfortably exceeding its target of 200,000 subscribers by Christmas.

BSkyB's call centre at Livingstone, Scotland has been receiving 100,000 enquiries a day about the digital service. An extra 1,200 staff have been recruited to deal with the calls, while 500 extra installation engineers have been taken on. Amstrad and Grundig are due to

start supplying set-top boxes for the service shortly.

While digital satellite TV has made a successful start, the total number of BSKyB's analogue TV subscribers fell by 17,000 during the quarter to end September. There was an increase (about 117,000) in the number of subscribers receiving the service via cable.

SkyDigital is to launch a video-on-demand service next year: it will enable viewers to call up video clips and data via a remote control handset. Viewers will, for example, be able to see replays of sporting action while watching a match. The move follows news that ONdigital is to launch information services via its digital terrestrial TV service next year.

Interactive TV

There have been a number of developments in the interactive TV sector. Cable TV operator Telewest has adopted the Open TV standard, which is also used by British Interactive Broadcasting, rather than one based on internet standards. The other two main UK cable operators, CWC and NTL, are to use internet-based technology.

NTL Interactive is to be launched on March 31st next year. Microsoft will provide the hosting software and develop server technology, while ICL will act as system integrator. NTL is approaching companies that want to market products and services through interactive TV set-top boxes.

NTL is to deliver two types of service to consumers via set-top boxes linked to a telephone line. One, already launched, includes TV-based internet access. There will later be the option to use an STB for both internet and digital TV services. NTL has ordered 100,000 digital cable set-top boxes from Pace. They will conform to the DVB-RC (Digital Video Broadcasting - Return Channel) standard, incorporating a cable modem.

Pace has demonstrated a digital cable set-top box developed for CWC. It includes DTV Navigator software developed by NCI - this offers interactive TV and internet features. CWC has ordered 100,000 of the boxes and plans to launch a digital service next spring.



CPC has added this new range of multimeters, from Wavetek, to its extensive list of test equipment. The handheld, pen-type multimeter, with built-in 3.75-digit display, is ideal for use where space is restricted. The DM78A pocket multimeter is designed for field use. The XL series models have compact, robust construction and a variety of additional application-specific features. The HD110B and HD115B are intended for use in harsh environments. For further details phone CPC on 01772 654 455

Satellite TV

Eutelsat's Hot Bird 5, which was launched from Cape Canaveral on October 9th, is now in operation at 13°E where it has taken over from Eutelsat II F1. Hot Bird 5 increases the number of transponders at 13°E by five, to a total of 98 capable of handling 90 analogue TV channels, 900 digital TV channels or a combination. Hot Bird transmissions now reach 70-6m homes in Europe, Africa and the Middle East, an increase of 6.5m over the last year. Earlier Eutelsat W2, which was launched four days before Hot Bird 5, took over from Eutelsat II F3 at 16°E.

Astra 2A, SES's first digital satellite, entered commercial service on October 1st at 28.2°E. Sirius-3 is heading for 28.2°E as a back-up satellite. Astra 2B is to be launched in the second quarter next year and will occupy the same orbital slot.

Longreach has introduced the Platinum LNB which has been designed specifically for digital TV reception. It was developed in conjunction with Cambridge Industries and is being marketed under the Maspro brand name. It's exclusive to Longreach and Michael Black customers at a price of just under £25 per unit. The noise figure is an amazingly low 0.6dB.

Widescreen Television

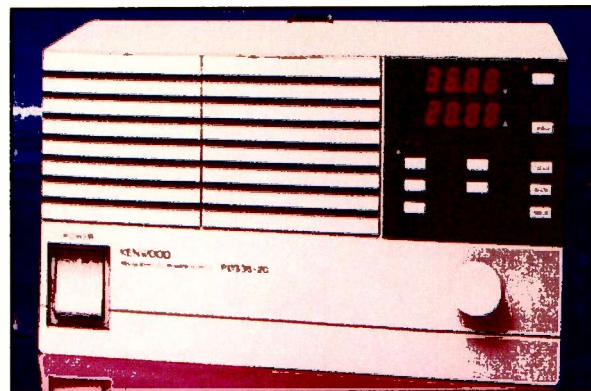
According to BREMA, sales of widescreen TV sets in the UK showed a year-on-year growth of 300 per cent in September. Over 250,000 have now been sold. There are plenty of new models to tempt consumers.

Sanyo has launched two models (28WP2 and 32WP2) that feature the Super Active 3D system, Megatext, super flat tubes, auto-expansion and scan velocity modulation for improved sharpness. Sanyo says that the widescreen market is at present six per cent of large-screen set sales and expects this to

rise to around twenty per cent by the end of next year.

Toshiba's latest widescreen model (28W8DB) includes Dolby Pro-Logic with seven speakers, NTSC playback and digital surround processing.

Samsung has launched Model SP403JHA, a 40in. widescreen LCD rear-projection set. Features include progressive scan technology, a digital noise-reduction system and Dolby Pro-Logic acoustic 3D. The TFT LCD panel has over 760,000 pixels. It's expected to sell at about £2,450.



Kenwood Electronics has introduced a new range of high-performance, universal bench DC power supply units. The models in the PDS range are as follows: PDS20-18, PDS20-36, PDS36-10, PDS36-20, PDS60-6, PDS60-12 and PDS120-6 – the first figure indicates the maximum output voltage, the second figure the maximum output current. The innovative design uses a combination of switch-mode and linear technology to provide lightweight, compact units with the performance level previously available only with heavy, fully-linear designs.

Key specifications include voltage line and load regulation better than 0.005 per cent; current line and load regulation of 1mA; low transient response (100µsec); and a temperature coefficient of typically 100 p.p.m. All models incorporate dual 3.5-digit displays which in addition to providing simultaneous voltage and current output indications can be used to set the levels. For further information phone Kenwood UK Ltd. on 01923 655 291.

Discs

DVD was officially launched in the UK on October 14th: over 250 DVD movie titles are expected to be available by the end of the year. Warner Home Video has launched its first two DVD-9 (dual-density) films, *Contact* and *The Postman*, at £16. Dual-density discs can store up to three hours, twenty minutes of programme material – so far the majority of releases have been single-sided, DVD-5 discs capable of storing up to 130 minutes of material on the single side.

Samsung has launched a new DVD player, Model DVD907, with a built-in Dolby Digital decoder. Panasonic's latest model is the DVD-A150. The Sharp DV560H incorporates digital gamma correction to enhance the dark areas of the picture and "digital super picture" to provide improved edge resolution with objects or people in shot. These models all double as CD players.

Sony has just launched the portable DVD Discman Model PBD-V30 which also plays CDs. It can be

powered by a Sony camcorder battery or an AC adaptor that comes with it, and can be connected to most screens including laptops.

Pioneer has developed a rewritable DVD system, DVD-RW, which has a 4.7Gbyte capacity – the capacity of the existing DVD-RAM format is 2.6Gbytes per side. According to Pioneer its new format is compatible with the existing DVD-R, DVD-ROM and DVD-Video formats. DVD-RW has been submitted to the DVD Forum, which is responsible for the adoption of DVD technical standards.

Pioneer has also developed a prototype DVD system that can store up to 15Gbytes of data, enough for more than four hours of high-definition video. Pioneer has produced a semiconductor blue laser pick-up.

Kodak and Intel have developed a new optical disc format, Picture CD, which stores images on a CD-ROM for viewing via a PC – shades of Photo CD. The system is to be launched in the USA early next year.

Piracy

The use of unauthorised decoders to view pay-TV services is expected to be made illegal throughout the European Union. Ministers have backed a proposed directive that has also received broad support from the European parliament. The directive would make any commercial activity relating to unauthorised viewing of encrypted services illegal, including the sale of decoders, smart cards and other pirate devices. The manufacture, import, sale, possession, installation, maintenance or replacement of a device for commercial purposes would all be banned. Marketing and advertising would also be banned.

As more pay-TV services have been introduced there's been a big increase in piracy.

Business News

Poor trading results have been announced by several major Japanese electronics manufacturers. Hitachi has been particularly hard hit, reporting its first half-year loss, of some £620m, since 1949. The company has warned that the loss could more than double by the end of the financial year. Toshiba made a loss of some £28m during the first six months of its current trading year, the first for 48 years: some improvement is expected in the second half of the year.

Sony has announced lower profits for the half year to end September and has warned that the company is likely to make a loss in the second half, its first for six years. While sales in the electronics section rose by 9.6 per cent, income fell by 23 per cent. Computer moni-

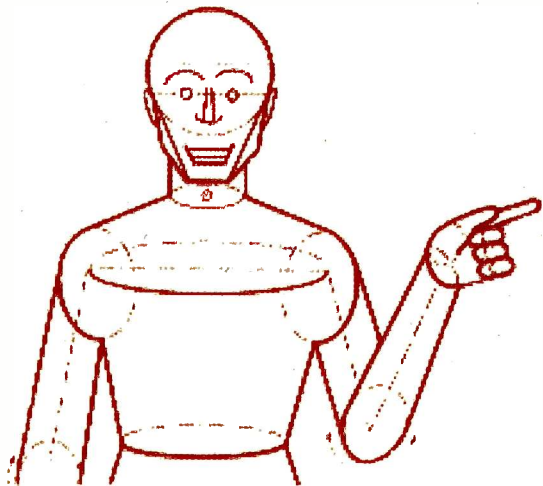
tors, cellular phones and other communications products came under price pressure, but MiniDisc systems, camcorders and, in the USA, DVD players produced successful business.

Sharp has warned that its results for the year to end September were the worst in the group's history. Lower prices for semiconductor devices and LCD screens are to blame. The company expects an improvement during the next half year. NEC, Japan's largest semiconductor device and leading PC manufacturer, has reported a first-half loss: the company expects its first full-year loss for six years. Fujitsu, the largest Japanese computer manufacturer, has reported a sharp profit decline for the half year.

Earlier, Matsushita warned of a 66 per cent fall in profits for the half year while Pioneer has announced a loss, mainly because of a sharp decline in investment values.

Philips plans to reduce the number of its manufacturing sites from 244 to between 160 and 170 over the next four years. Twenty five plants have already been closed this year and another eighteen are scheduled for closure. The company, which expects flat profits this year, is to consider global partnerships with other electronics manufacturers.

It seems that NEI/Network is to withdraw from the TV/video business in the UK. We understand that spares will be handled by Maplin. The two companies are part of the same group.



Toshiba Service Briefs

More know-how from Toshiba, based on Technical Bulletins AH71 and AH72

TV Sets

Models 2173DB (C7S chassis) and 2573DB/2873DB (C7SR chassis)

Intermittent failure to respond to remote control commands, OK after a full reset: This microcontroller lock-up problem is caused by a software anomaly. The cure is to replace the microcontroller chip QA01 with a modified type as follows:

Model 2173DB type SAA5297A/056, part no. 23906377.

Models 2573DB and 2873DB type SAA2597A/055, part no. 23906378.

In Model 2173DB a 100µF, 25V capacitor must be added between the junction of RV60/RA84 and chassis, as shown in Fig. 1.

Model 2550TB (C4E-R chassis)

Lack of width with severe EW error: Can occur when RD01 goes short-circuit because one leg of RD05 has bent over, shorting out PCB track. Remove short from RD05 and replace RD01 (15Ω, 0.5W).

Models 2557DB, 2857DB, 3357DB, 2577DB, 2877DB and 3377DB (C5SS chassis)

Luminance reduces gradually over a period of fifteen minutes: Cause is leakage in the luminance coupling capacitor C203 (0.1µF), which is connected between pins 4 and 53 of Q501. Replace C203.

Model 32W6DB (C6SS widescreen chassis)

No EW correction: Can be caused by shorted turns in coil L461 on the wide deflection PCB. Replace the coil, type TLN3349D, part no. 23248111.

Models 48PJ6DB and 55PJ6DB (C5SS chassis)

Poor convergence and field scan jumping: Check whether the VD waveform is present at pin 20 of P708, the convergence module connector. If it's missing, replace Q774 (type 2SC1815, part no. A6317440).

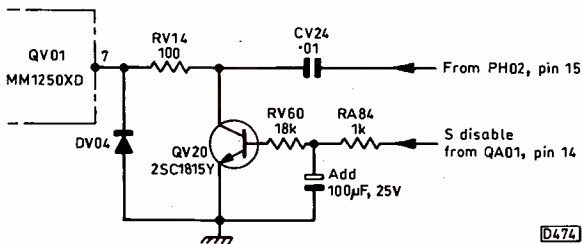
Hotel mode - C80 chassis

This chassis is used in Models 1480RB, 1480RBW, 1480TB, 1480TBW, 1782TB and 2181TB. There are two modes for hotel use: (a) disable the tuning functions and (b) disable the tuning and limit the volume to 50 per cent. To enable these modes, proceed as follows:

(1) Enter the service mode by pressing the sound mute button on the remote control unit once, then press and hold the sound mute button while also pressing the TV set's volume down (-) button.

(2) At the top left of the screen you will see adjustment

Fig. 1: In Model 2173DB a 100µF, 25V capacitor must be added between the junction of RV60/RA84 and chassis when the modified type of microcontroller chip is fitted.



item OPT with a data number 07H underneath, and at the top right S/D to indicate that you are in the service mode.

(3) To set hotel mode (a) change the data setting to 82H by pressing the volume up/down buttons. To set hotel mode (b) change the data setting to 83H by pressing the volume up/down buttons.

(4) Press the on/standby button to exit the service mode and store the new settings.

Caution: When you are in the service mode there is access to 45 adjustments which are selected by using the channel up/down buttons. It's possible that when you enter the service mode you won't start at OPT: you will then have to scroll through these adjustments until you find OPT. Do not alter any of the other settings without reference to the service manual.

QUICK FAULT-FINDING GUIDE - C5SS CHASSIS

This chassis is used in two projection receivers, Models 48PJ6DB and 55PJ6DB. Because of their size and weight, they can present a problem for the field service engineer. Faults are generally associated with the two power supplies however, and a few quick checks will sort most of them out. In some cases a replacement fuse may be all that's required.

Fig. 2 shows the chassis layout. Power supply 1 is on the deflection/power supply PCB, shown at the centre. Power supply 2 is on a PCB with the digital convergence module and the surround and centre audio amplifier chips, shown at the left-hand side.

Picture is completely misconverged, with the LED at the front flashing red/green: The digital convergence circuit is not functioning. It requires three supplies,

+18V, -18V and +30V, which are provided by power supply 2 (left-hand side, Fig. 2). Each of these supplies is protected by a fuse (F802, F803 and F804 respectively). A quick check at these fuses (test points 4, 6 and 3) will usually show that F803 is open-circuit. The flashing LED indicates that the power protection circuit has operated.

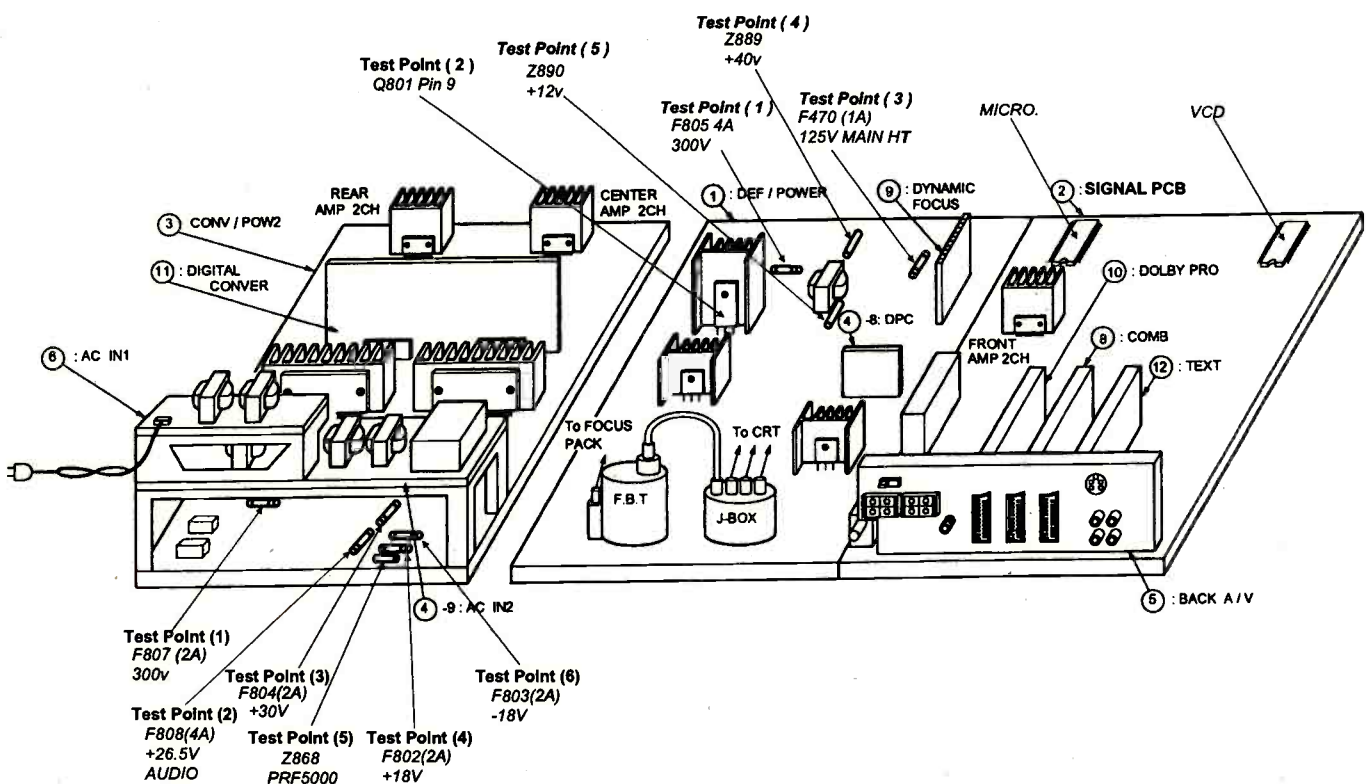
Replacement of F803 (2A, part no. 23144870) will usually clear the fault. If this fuse fails repeatedly, the digital convergence module may be faulty.

Dead set, LED at front not alight: Power supply 1 provides the main 125V HT output but relies on +18V from power supply 2 to keep running. It produces no outputs in the standby mode. Power supply 2 provides supplies to the digital convergence circuit (see above) and also provides the regulated 5V-1 supply for the microcontroller chip and the front LED.

If the front LED is not lit, power supply 2 isn't working. Check at test point 1 (fuse F807, 2A). The fuse is probably open-circuit. Check the resistance from the fuse to chassis. If the reading is low, Q803 (STRS6708) is faulty and zener diode D854 (6.2V) is short-circuit. Replace Q803 (part no. 23904247), D854 (part no. A7270200) and F807 (part no. 23144870).

No centre or surround audio: Power supply 2 provides a 26.5V output which is used by the surround and centre audio amplifier chips Q641 and Q621. These chips may be damaged if the user connects faulty or incorrect equipment to the external sockets. Check at F808 (4A). If this fuse is open-circuit, Q641 or Q621 may be damaged. Each of these chips is protected by six 1N4148 diodes which should also be replaced if the chip has failed - otherwise repeated failure may occur. Q641 (rear/surround amplifier) is protected by D641-D646, Q621 (centre amplifier) by D621-D626).

Fig. 2: Layout of the C6SS projection TV chassis, showing test points for quick checks.



Replace F808 (part no. 23144867) and Q641 or Q621 (part no. B0376795) and the associated protection diodes.

General Notes

The standby/on command comes from pin 7 of the microcontroller chip. It goes low for standby, high for normal operation. If power supply 2 isn't working there will be no supply to the microcontroller circuit and thus no switch-on signal.

Power supply 1: Provides 125V at F470, 40V at the cathode of D885 which is protected by Z889, and 12V at Z890. There should be 9V at pin 9 of Q801 (test point 2). None of these supplies are present in standby. They are not present when power supply 2 is inoperative, nor will there be a 300V supply at F805. The input to this power supply is switched by relay SR80. The chopper chip is Q801 (STRS6709).

Power supply 2: Should have 300V at F807. Outputs are 26.5V (audio) at F808, +18V at F802, -18V at F803 and +30V at F804 (these are the digital convergence supplies), and the 5V-1 supply from a regulator which is fed via Z868 and D863. The chopper chip is Q803 (STRS6708). Power supply 2 is also subject to standby switching from the microcontroller chip.

AC fuse: The inputs to both power supplies are via F801 (3-15A).

VCRs

Models V228B and V428B

Once the incoming signals have been stored in the correct positions the auto set-up operation places the RF modulator's output in a spare UHF channel. This channel number is stored in a volatile memory location. Thus if the power to the VCR is interrupted, the position is lost and is either reset to ch. 60 or the modulator's output is switched off. In this event a customer using RF connection will have lost the video channel.

The cure is to select an RF channel between 53-69 and store it manually as follows: turn on the VCR, press and hold the menu buttons for eight seconds, select a suitable channel with the shift up or down buttons, and finally press menu again to store.

Models V726B and V856B

Cannot access automatic head-switching adjustment, display is slightly dim, and there's dropout type interference on playback: This occurs when the -32V supply at pin 3 of the power supply connector is low. The cause is reservoir capacitor CP051 (1µF, 16V) being low in value or open-circuit. Replace it.

Models V726B, V727B, V856B and V857B

Squelching noise on E-E - a similar sound to an off-tune AM radio receiver: This occurs when the 2,200pF, 50V decoupling capacitors C102/3/4/5 are leaky. Replace these chip capacitors.

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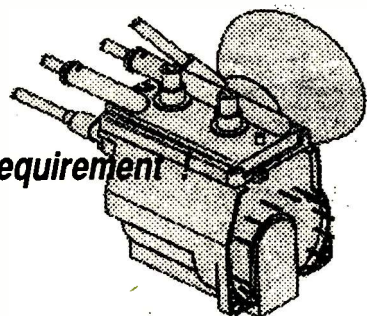
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PRODUCT

Chips for DTT

Edwin Crophorne describes the modulation system used for digital terrestrial TV and LSI Logic's solution to reception/decoding

The difference between satellite, cable and terrestrial digital TV lies largely in the method of signal modulation used. For digital terrestrial transmission a technique known as COFDM has been adopted: the initials stand for Coded Orthogonal Frequency Division Multiplex. The basic problem is that terrestrial signals are subject to a greater degree of interference of one sort or another than satellite or cable ones, so a more robust modulation system is required to provide reliable reception.

The COFDM Technique

With COFDM the transmission channel is occupied by a large number of carriers. The 2K version used in the UK has 1,705 of them – see Fig. 1. The bit stream being transmitted is spread between these carriers, hence the phrase frequency-division multiplex. The advantage of this is that each carrier handles a far lower data rate than with a single-carrier system. With the system used in the UK, each individual carrier is 64-QAM modulated (Quadrature Amplitude Modulated, with 64 possible states). The carriers are modulated and generated simultaneously by means of a Fast Fourier Transform (FFT) processor.

Orthogonal means that the carriers are separated by a phase difference of 90°. Thus when one carrier is at maximum amplitude its adjacent carriers are at zero amplitude. There is therefore negligible interference between them.

Coded means that frequency interleaving and other error protection methods are used to improve the ruggedness of the signal – this is in addition to the standard FEC error protection. The coding interleaves the data in time and frequency. By cross-referencing data

bits, information mutilated by signal fading and interference can be recovered. A guard band is added to each transmitted data symbol to lengthen it. This enhances tolerance to multipath effects and also prevents interference between the data symbols.

The DVB-T standard adopted in Europe specifies two alternative FFT modes, 2K and 8K. The latter, with some 6,817 carriers, gives improved performance but is more complex and difficult to implement. It's likely to be used in Continental Europe where, in many areas, the reception problems will be greater than in the UK.

A further advantage of COFDM is its more efficient use of the available frequency spectrum. This means that lower transmission ERPs can be used.

Reception

A DTT receiver follows the same basic pattern (see Fig. 2) as a satellite TV one, with a tuner, digital signal demodulator, FEC correction, transport stream demultiplexing and MPEG decoding, but the demodulator has to be able to deal with the COFDM signal. From the above, it's clear that the development of a COFDM demodulator chip is a difficult undertaking. While chips that can provide the other functions have been available for some time, with varying degrees of function integration, COFDM decoder chips have only recently started to appear.

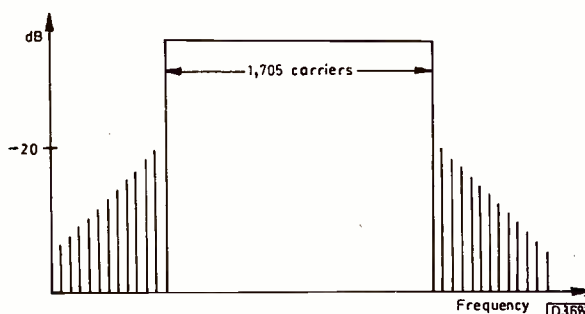
One of the first is the L64780 from LSI Logic. The BBC collaborated with LSI Logic in the development of this chip, with the latter being responsible for its implementation in IC form. The chip can handle both the 2K and 8K modes, and has high immunity to PAL interference. It could be used with a single-frequency network, i.e. where a national broadcast service is based on a single channel, though it's doubtful whether this demanding method of transmission will be used for some years.

Fig. 3 shows a much-simplified block diagram of the L64780 chip, which incorporates the analogue-to-digital converter (ADC) required to present the signal in appropriate form to the digital demodulator. The chip provides AGC and AFC outputs for the tuner.

After real-to-complex conversion, a Fast Fourier Transform is carried out to reverse what's done at the transmitter. This is followed by the elaborate error correction processing that's a part of COFDM. The output is fed to a conventional FEC chip.

The timing sync system produces an output to control

Fig. 1: 2K COFDM channel spectrum.



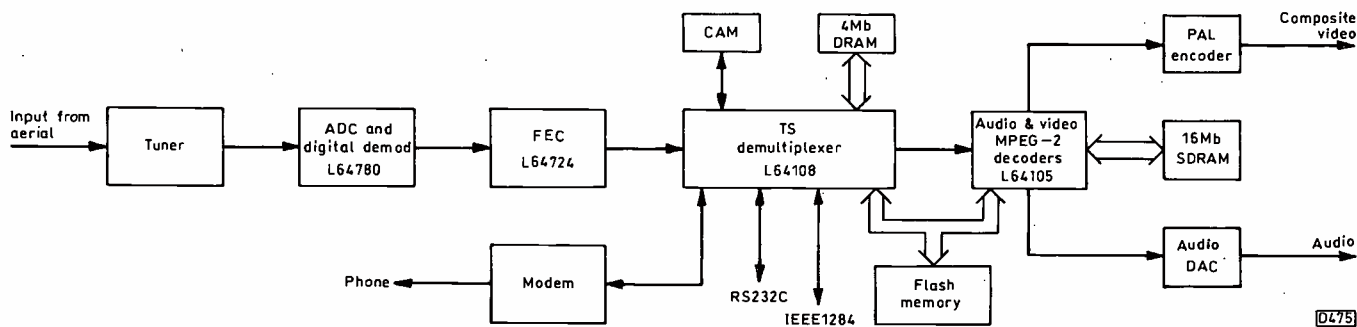


Fig. 2: Basic DTT receiver outline, showing the use of LSI Logic's range of chips.

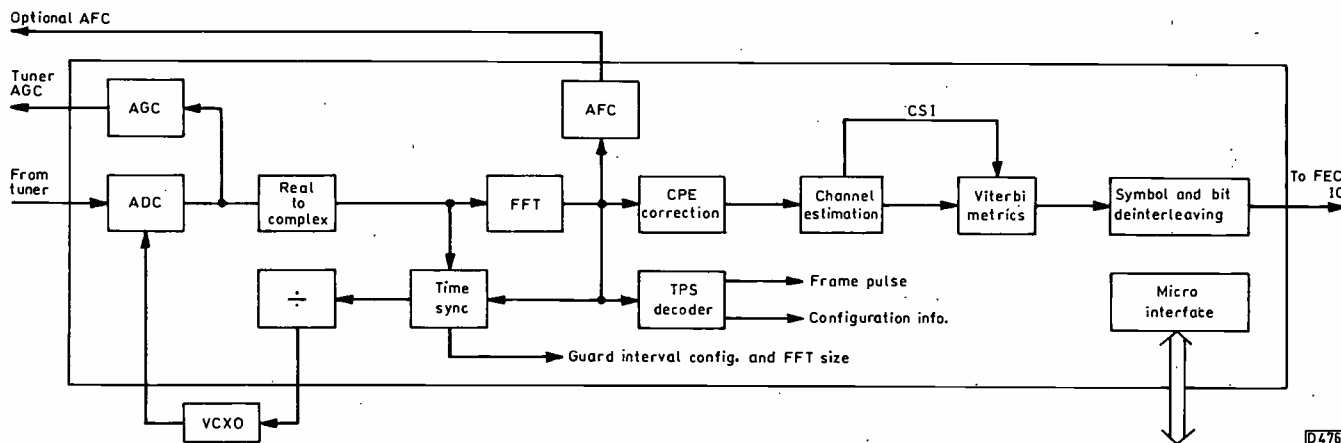


Fig. 3: Simplified block diagram of the L64780 COFDM demodulator chip.

an external VCXO (voltage-controlled crystal oscillator) that generates the ADC clock. It also provides guard interval configuration and FFT size outputs. The transmitted signal includes pilot carriers that provide transmission parameter signalling (TPS) to tell the receiver about the modulation and coding in use. A decoder section is required for this. And, naturally, the chip incorporates a microprocessor interface.

Performance Tests

A BBC paper presented at the International Broadcasting Convention in Amsterdam in September described the results of reception tests carried out using the L64780 chip. Its performance exceeded expectations in several important respects. The chip had already been shown to conform to the DVB-T specification in all the 2K and 8K modes tested, including hierarchical modulation modes and tests in a single-frequency network.

The range of BBC tests included the following: co-channel PAL interference; multipath performance; single echo with Doppler; and Additive White Gaussian Noise (AWGN).

Because the COFDM signals are transmitted at a lower power than the current PAL analogue signals, they risk degradation by the higher-power analogue transmissions. This can lead to digital signal attenuation and corruption. The digital demodulator chip has to ensure that the signal can still be correctly demodulated. In this respect the L64780 chip was found to perform 4dB better than the frequency-planning assumptions, ensuring reliable digital reception.

How well a receiver works in the presence of multipath (reflected) signals is particularly important in urban environments. Built-up areas create multiple signal paths as signals are bounced from buildings. COFDM is designed to provide protection in this respect, by lower-

ing the data rate per carrier, but the degree of reception ruggedness still depends on demodulator design. The L64780 was found to cope more than adequately with multipath problems, providing excellent reception even in difficult areas.

Single echo with Doppler relates to mobile reception (train or car for example), when Doppler effects occur. The L64780 has been designed to tackle this and its capability has been demonstrated.

The AWGN test is fundamental: it confirms whether the system can operate with a high level of noise at the demodulator's input. The L64780 was proved to function successfully in this test situation.

The LSI Logic Chip Range

The LSI Logic range of chips for digital TV reception consists of four major items, as indicated in Fig. 2. The L64780 has been described above. The L64724 is a QPSK demodulator plus FEC correction chip designed primarily for satellite TV reception. Its FEC section can be used to complement the L64780 for DTT reception.

The L64108 transport stream demultiplexer chip is based on a 32-bit, 54MHz MIPS processor. It incorporates extensive programmable hardware-assisted section filters, an 8KB instruction memory, a 4KB data memory and many peripherals including serial and parallel data ports.

Finally the L64105 is a combined MPEG-2 decoder for both the video and audio signals.

This chip range represents a high degree of integration for digital signal processing, providing a cost-effective approach with proved performance.

Hitachi is one of the first manufacturers to have placed orders for these chips, which will be used in the company's recently announced IDTV Models C28W40DTN and C32W40DTN and the DTR801 DTT set-top box.

Test Report



This LCD scope/digital voltmeter, which is available as a kit or ready-assembled, is excellent value.

Pete Roberts has built a couple and reports on construction, testing, performance and use

Velleman hand-held digital oscilloscope

Have you ever drooled over the Fluke Scopemeter and similar instruments in the trade catalogues, only to be brought down to earth by the three-figure price tags? A combined LCD digital storage oscilloscope and multimeter, battery-powered in a neat hand-held case, would be very handy. But at anything from £600 to £2,000 plus I'd be afraid of taking it out of its box, let alone out of the workshop!

You can have a similar instrument for as little as £149.99 however (the price includes VAT), provided you accept a somewhat lower specification and are willing to spend a few hours putting it together. You may have glanced through the range of Velleman kits in the Maplin catalogue. A recent addition is this combined LCD oscilloscope and multifunction digital voltmeter, Model K7105. The instrument is also available ready built and tested, as Model HHS5. It's only fair to point out that in comparison with the £1,000+ units the Velleman scope is somewhat restricted in ranges and bandwidth. But at less than one-fifth the cost, who can complain? The box on page 95 shows a brief features list; Table 1 provides a brief specification.

The Kit

The kit comes packed in a strong corrugated carton. Large items like the PCB and the display are packed in the instrument casing, the remaining small items being in two transparent plastic boxes. The documentation that comes with it is multilingual, and consists of a comprehensive operating manual and the kit assembly instructions. The manual is written for both the kit and the ready-built versions. It describes use of the instru-

ment, calibration procedures and troubleshooting and, a true delight, contains a PCB layout and a full circuit diagram, both of which are helpful during assembly, also for any repairs that might be necessary in the future.

The kit contains everything required down to the last nut and bolt. All you need to assemble it is a decent pair of sidecutters, a pair of long-nose pliers, a pair of tweezers, a couple of small screwdrivers (terminal and cross-head) and a standard 15-25W soldering iron with a 1.5-2mm bit in good condition. A tube of Bostik or similar spirit-based impact adhesive isn't necessary but comes in handy when fitting the internal screening foil.

Before going any farther, it's only fair to point out that assembling the K7105 calls for skill and patience – that rules out Snoddies' engineers for starters! The job should be pure ecstasy for those masochists who enjoy putting 1,000-piece jigsaws together! But, having said that, I have to admit to being fairly ham-fisted and not the most patient of individuals, yet I built two of these kits, each taking about four hours to complete. Fortunately both worked first go – after a bit of pilot error on my part. The secret is to follow the assembly instructions carefully and to the letter.

Assembly

You'll need a clear workbench with somewhere to store the part-built instrument – unless you plan to complete the unit in one day. A decent bench light is a great help. The first job is to unpack the kit and check its contents against the check-list supplied. The robust, double-sided fibreglass/epoxy PCB is easy to work with, but it is strongly advised that the parts are fitted in the recom-

mended order. Check them off as you do so. Watch out for component value changes – both the examples I built had one changed resistor value.

The PCB is silk-screened with component reference numbers and outlines. Despite a lot of parts being crammed into quite a small space, standard through-hole mounted components are used throughout – there's no need to grapple with match-head sized SMDs. To achieve the high-packing density, the components are fitted fairly closely, with some mounted vertically.

The PCB is not through-hole plated, interconnection between the two sides being via component leads and wire links that have to be soldered on both sides of the board – the component check-list specifies which require this soldering, and this is further indicated by small, square marks that are silk-screened around the holes concerned. Most of the signal tracks are on the underside of the PCB, with the ground plane on top. This is not as odd as it may at first seem – the lower side of the PCB is screened by the foil shield that's later fitted inside the instrument's casing.

Except for the preprogrammed Arizona Microchip PIC microcontroller IC and the display, all the semiconductor devices are industry-standard ones. There are sockets for all the chips and the display. Those supplied are of standard commercial quality: I used instead the higher-quality, turned-pin sockets I use for computer repairs – but that was just fussiness on my part.

While most of the chips are not static-sensitive, anti-static precautions are advisable when handling the microcontroller chip and the display – the latter is by far the most expensive item in the kit. There are nine chips in all, as follows: two 74H4052 CMOS switch arrays, an LF357 J-FET op-amp, a 741 op-amp, an LM311 comparator, an LM358 dual op-amp, the preprogrammed PIC16C85 microcontroller, a TDA8703 AD converter and a 7805 regulator.

Circuitry

The incoming signal is scaled via resistor networks, whose sections are switched by the two CMOS switch arrays, then fed to the LF357 Y amplifier. AC or DC input is selected by a slide switch; a small push-switch earths the LF357's input to aid trace finding and range setting. There are two rotary trimmer capacitors for HF compensation adjustment.

The Y amplifier's output is fed to the TDA8703 AD converter and to the LM311 comparator, which sets the trigger level. Y position is determined by an offset voltage, courtesy of the 741. The 358 dual op-amp is wired as a phase-shift oscillator which provides the 400Hz sinewave test signal.

Connections

The scope's RS232 computer interface is unidirectional (transmit only) and shares a 3.5mm stereo jack with the audio test signal – the tip is used for the data and the ring for the audio, both sharing a common earth. For safety, it's strongly advised that connection to an earthed PC should be via the special, optically-isolated lead that Velleman supplies, together with the relevant software, as an optional extra (Maplin order code VF86T, £11.99). You will also need to buy a scope probe – why don't scope manufacturers supply even just a basic probe with their instruments? None of them do.

Testing and Calibration

When you first test the K7105 after completion of the assembly there are a couple of traps that can catch the unwary (like me). After plugging in the power supply,

guess what? – no display! It was only after some feverish checking that I thought of turning the contrast up! The range is very wide, from absolutely clear to totally black.

After sorting that out I was troubled by intermittent, sometimes garbled, displays that blanked as soon as I touched the PCB. Out with the magnifier, then the best part of an hour spent looking for dry-joints. I had, of course, overlooked the reset switch at the rear of the PCB. So I thought it best to fit the innards into the case before going any farther.

First you have to fit the screening foil. The instructions suggest wrapping the foil around the PCB before installing it in the case. I found it easier to fit the foil inside the rear part of the case before offering up the PCB. A couple of small dabs of Bostik will prevent the foil moving around during subsequent work. Before you fit the PCB it's important to check that all the component leads have been close-cropped, otherwise there is a risk of puncturing the foil's plastic insulating layer.

Velleman strongly advises against the use of disposable batteries, which is why no battery hatch is provided and a constant-current charging circuit is incorporated.

Set-up and calibration procedures are outlined in the main user manual, and you'll need to plug in the keypad. The only test gear required for calibration is an accurate digital multimeter. I allowed an hour or so powered up for burn-in before beginning. The accuracy

Table 1: Brief technical specification

Input impedance: 1M Ω /20pF

Input sensitivity: 5mV-20V/div

Maximum sampling rate: 5MHz for repetitive signals, 0.5MHz for single-shot events

Vertical resolution: 8-bit (6-bit on screen), linearity 1 bit

LCD: 64 x 128 pixels

Timebase: 2 μ sec-20sec/div

of the finished instrument depends entirely on the accuracy of the multimeter used and the care taken over calibration: beg or borrow the best DMM you can get your hands on. You have to override the auto power-down, otherwise the scope will turn itself off after about eight minutes. This is done by switching the instrument on using the red graticule select key.

When you've finished, lock all the potentiometer settings with Bloclube or nail varnish before you fold over the foil screen and fit the battery holders. Fit the six rechargeable AA cells, then the top casing – take care not to trap the battery leads – and dress the keypad's ribbon connector exactly as described in the manual.

The first time I used battery power another quirk showed up. When I switched on, the display was blank and the contrast had to be advanced quite a lot before the display became visible. Later, when operated with the mains power supply, the display was totally black until the contrast control had been returned to its former setting. This is down to what appears to be a power-saving arrangement to avoid wasting battery power as heat dissipated by the regulator chip. Only critical parts of the circuit receive a regulated supply. The LCD doesn't fall into this category, as changes in its supply voltage don't

The Velleman hand-held digital storage scope/volt-meter on location!



affect the accuracy of the readout, only the contrast. You just have to get used to readjusting the contrast when changing from battery to mains power and vice versa.

Batteries

The batteries are automatically charged whenever the external supply is connected, so disposable batteries must *never* be fitted when operation with an external supply is envisaged. With the scope turned off, standard 500mAh Ni-Cads need fourteen hours or so to charge fully: a LED near the external power supply socket lights to indicate that charging is in progress.

When they are fully charged, the life of the batteries before recharging is needed is estimated by Velleman to be about four hours with continuous use. I managed a little more than five hours using a set of RS Components own-brand 800mAh Ni-Cads. High-capacity Ni-Cads or NiMH cells increase battery life, but the charging time is longer. Although they are more expensive, NiMH cells can be topped up without running the risk of the dreaded memory effect.

When the batteries get a bit low, the scope may not initialise properly: the on LED lights but the screen remains blank or garbled. Pressing the reset switch restores the display but the scope restarts in the auto power-down mode. I put the cause of this problem down to the comparatively small difference between the 5V rail and the 7.2V battery supply. A standard 78XX series regulator can be a bit fussy when operated with less than 3V between the unregulated input and the regulated output. I used instead an LM2940-5.0 low-dropout regulator. This pin-for-pin compatible device is specifically designed for battery-powered equipment, and can work with as little as 0.5V headroom. It cured the problem with my own instrument. Velleman has an 'official fix' for the problem at its new website: change transistor T6 (BC547B) to the higher-gain BC547C type.

Power Supplies

Velleman supplies a suitable power supply for the K7105, but it's not listed in the Maplin catalogue. When you are working on high-voltage gear, the scope's plastic case reduces the chance of an electric shock. The insulation of the mains transformer in any attached power supply will be stressed however: under such cir-

cumstances I prefer to use battery power.

While the power jack is labelled 9V in, this applies only when using an unregulated 300mA power supply. If, like me, you prefer to use a regulated power supply, it must be set at 12V output. The scope works perfectly with a 9V regulated input, but the internal charging circuit doesn't.

Use

While a bandwidth of 750kHz may seem to be limited, it's perfectly adequate for field checks on switch-mode power supplies, sync and timebase circuitry, servo systems and audio amplifiers. I use my K7105 for troubleshooting in industrial control gear and for working on the RF and IF stages of the old broadcast radios I do up as a hobby. It also comes in handy for checking RS232 and other data communications systems.

The freeze display feature can be very useful when tracing the cause of intermittent faults.

The numerical voltmeter display is to the right of the waveform display. It can be switched to read steady or pulsed DC, true RMS AC, AC peak-to-peak or decibels – the latter feature is particularly useful for sound engineers.

There's a choice of four different on-screen graticules. One has a moveable cursor that can be positioned on a portion of the waveform displayed: the numerical display then indicates the period of the waveform at that point, or the frequency if the waveform is repetitive, and the peak-to-peak amplitude.

The plastic case reduces the chances of getting a shock – provided you keep your fingers away from the BNC input connection.

In the event of damage, a home-built instrument has one great advantage over a factory-built one: you know how it's put together and how it works. In this case you also have all the service information you need. The expensive bits are remote from the signal input, and all the devices likely to suffer a burn-up are cheap and readily obtainable.

The K7105 has a maximum input limitation of 100V AC + DC. Higher voltages can be checked using a suitably rated X10 probe – I use a Black Star probe that can withstand 500V DC + AC.

Battery-powered Scopes

Finally a few words about battery-powered scopes in general. They have one major advantage, apart from portability, over mains-powered instruments – relative safety when observing signals in the presence of high voltages. It makes me shudder to find a metal-cased, mains-powered scope connected to a high voltage with the mains earth disconnected at the plug. This practice is potentially lethal, and probably illegal. The engineer concerned may know not to touch the scope's case, but casual passersby may not. Furthermore, using a scope with its internal circuitry at perhaps several hundred volts above earth potential strains the insulation of its mains transformer.

When working on high-energy circuitry such as a large thyristor DC drive, where the incoming 415V three-phase supply may come straight from a 1.5MVA transformer and be fused at 1,000A or more, even a partial short from live to earth can pass enough instantaneous fault current to cause a dangerous explosion. All test prods used with high-energy circuits should be fused.

Small, portable scopes are easy to carry when servicing in the field, and can be taken into the smallest of working areas. As I don't drive, all my test equipment has to fit into a reasonably-sized backpack. In fact I

Features of the Velleman K7105

- Touch-button operation
- True RMS or peak-to-peak readout
- Markers for voltage and time
- Auto-range function for input measurement
- DC readout with zero reference function
- Frequency readout through markers
- dB measurement
- Dot-joint function
- Grid or ruler function
- Adjustable trigger level
- Trigger mode: normal, auto or single
- Trigger edge: rising or falling
- Waveform memory
- Built-in sinewave generator
- RS232 output to computer
- Auto power-off

don't actually possess an 'ordinary' bench scope. In addition to my Velleman I have a ten-year old RS (Thandar) SC10 10MHz single-beam scope and a nifty little Philips 10MHz double-trace scope - complete with magnifier for its 1in. screen.

The main attraction of the Velleman scope, apart from it being an interesting device to build, is that it doesn't use a fragile, expensive CRT. I almost always have to work on live equipment, often in some cramped and grotty cranny that I can barely fit myself into, let alone any bulky test gear.

Bear in mind that with a conventional CRT scope the deflection power and EHT requirement increase sharply as the frequency response is extended, even with an electrostatically deflected tube. Digital instruments involve a similar compromise: a higher sampling rate means a faster clock rate and higher power consumption. Even a digital scope requires some form of analogue signal processing prior to the ADC, and fast op-amps use lots of milliamps. So there's always a trade-off between bandwidth and battery life.

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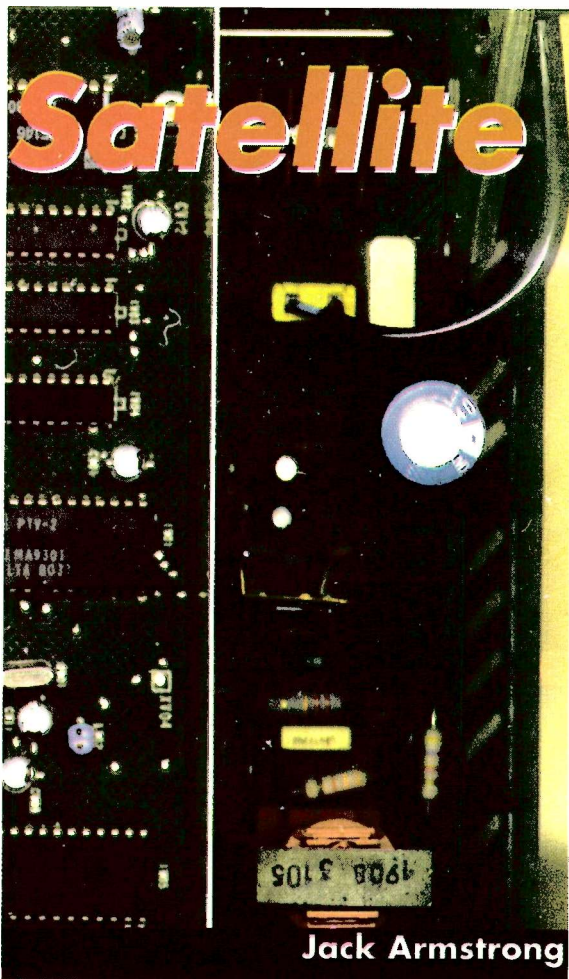
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Workshop

NEC 4012

A repair shop some distance away phoned for advice on an NEC 4012 receiver with "no audio".

I replied, sadly, that I couldn't help. "I may be old, but I'm not that old" I added. "The model was obsolete seven years ago and NEC has pulled out of the satellite business, so spares and service information are probably not available."

"So what do I tell my customer?"

It amazes me how often I get asked this question. Why are these people in business if they can't speak intelligently to the general public? I gave him my usual jokey reply:

"Tell him to chuck it in the bin."

"He'd kill me! Says he paid five hundred pounds for it, new."

"Did he buy it from you?"

"No."

"Fine, so tell him you'll get it fixed for £499 and bring it to me."

The line went dead. So people can't take a joke. I would have done it for a bit less than that. I carried on working for half an hour then the phone rang again. I noticed that the area code was the same.

"I've got an NEC 4012 with no

audio and I wonder if you can help me?"

Oh boy! He'd given his customer my number! I tried to explain the merits of the new SkyDigital system, but he wasn't interested. Eventually, against my better judgement, I agreed to have a look at the receiver. It was an hour's drive, so he agreed to bring it to me and leave it for however long it took.

I found that the receiver worked perfectly, so I left it on soak test while I went out to deliver a tired SRD510 back to a shop. On my return I found that the 4012 was hissing to itself and that no amount of button pressing would bring back the sound. When I gave what I guessed was the audio circuit a good dose of freezer spray, then switched the receiver off and on, the sound came back.

With the help of the famous hairdryer (she's bought a new one) I traced the cause of the trouble to a Sony CX7925B chip. As I was unable to find it listed in any of my catalogues, I fitted a miniature cooling fan above it and phoned the customer to tell him the news.

He was delighted to get the receiver back in time "for the match", but still wanted it fixed "properly". I promised to try to locate a CX7925B IC, and he collected the receiver to put back on top of his VCR in its nice warm cabinet – I warned him, but he wouldn't listen.

To cut an already long story a bit shorter, I discovered that our very own advertiser Grandata stocks this IC. It arrived next day. The customer's invoice should be slightly less than £499, but not much less.

Digital Challenge

Now that SkyDigital satellite TV transmissions are with us I'm getting a lot of people who ask me why their picture and sound disappear in heavy rain – with analogue transmissions the picture would simply go a little "sparkly".

The simple answer is that digital TV tends to be an "all or nothing" system. If the installation isn't perfect, a poor signal and/or cross-polar interference can cause drop-

out. The solution is to make sure that the highest-quality cable has been used and that the dish is accurately aligned and is not distorted. In addition the LNB skew, or rotational angle, is very critical and ought to be checked using a spectrum analyser – though a rough check can be carried out using a signal-strength meter meter equipped with a 22kHz oscillator that will switch the universal LNB to high-band operation (10-60GHz local oscillator frequency).

A local installer recently asked me if I could add a 22kHz oscillator to his Manhattan signal meter. This wasn't difficult and was achieved by fitting a 22kHz tone board from SatCure inside the meter, with a switch to bypass it. The board can be fitted inside most satellite receivers and signal meters, and is available from SatCure, PO Box 12, Sandbach, Cheshire CW11 1XA at £9.95 plus £2.25 post and packing. State make/model when ordering. Note that the tone board must be fitted in series with the DC voltage feed to the LNB, not in-line with the coaxial signal feed.

A normal satellite signal-strength meter designed for use with analogue signals will read 3-4dB low with a digital signal, because it detects peak signal level. Digital transmissions have a more even energy spread across the band, so the peak reading is lower. This doesn't matter, but you should be aware of it.

The Sky Digibox gives bargraph indications of signal strength and of error rate in the installation menu. There's also a "lock" indication that should read "OK". If it doesn't, the error rate is too high and the installation needs to be checked thoroughly.

Amstrad SRD2000

This receiver appeared on the market as a direct rival to the Pace MSS1000. It has similar features in a slightly smaller box, and the price was somewhat lower. Recently the price fell even further – you can buy one for the price of a PRD800. But as with anything, you get what you pay for. In my experience the reliability is not too bad, but if the

receiver does fail some parts are difficult to obtain. For example IC602, which is labelled AMS42577 and controls the LNB voltage, is "unavailable" from CPC as a spare part. Strange, since Pete Gurney tells me that it's just a standard LM2574N switching regulator!

But I digress. When Betty from the cake shop demonstrated her receiver to me it was clearly not well. But nor was it a power supply fault. The picture was dull, and would occasionally become even duller or flash bright horizontal lines then give a blank screen. It looked very much like the 'Q105' symptom with later Pace PRD receivers, so I rubbed my hands together and thought "goody".

Two hours later I was less confident. My oscilloscope showed that the baseband signal that came from the tuner and went to TR5 was 'jittering'. Both the DC level and the peak amplitude were varying. Scraping my plastic toothbrush handle inside the tuner would correct the fault for a few minutes, but it would then return. I got out my magnifying glass and resoldered a few joints as a token gesture. But it seemed to me that a semiconductor device was failing.

A replacement tuner made no difference. Then I noticed a tiny con-

nection on the circuit diagram: it took the tuner's baseband output straight to - where?

Straight into the decoder in fact, but the service manual doesn't show the decoder circuit. So the cause of the fault was definitely in the decoder, which meant that the receiver was a write-off, as I was not prepared to spend any more time on it. Sometimes you just have to cut your losses. Knowing when to stop is all part of running a business. I'll find Betty a good second-hand Pace receiver instead.

Pace SS9200IRD

When Wosname from up Church Street waddled into the workshop and presented me with a 90-channel Pace SS9200 I feared the worst. Ever since he bought a copy of the first edition of the *Satellite Repair Manual* he's considered himself to be a first-class repairman. This wouldn't matter too much, but he brings me the ones he's messed up and expects me to fix them while he points out what I'm doing wrong!

"Blank screen" he announced. "Replaced tuner as per page 77, but no better. Must be the decoder chip as per page 83, but I don't have one. Be a good chap and bung one in for me. I'll just hold this solder

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.

for you."

I moved his helpful hand aside and checked the video output from each socket. There was the normal flickering picture from the decoder scart socket, but the TV and VCR scart sockets produced no output at all on any channel. So I checked for the presence of sync signal outputs from the TEA2029C sync separator chip U6 to the decoder board connector and found them missing. A new TEA2029C cured the fault.

"Oh, that's not in the book!" remarked Wosname.

I grinned and handed him the receiver together with his change.

"A quid!" he exclaimed, "is that all the change I get?"

Test Case 432

There's no doubt that the features now built into TV sets, VCRs and the like - even the cheapest models - are very sophisticated and advanced. In some cases they are quite useful! Auto-tuning and auto clock setting are good examples. These seldom give trouble, but when they do there can be trouble indeed - as we shall see.

This latest saga started with a call to a rented Akai VCR, Model VSG240EK. It's a fairly recent two-head machine with several auto functions. The reported fault was no picture, but our man on the spot Colin found that there was in fact no reception - though the TV set worked all right on all channels. He called up the auto-tune mode and went through the seek-and-search process. After doing this he thought that everything would be OK, but in fact the machine had stored nothing: snow came up on the screen at all the preset positions. Into the van with it then and back to the workshop!

In that haven of warmth and light we confirmed the symptom. Every available TV channel appeared briefly on the monitor during the VCR's tuning routine. But it was strange that the machine swept the entire UHF band three or four times before it finished its presetting cycle by offering a "cancel unwanted programmes" facility.

We declined with a press on the menu key. The TV programme this brought up was irretrievably lost when another channel was requested. TechnoCrat gave this some thought, then switched on his oscilloscope and connected it to pin 8 of the control processor chip IC401. This is the pin where sync

pulses arrive to indicate that a TV signal has been tuned in. The sync signal was clearly visible as each transmission was encountered during the auto-sweep of the UHF band.

He next took a look at the signals on the I²C control lines at the pins of the 24LCO4BT EEPROM chip IC404: to be specific, pins 5 serial data (SDA) and 6 serial clock (SCL). Bursts of activity were seen each time a station came in and out of tune. It was beginning to look as if the EEPROM was faulty.

Just then Service Manager came along, waving a VHS cassette in the air. He asked TechnoCrat to check its contents. They watched together as the Akai machine laced the tape up then played it. The sound was OK, but there was no picture - just snow on the monitor's screen.

TechnoCrat cleaned the video heads then tried again. Still no picture. The upshot was that Service Manager went off to find another VCR, while TechnoCrat phoned the customer to ask about this newly discovered fault symptom. He was told that yes, the no playback symptom had appeared at the same time as the loss of programme reception.

What devilment was at work here? As it happened there was another identical model in the stock pile. It was the work of a few minutes to swap over their upper drums, which made no difference, then their head preamplifier modules - they are pluggable - which made no difference either! You couldn't get two more diverse symptoms than these, could you? Was there a common cause? You'll find the solution on page 141.



Reports from
Philip Blundell, AMIEelec
Alan J. Roberts
Chris Watton
Michael Maurice
Roger Burchett and
P.J. Roberts

Dusty Laser Lenses

Am I alone in finding that a lot of CD players that refuse to read discs have a layer of dust on the laser lens? A *gentle* clean with a camera lens brush or air puffer restores normal operation. Maybe CD player manufacturers should fit a lens cleaner in the same way that current VCRs incorporate head cleaners. **P.B.**

Aiwa CX-NV70

A common fault with the three-CD changer mechanism is a broken ribbon cable to the CD drawer. The part number is 84-ZG1-614, Willow Vale order code 89004C. **P.B.**

Philips AK701

This five-disc carousel machine came in with the tray assembly stuck in the out position. When I tested it, the whole machine seemed to be confused. Before you dismantle it you can call up the test mode, which is very useful. I got a no-go indication on the light-sensor test. This made sense, as the carousel didn't seem to know where it was and stopped at intermediate positions.

It's always a struggle to remove the tray from one of these machines. Once this had been done I examined the sensor panel under the carousel and could just make out a dry-joint on the position sensor. When this had been resoldered

CD Player Casebook

and the machine had been reassembled all was well. **A.J.R.**

Sony CDPC311M

When this five-disc multiplayer was switched on the carousel turned continuously. I removed it and found that the flexible ribbon cable that carries the pulses from the opto-sensors to the main panel was frayed, which is not uncommon with this model.

I was able to repair the old cable by carefully removing the tray assembly and remaking it. After doing this and reassembling the machine it worked correctly. **A.J.R.**

Philips AK701

Erratic operation was the complaint with this machine. When 'open' was pressed, the tray would sometimes come out half way, go back in then, if you were lucky, come out and stay out. Sometimes it would do a little shuffle back-and-forth, while at other times the machine would freeze and no buttons would operate.

There's a Philips modification for this. It consists of adding a 220µF, 10V capacitor to provide extra 5V supply decoupling. All you have to do is to remove the front control panel and add the capacitor between pins 4 and 5 of connector 1530, with the negative side of the capacitor to pin 5. Once this had been done the machine behaved itself perfectly. **A.J.R.**

Mitsubishi DP703

"The disc plays then the sound goes off" the customer said. Sure enough it did: the disc started to play, then the audio went off, with the clock and remain indicator still working. Slight pressure on the PCB would occasionally bring either a crackle from the speakers or, on the odd occasion, a microsecond of sound. After a good solder up this no

longer happened. I hadn't bridged any print, so what was amiss?

Further investigation revealed that C803 (1,000µF) was short-circuit, removing one of the supply voltages. While checking it with a component tester I discovered that it went short-circuit when the can was squeezed. **C.W.**

Portable Players

When the CD door has to be pressed to open and close, the turntable can be pushed down the motor shaft until the disc is too far out of position with respect to the laser lens. An indication of this can be circular scratches on the data side of a disc. **C.W.**

Aiwa NSX800

This stereo system had been imported from Hong Kong. Its input voltage was set at 220V and it was fitted with a Continental plug. The customer brought it to us because it wouldn't play CDs.

The cause of the problem was quickly traced to IC602 (STA341M). After fitting a replacement, a 13A plug, resetting the mains input to 240V and testing the unit I returned it to the customer.

A few months later I was asked to look at it again because, once again, it wouldn't play discs. This time there was no focus search. Checks around IC601 (LA6515) showed that the focus error voltage was present at pin 4 but there was no output at pin 2. Once a replacement IC had been fitted the player was OK. **M.M.**

Aiwa CXZ720

The fault with the CD section of this music system was skipping and jumping at the beginning of a disc, particularly the first track - later tracks played perfectly. This ruled out the optical block, so attention was turned to the sled movement.

After removing the block's drive gear I found that the block didn't move smoothly along the metal rail. So I lubricated the metal runner and the block's bearings lightly with some Amberlube. After this the block traversed from beginning to end very smoothly. Once the drive gear had been replaced a test showed that all was now well.
M.M.

Sony CDPS207

This CD player arrived with its associated TA717 amplifier whose left-channel output was intermittent. The cause of this turned out to be dry-joints at the muting relay RY801. A stock fault?

When the CD player was brought out of standby it flashed zero on the display then shut down. I had a brief note on file to check the 5V line smoothing capacitor C333 (100µF, 10V) on the front control panel in this event. When I did so I found that it was very leaky. It had also leaked over the print, so some cleaning up was required.

Here's a quick check for this fault. Disconnect the panel at

plug/socket CNJ11 and see if this restores the ±5V supplies at pins 12 and 3 of regulator IC1 (M5294P). If so, the hunt is over before it really begins!

My thanks to whoever originally provided the note on C333. R.B.

Pioneer CLD2950 CDV Player

The complaint with this unit was that it wouldn't play any discs. I put the unit on the bench and found that once a disc was loaded (I used a CD – you'll see why in a minute) it would be clamped and the focus would be found but, instead of the TOC readout, the disc would spin in the right direction at a very high speed (I didn't dare try a 12in. disc), with a squealing sound from the spindle motor.

I decided to tackle the high-speed runaway fault first. The power supplies were present and correct, also the Vref (2.5V) voltage. A closer examination of the mechanism then revealed that the spindle motor FG opto-sensor was badly contaminated with dust. Once this had been cleaned off the unit read and played discs, but the

squealing sound was still present – especially when the video track of a CDV single was being played. The cause was found to be the spindle motor, which had worn bearings. A replacement, part number VXA2208, cured this final problem. After a good test the unit was returned to the customer.
P.J.R.

Sony D240

We've had a number of these portable CD players in the workshop, all with the same complaint: that with both battery and external power supply operation the unit is "dead". On examination we've found that they won't do anything at all. Voltage checks have proved that the supplies are all present and correct – then suddenly the unit will start to work!

Investigation showed that the units would work only with the top assembly in a certain position. The problem is caused by the ribbon cable that connects the operation keys to the main PCB. It becomes intermittent, so a new one is required – the part number is 1-473-074-11. P.J.R.

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Servicing

The Panasonic Alpha 2 Chassis

The Alpha 2 series chassis appeared in numerous forms and remained in production for several years. So there are a lot of these sets around. John Coombes provides a guide to fault diagnosis

The Panasonic Alpha 2 chassis proved to be quite a success. There were a number of versions, including the 2N and 2W (larger-screen models), versions with and without teletext or Nicam sound, and versions with different AV and audio output arrangements. Several different tubes from various manufacturers were used. This article is mainly based on Model TX21T1, a popular 21in. set with teletext – the non-teletext version was Model TC21R1. Production of the Alpha 2 series continued for a number of years, from 1988 to about 1994.

Power Supplies

There are two separate power supplies, see Figs. 1 and 2. The main one (Fig. 1) is based on an STR54041M chopper chip (IC801). The standby power supply (Fig. 2) produces 5V for the remote control and microcontroller sections of the receiver.

If the set is dead, check the 3.15A mains fuse F801. If it's open-circuit, check the RBV4-08 (there are alternatives) mains bridge rectifier D801 and the spike-suppression varistor, type ERZC10DK621C, which has the circuit reference number D804. It can go short-circuit then blow itself open-circuit.

If F801 is OK, check whether the surge-limiter resistor R802 (4.7Ω, 5W), the bridge rectifier D801 or the start-up resistor R803 is open-circuit. R803 may have gone high-resistance. In some models there's a 270kΩ resistor, R827, in series with R803. This can also go open-circuit.

If there is 300V at pin 3 of IC801 but the power supply is producing no outputs, the chip could be open-circuit or intermittent in operation. As a quick check, the voltage at pin 2 should not exceed 0.4V. If there is no voltage at this pin the opto-coupler D811 (TLP621GR-LF2), which is used for standby switching, could be faulty.

If the symptom is no results with the power supply

screaming very loudly, check the HT rectifier D851 (C2408M) then, if necessary, the 17V supply (audio) rectifier D853 (EU02). These rectifiers can be leaky or short-circuit.

If the power supply is 'dead' but whistles, check whether the SR2KN over-voltage protection diode D854 is short-circuit. If so, this means that the chopper IC has failed to regulate the output. Replace D854, IC801 and C808 (10μF, 50V). Also check D807 (ERA22-04), R815, R818 and L808. With this fault you will find that the fusible link R567 (TSF19102) in the feed to the line output stage has gone open-circuit while the line output transistor Q551 has gone short-circuit. The line output transformer T551 may also have failed.

A dead set with a squeal from the power supply means trouble in the line output stage – see the next section.

If R851 or D852 (EU02) in the 26.5V supply has gone open-circuit there will be no line drive, hence the dead-set symptom – usually with whistling from the power supply. The value of R851 varies slightly. In the TX21T1 it's 2.2Ω, 0.5W while in larger-screen models it's 1.2Ω. Check the reservoir capacitor C855 (100μF, 35V) as well if necessary.

If the set powers up briefly then shuts down, check whether L303 (10μH) is open-circuit. It's in the 12V feed to the CITAC and other chips. If the set shuts down after a quarter of an hour or so D811 is suspect.

The dead set symptom can also be caused by failure of the 5V standby supply. Check the reservoir capacitor C1206 (1,000μF, 16V) and if necessary the L78M05MRB regulator IC1204 which can go open-circuit.

The Line Timebase

To check whether the cause of set failure is in the line output stage or the power supply, remove the fusible

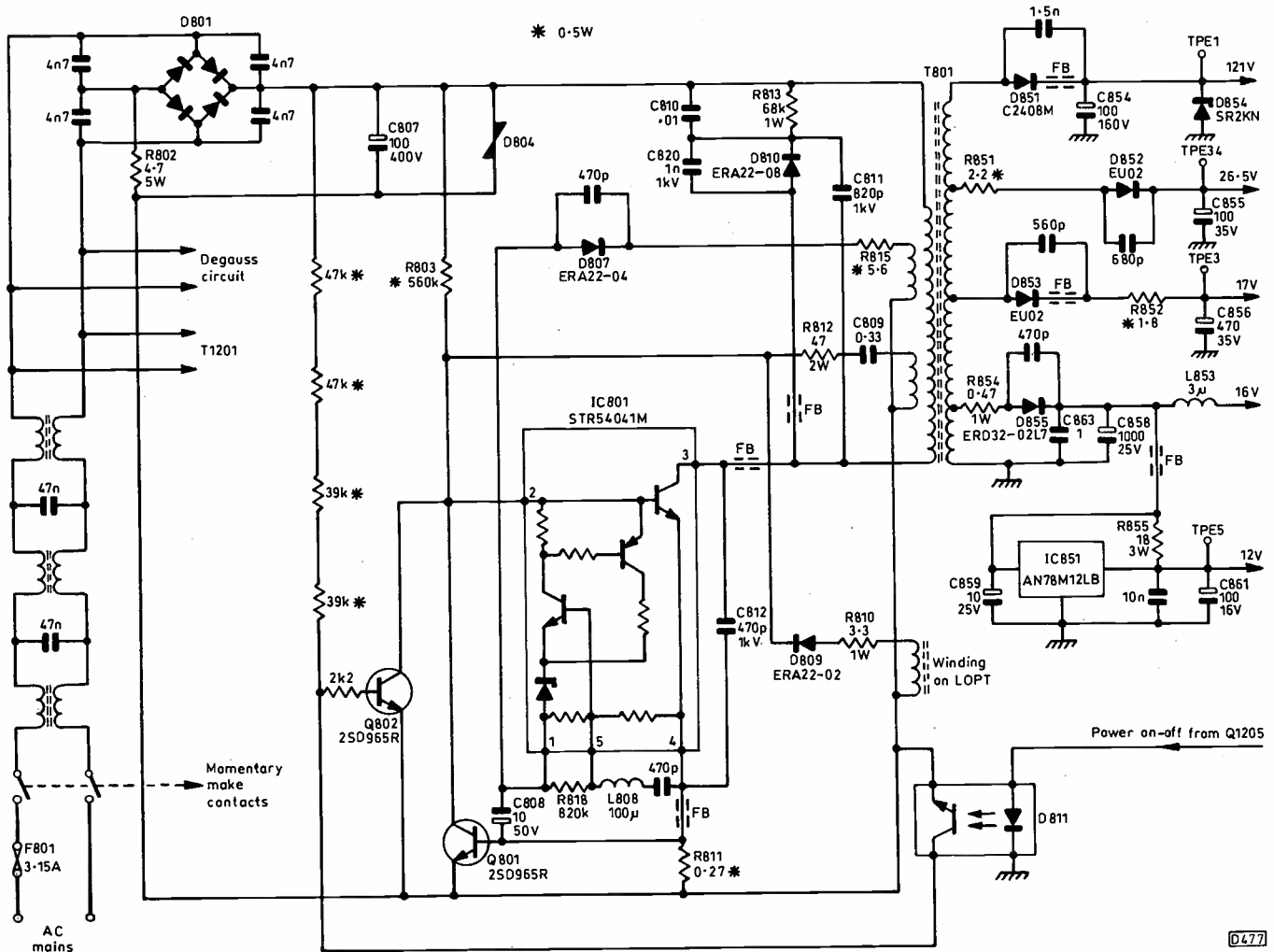


Fig. 1: The main power supply circuit in the Panasonic Alpha 2 chassis. Some component values vary with different versions of the chassis, see text. The values shown here are based on Model TX21T1.

link R567 and connect a 60W bulb between test point TPE1 and chassis. If the bulb lights and there's 121V at TPE1 the power supply is OK.

Check the following: R567 and R551 which could be open-circuit, and the line output transistor Q551 which could be short-circuit. In 21in. models Q551 is type 2SD1439RL while in larger-screen models it's type 2SD1441RL. The value of R551 also varies - 8.2Ω, 7W in 21in. sets, 10Ω, 7W in others. If Q551 is leaky or short-circuit, with R567 open-circuit, the likely cause is dry-joints at the line driver transformer T531. Resolder all four pins.

If Q551 is short-circuit with R567 open-circuit and D854 in the power supply short-circuit the cause is excessive HT, see previous section. The line output transformer T551 could have developed shorted turns and there will be a whistle from the power supply.

If there is sound but no picture, check R557 in the tube's heater supply. Again the value varies. In the TX21T1 it's 0.56Ω, 0.5W. Alternatively check for dry-joints at pins 7 and 10 of the line output transformer.

If there is intermittent operation of the receiver, or there's flashing or arcing that produces a great number of bright lines on the screen, check for dry-joints at the line output transformer T551. Check all pins carefully, ensuring that there is correct connection through the PCB. A dry-joint at T551 can be the

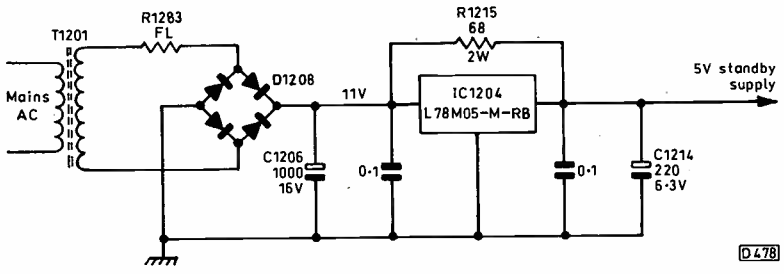


Fig. 2: The standby power supply circuit. D1208 is type S1WB810.

cause of intermittent loss of line hold. In the event of no line drive, check for about 27V at the collector of the 2SD836ALB line driver transistor Q501. If this voltage is missing, check the relevant rectifier circuit in the power supply - see previous section. Alternatively the driver transformer T531 could be dry-jointed and/or Q501 faulty.

If the line driver stage is OK, use a scope to check the line drive waveform at pin 11 of the TDA2579A timebase generator chip IC501. It should be a 1.5V peak-to-peak amplitude squarewave at 20µsec. If the waveform is incorrect, IC501 is probably faulty. If the waveform is missing, check that IC501 is receiving its 11V supply at pin 10. It comes from pin 3 of IC851 (AN78M12LB) via D501. If the voltage at pin 3 of IC851 is missing, check this regulator: if the reading obtained is low, check C861 (100µF, 16V).

Bad dressing of the leads in the EHT circuitry can cause striations on the picture.

Larger-screen models (Alpha 2W chassis) incorporate a conventional EW diode-modulator. If the symptom with one of these sets is a bowed picture, C754 (180pF) in the PCC amplifier circuit could well be the cause.

Field Faults

Repeated failure of the AN5521 field output chip IC451 is a problem with some models, such as the TX25T2. A modification kit, part no. TXS3EH001, is available from Panasonic to deal with it.

IC451 should have a 26.5V supply at pin 7. The source is the same as the supply to the line driver stage, i.e. D852 (EU02) etc. Check this rectifier and R851 if the supply is missing. There should be a boosted supply of about 27.5V at pin 3. If this is missing, check D451 (ERA15-02) and the fusible link R484 (TSF19631) either of which could be open-circuit. The AN5521 chip itself is suspect for field collapse of course.

If the output stage seems to be OK, check that the field drive input is present at pin 4 of IC451. If it's missing, check back to pin 1 of the TDA2579A chip IC501. Check for dry-joints at pins 1, 2 and 3 of this chip, also the DC conditions. IC501 could be faulty, but quite a common cause of field collapse is failure of C403 (10nF). It becomes leaky.

Other possibilities are open-circuit field scan coils or dry-joints at pins 2 and 4 of the scan-coil connector E4.

Field scan distortion – striations and line pairing – occurs when R469 goes high-resistance. This resistor is connected in parallel with the field scan coils and its value varies. In Model TX21T1 it's 470Ω. Typical values in larger-screen models are 150Ω and 180Ω. Check it by replacement.

Loss of Sync

The main cause of loss of sync is the TDA2579A timebase generator chip IC501. Check for dry-joints, check the DC conditions and check IC501 by replacement. In some cases the screen goes black and the power supply squeals.

If the sync is very poor, replace the non-polarised 1μF, 50V electrolytic capacitor C3550 on the teletext panel.

Picture Faults

Blank raster/flyback lines: The cause of this can be difficult to establish. It can be to do with the first anode control. We have on occasion found the cause to be the MAB8461PW135 microcontroller chip IC3507 on the teletext board.

No picture, loss of the brightness control voltage: Check C309 (10μF, 50V). It's connected to pin 20 of the TDA3505 video control chip IC602.

Intermittent loss of video: Check the TVSM1326P TV/AV switching chip IC2601.

No/poor contrast: Check whether R562 (130kΩ) in the beam limiter circuit has gone open-circuit or high in value. IC602 (TDA3505) could be faulty.

Dark screen, possibly intermittent: The voltage at the contrast control pin 19 of the TDA3505 chip IC602 should be variable between 1.5-4.3V. The chip

can be faulty and either C311 (0.47μF, 50V electrolytic) or C626 (10nF) can be leaky. Check these items by replacement.

Shading at right-hand side: Look for a very faint line down the right-hand side of the screen. The cause is lack of decoupling on the 16V supply. Replace the reservoir capacitor C858 (1,000μF, 25V).

Unstable on-screen graphics: Various graphics/teletext display problems can be caused by C3511 (220pF) on the teletext panel. It's connected to pin 24 (pulse generator) of the SAA5231 video processor chip IC3501.

Bright red/green/blue picture: Check whether the relevant 2SC2923RL RGB output transistor is short-circuit – Q351 green, Q352 blue, Q353 red. Excessive red/green/blue can be caused by a leaky emitter decoupling capacitor in the RGB output stages. They are C351 (220pF) green, C352 (270pF) blue and C353 (220pF) red. If these are OK, the cause of excessive red, green or blue is likely to be the TDA3505 chip IC602. Check it by replacement.

Colour Faults

If the colour is unlocked, check C642 (10nF) by replacement. For erratic/incorrect colour, check the 10nF capacitors C612 and C613 by replacement.

Intermittent colour can be caused by the chroma delay line DL601, which can also be responsible for low saturation. Other causes of intermittent colour are: dry-joints at the oscillator crystal X601; the 30pF trimmer C637 which may be faulty or misaligned; and the TDA4510 colour decoder chip IC601 which may be faulty or dry-jointed.

Teletext Faults

If there's teletext in the mix mode but not otherwise, replace C3526 (10nF). If there's no teletext and the channel number is unstable, check C3511 (220pF) and C3517 (10nF) by replacement.

If there is no teletext and the picture is unlocked until the text button is pressed or set to the AV position, check IC3506 (M68400P-12L) by replacement.

A modification kit, TZ5803001, is available to deal with white beating bars over the text – the cause of the trouble is within IC3507.

Sound Faults

We will have to restrict coverage to the basic mono sound circuitry. If there's no sound, check that the 17V supply is present at pin 9 of the AN5265 audio output chip IC253. If this supply is missing, R288 (12Ω, 1W) could be open-circuit and/or C272 (470μF, 25V) short-circuit. If the supply is present, IC253 could be faulty, C269 (10nF) could be leaky or R221 (56Ω, safety) could be open-circuit – if this resistor is intact there should be 11.5V at pin 1 of IC253. R221 is not fitted in all versions of the circuit.

If the sound is muting, the PCD8582 memory chip IC1202 could be the cause – check it by replacement.

Remote Control Faults

Ensure that the battery connections are not corroded or broken. If the hand unit is OK, check that the UPC1474HAL remote control decoder chip IC1101 is receiving its 4.5V supply at pin 9. C1107 (100μF, 6.3V) and R1104 (100Ω) are suspect when this voltage is missing.

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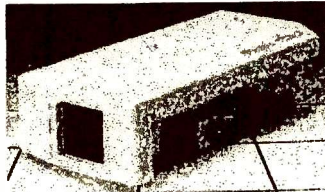
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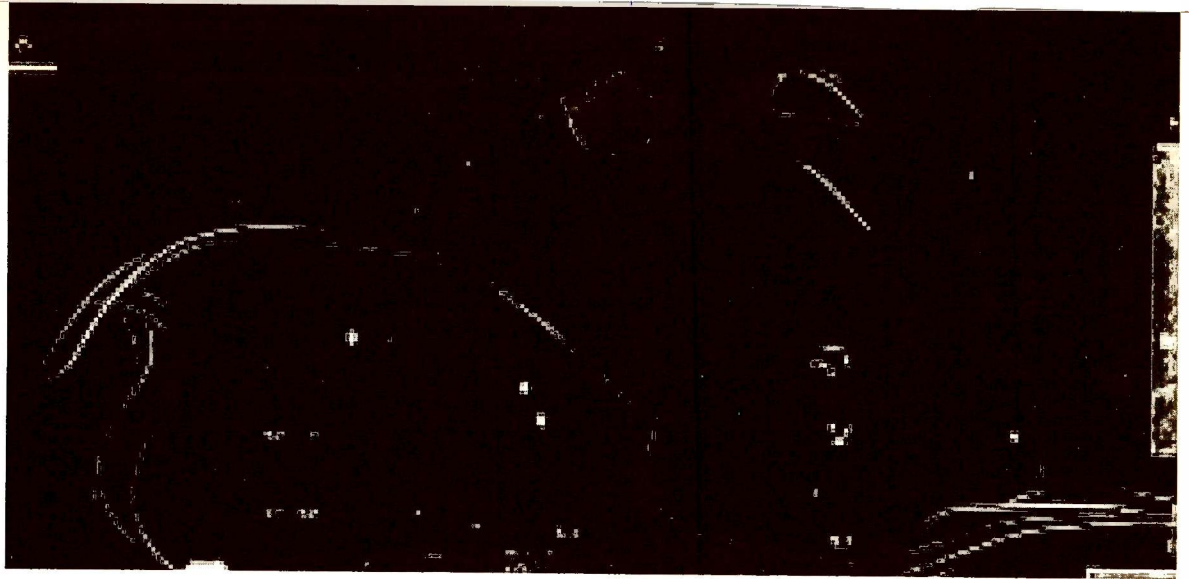
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Satellite Notebook

**Reports from
Nick Beer
Pete Haylor
and
Hugh Cocks**

Grundig STR1

There was no LNB DC supply of either polarity – the customer admitted to shorting across the F connector. The power supply and the H/V switching were OK, but the supply was not getting to the tuner. There's quite a lot of extra circuitry in these twin input receivers (**Pace PRD900**) in comparison with the basic single-input model (**PRD800**). This is where the problem lay. R543 (1Ω, 0.25W) was burnt up but not open-circuit, while Q60 and Q61 (both type FTX749) were respectively short-circuit and leaky. Replacements restored normal operation. **N.B.**

Fault Round-up

Here's a selection of faults we've had in the workshop over the past few weeks:

Pace PRD800: *No raster, no sound, no menus, display OK:* Open-circuit print between D14 and L2.

Intermittent operation: The IR module was dry-jointed.

Swirling pictures: C23 (1,000μF, 25V) was leaky.

Low gain through modulator: R564/5 were open-circuit.

Display missing, 5V supply low: C15 (2,200μF, 25V) had failed.

No horizontal signals: C23 again. *No sound:* Cause was U15 (TL084).

Still dead after upgrade kit fitted: Worked only when the full PS kit had been fitted (we've also had this with the **PRD900**).

Pace MSS300: *No sound:* Cause was U14 (MSP3410).

Pace PRD900: *No sound and*

vision after a power cut: D2-MAC locked up. OK after reset.

Pace MSS500: *Evenly spaced dots on the screen:* U7 (M50555) was faulty.

Pace Apollo: *No LNB supply:* Q25 and Q27 (both type BD329) were faulty.

Amstrad SRD500: *Blank raster, no sound, display OK:* C14 (1,000μF, 10V) was leaky.

BT SVS250: *No graphics, no decoding:* C34 faulty.

Cambridge 200: *Display numbers rolled like a pinball:* R292 was open-circuit because of a short-circuit in the tuner.

Nokia 1800: *Intermittent picture:* Cause was an intermittent open-circuit in the print for the 12V supply to the tuner. **P.H.**

Seized Actuators

We quite often come across a motor-driven dish system that's rarely moved. Suddenly the actuator is asked to move, and either does so very slowly or refuses to move at all, producing a "motor error" message from the receiver-positioner unit. The problem can occur with even a fairly new actuator. While the drive unit could be replaced, oiling the actuator thread usually restores normal movement. It's likely to be worthwhile if the unit isn't very old. Start by disconnecting it from the dish.

Usually the motor part of the actuator is OK. You can confirm this by detaching it from the actuator shaft (usually by removing a locking screw where the shaft and

the motor meet) and applying power. Return the motor to its original position after carrying out this test.

Once it has been detached from the motor, the end of the actuator shaft can be turned manually. Don't lose the shear pin, which is there to break mechanical contact between the motor and actuator in severe cases. More often than not these days however the receiver-positioner detects a cessation of pulse counting, together with heavier than normal current to the motor, and prevents further movement.

The oiling procedure is as follows. Pour a little engine oil on to the actuator shaft from the motor end and attempt to turn it, noting the initial position. It should free quite quickly. Once movement has started, reconnect the motor to the shaft and use it to continue the process. Prevent the dish end of the actuator from turning round while in motion – it will do this when detached from the dish mount. It may be easier to reconnect the shaft to the dish mount at this point. Rather dirty oil may come from the actuator once it's back on the dish. The trick is not to use too much oil to start with.

Before fitting it back on the dish, check the state of the sleeve where the actuator comes out from its housing. If this is in a poor state it can become jammed inside the assembly as the actuator retracts. One model had a rubber sleeve that often did this. If in any doubt, remove it completely – it doesn't prevent water from entering the assembly!

The motor must be mounted pointing upwards once bolted back on to the dish mount – the manufacturer usually prints a warning

about this on the case. If the motor is mounted downwards, it will more than likely fill with rainwater, which will cancel your hard work!

For trouble-free operation an actuator must be moved fairly regularly. I normally advise an owner to move the dish to an adjacent satellite at least once a week so that the motor gets some use. Unfortunately Intelsat's 27.5°W satellite is no longer used for domestic transmissions: in days gone by, a dish would often move from 27.5°W to 19.2°E on a daily basis and the problem would occur much less frequently. H.C.

Problem with a Satellite Peaker

We've recently started to use universal LNBs of MTI manufacture for new installations. They work well, and have an outer plastic cover that gives good protection against the elements.

We were doing a Eutelsat Hot Bird installation recently and were using a new wideband satellite peaking meter. It told us it had found a satellite in the general

direction of 13°E, but the first channels on the Pace MSS228 non-decoder receiver's preprogrammed station list said no signals were present. There were no signs of signals from Astra either - Sky News from Astra and RAI-1 (Italy) from Hot Bird are at similar frequencies (about 11.37GHz, with vertical polarisation). We next checked another satellite frequency: CNN from Astra, Libya from 16°E and BBC World from 13°E are all at about 11.62GHz vertical. None of these sources produced any analogue pictures.

I then flicked right through to the end of the preprogrammed list and found pictures from Hungary, Greece and Iran. These analogue transmissions from Hot Bird are in the 12.1-12.5GHz part of the spectrum. Things were clearly not as they should be, as the receiver was set for no 22kHz switching tone on the low-band channels. It seemed that either the receiver or the LNB was not working correctly.

Changing them both made no difference. I was beginning to suspect a bout of madness - the fact

that it was a hot day didn't help either! The only common factor in all the LNB and receiver connection permutations we'd tried was that the in-line satellite peaker/tone squawker had been left in the coaxial feed, adjacent to the LNB. Removing it produced normal band switching, with all channels present in their correct, preset positions.

The audio tone from the unit produced enough ripple to make the MTI LNB switch bands! When I inspected the picture closely while the LNB was being driven by this unexpected tone generator I noticed that fine, horizontal lines moved down the screen.

The satellite peaker has now been modified, a 22µF electrolytic capacitor being added across the supply to the LNB. There's just enough room in the case to fit it. Some inductance was added by forming in each capacitor leg a single turn wound on a narrow screwdriver. The idea is to reduce the possibility that the capacitor might attenuate the signal from the LNB. MTI LNBs no longer switch bands with the peaker in circuit! H.C.

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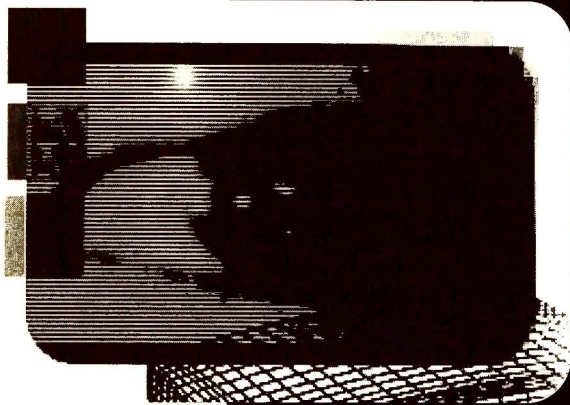
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Philips G90 Chassis

When the problem is low gain, don't forget to check the voltage at pin 6 of the tuner unit. If R3001 (15 Ω , part no. 4822 111 30513) is open-circuit, removing the voltage at this pin, the symptom is low gain, not no signals as you might have thought from the way in which the circuit diagram is drawn. This applies to both versions of the chassis, B and AE, P.B.

Philips GR2.1AA

If the symptoms are reduced with bowed verticals, check for dry-joints at the legs of the EW modulator driver transistor Tr7533 (or Tr7534, depending on tube type). Should resoldering its legs fail to cure the fault, the BC848 transistor Tr7530 has probably suffered and is open-circuit base-to-emitter. P.B.

Sharp Model DV5150H (S3B chassis)

If the 2SD1554 line output transistor Q603 has gone short-circuit and the PCB around the heatsink is scorched, check whether the line drive waveform is correct. In one set recently the waveform was of low amplitude, but a puff of freezer on the three series-connected diodes in the transistor's base circuit brought it back to normal. So we replaced these three diodes

TV Fault Finding

(D601, D603 and D607), using 1N4004s. P.B.

Mitsubishi CT14MS1 (EE2 chassis)

There was a black line down the left-hand side of the screen, i.e. the whole picture had moved over to the right. Checks in the line output stage revealed that R571 (560 Ω , 1W) was open-circuit. As a result there was no pulse feedback to the earlier circuitry. K.J.G.

Panasonic Euro 2 Chassis

The picture's contrast content was breaking up wildly: there were black lines across the picture, which was of generally poor quality. After much searching I discovered that the cause was a very leaky surface-mounted capacitor, C310 (0.1 μ F). As a result, the voltage at the collector of transistor Q311 in the video processing circuitry was at only 3.8V instead of 11V. K.J.G.

Bush 2850NTX-MS (TV4 chassis)

The complaint with this set was that it took a long time to come on. When I tested it I found that it took varying periods of time to do anything, though the power supply was up and running and the output voltages were all correct.

Checks around the ST6385 microcontroller chip IC101 showed that there was a reset problem. The voltage at the reset pin (33) started at around 3.5V and eventually rose to 4.8V, when the set sprang to life.

There seems to have been a design problem here. The circuit diagram shows just a 1 μ F capacitor (C113) from pin 33 to chassis. It relies on an internal pull-up resistor to charge to the required voltage. In this particular set and a few others

I've come across, an elaborate circuit on a small stand-off PCB is fitted in place of C113. It produces the reset action from the 5V supply. But it doesn't seem to cure the problem. My unofficial cure is to revert to the arrangement shown in the circuit diagram, i.e. delete the added board and fit the 1 μ F capacitor, then add a 100k Ω pull-up resistor from pin 33 to the 5V line. This has provided a cure on each occasion.

Note that this model may be fitted with one of two quite different chassis – the suffix indicates which one is used. P.G.

Mitsubishi CT25M1

This set was supposed to be dead, but on test its power supply was found to be running. Furthermore a check at pin 10 of the microcontroller chip showed that the power-on line worked correctly when the remote control unit was used. The line controls various switching transistors on the power supply panel. Connection is via pin 2 of plug PB: it was open-circuit.

Several electrolytic capacitors on the power supply panel, which had been repaired previously, tend to leak electrolyte. Most of them are directly above plug PB. I found that electrolyte had run down the panel and rotted away the pins within the plug and socket. The solution was to clean off the board and reconnect the leads directly to the panel. P.G.

Amstrad TVR2

There was no sound from this combined TV/VCR unit. Checks on the voltages around the AN5265 audio amplifier chip IC1301 produced correct readings except for the DC volume control pin 4, where the reading was 0V instead of about 5-

7V. The source of this voltage is pin 22 of the main microcontroller chip. It's linked to IC1301 via a level-shifting transistor and is then decoupled by C1137 (47 μ F) which was short-circuit. A replacement restored the sound. **P.G.**

Mitsubishi CT2125TX

The user settings couldn't be stored and had to be reset each time the receiver was switched on. Tuning was not affected. The settings and the tuning information are stored in an EEPROM, IC702, which needs a -30V program voltage at pin 2 for it to store information. When this voltage was checked it was found to be only slightly low, at -26V, but the fall was enough to prevent the settings being written in.

The cause of the fault was traced to the power supply panel, where C962 had leaked most of its electrolyte. I usually replace all the secondary side electrolytics in these sets as they are prone to leakage. Be sure to fit the correct grade of capacitor, as incorrect types will not last long.

Should the EEPROM need replacement, note that when returning you must enter a channel identification, e.g. BBC1, otherwise the channel will skip when stepping through. **P.G.**

Thomson TX90 Chassis

This set wouldn't tune, though the on-screen graphics indicated that it was on the correct channels. The tuner is of the digitally-controlled I²C type. Clock and data pulses were present, but the 33V tuning voltage at pin 4 was missing. It comes from a potential divider where one of the resistors, Rh04 (27k Ω), was open-circuit. You'll find it in front of the line output transformer, viewed from the rear of the set. **P.G.**

Sony KVX2542TU (AE1C chassis)

This set had appalling purity errors. There was also some picture geometry distortion. It is something I've seen several times with these sets, the usual cause being movement of the scan coils down the tube neck over a period of time. Before the coils are fitted, fibre tape is wrapped round the neck of the tube. It tends to migrate with heat, taking the yoke with it. This is not very obvious, as the dust is intact and nothing appears to be amiss. But if you look between the CRT bowl and the yoke you will see a noticeable gap between the coils

and the rubber location wedges. When the coils have been relocated, a clean band of tape, usually up to an eighth of an inch, is usually visible, showing how much movement has taken place.

A warning with these sets and larger variants: the cabinets are quite fragile and, if handled incorrectly, can crack vertically at the front of the set - dead centre, where the Sony badge is located. **P.G.**

JVC C1480EK (BX11 chassis)

This 14in. portable regularly drifted off tune. The chassis is full of hybrid modules. It seemed that the cause of the trouble could be on the IF/AFC panel, but it was actually on the SBX-M903A tuning control board. There are three surface-mounted electrolytic capacitors on this panel, C015 (22 μ F, 6V), C016 (0.47 μ F, 50V) and C014 (3.3 μ F, 50V). They were all thermally sensitive. Replacements cured the fault. **P.G.**

Sony BE1 Chassis

A dark picture was the complaint with this set. Nice easy one I thought, just replace the diode and resistor in the first anode supply. But they weren't the cause this time.

The picture was OK to start with, but after twenty minutes it darkened to the extent that it was only just visible. The first anode voltage was OK, so I cooled the TDA3505 video control chip. As this seemed to cure the fault a replacement was fitted. But twenty minutes later the picture became dark again. To cut a long story short, the cause of the trouble was excessive leakage current in C329 when hot. C329 is a small, red tantalum-looking capacitor of 22 μ F, 16V. It's part of a circuit that appears to hold the picture dark until the tube has warmed up fully. **M.Dr.**

Hitachi C2114T

This set powered up then returned to standby. I suspected high HT. So, as a check, a 100W bulb was connected across the HT line. The set then came on and remained in operation long enough to show that the cause of the trouble was field collapse. In addition I found that the TA8427K field output IC was very hot. A new chip cured the problem. **M.Dr.**

Ferguson 20C3 (TX100 chassis)

This set worked manually but took

no notice of remote control commands. When I opened the remote control unit I found that it was wet inside. A nice easy start to the day I thought. Wrong!

After cleaning up the remote control unit I found that the set still didn't work correctly. A scope check at pin 22 of the SAA5012 IR decoder chip confirmed that it was receiving commands, so a new remote control unit and an SAA5012 chip from a scrap set were tried. This made no difference. I also noticed that of the set's manual channel up-down buttons only the up one worked correctly - if the down button was pressed the channels went up!

I eventually found the cause of the fault by accident, when I switched the set off at the bench socket by mistake. When the set was switched on again it came on instead of going to standby. The momentary contacts on the on/off switch were permanently stuck together. **M.Dr.**

Sharp DV5937

If the symptoms are field collapse with lack of width, check the 0.82 Ω , 1W safety resistor R615. If it's open-circuit, you will almost certainly find that diode D601 (DX0127) is short-circuit. **M.Dr.**

Hitachi C1414R-311

This set was dead with the ON4584 chopper transistor Q903 short-circuit. It had been driven hard on because R951 (39k Ω) had risen in value to 78k Ω . It's a good idea to fit an 0.6W metal-film resistor in this position. **M.Dr.**

Salora M Chassis

This set appeared to be dead. The thing to do is to switch off and pull out the mains plug, then switch the set on and replace the plug in the socket. This forces the set into the standby mode. If the standby LED operates, the power supply is usually OK. When I switched this set from standby the display went off and there was no sound or picture. But the tube's heaters were lit, so there was line output stage operation.

When the setting of the first anode control on the tube's base panel was advanced a single line appeared on the screen. So I replaced the TDA8172 field output chip and the two 470 μ F capacitors next to it - this is quite a common fault, but normally doesn't kill the display. There was no difference however. Further checks revealed

that the 17V and 12V supplies were missing because D601 (BY133) was open-circuit. This rectifier diode is fed from a winding on the combined line output/chopper transformer. C.W.

Amstrad CTV1400

If the symptom with one of these sets is weak contrast, the on-screen indicator showing that adjustment is taking place though it remains low, check R410 (120k Ω). It's connected to pin 2 of the line output transformer and tends to go high-resistance or open-circuit. C.W.

Goodmans 2170

There was flat out brightness. A check on the CRT base panel showed that the 190V supply did not reach the RGB output transistors. The small 100 μ H choke that's in series with the supply had gone open-circuit. A replacement restored the picture. C.W.

Hitachi C2118 (G7PS Mk 2 chassis)

There was no sound or picture though the HT was OK and the line output stage was working. I advanced the first anode control setting and found that there was field collapse. As there was 25V at pin 7 of the LA7835 field timebase chip I assumed that it was faulty and fitted a replacement. This made no difference. The chip also requires a 9V supply, which was missing because the MC7809 regulator chip IC703 was open-circuit. A replacement restored the sound and picture. Silly me! C.W.

Huanyu 37C3

This old Chinese Hitachi lookalike had a very bright raster with fly-back lines. A check showed that the supply to the RGB output stages was low at only 100V. The reservoir capacitor for the supply, C774 (10 μ F, 250V), was open-circuit. C.W.

Ferguson 36K3 (TX98 chassis)

The colour varied intermittently and lines would appear on the picture. The cause was a dry-joint at the focus/A1 supply earth pin (4) on the line output transformer. C.W.

Tatung VINYBEOP

Where do they get these model numbers from?! There were intermittent clicks from the speakers, the picture sometimes blanked out

and on occasion the set reverted to standby. I soon spotted the cause when the workshop lights had been turned out: the CRT connector lit up when the fault occurred. The focus pin spark gap was sparking. A replacement restored normal behaviour. C.W.

Hinari VTV100

This VCR/TV combination looked as if it had been used as a doorstop and footrest! There were also cigarette burns along the top. It came from a local 24-hour cabbie firm and had presumably been used to while away the small hours. The VCR section had been removed: I was told that it was still in use at the depot to watch films of a certain sort during the night via a small portable. They wanted the TV section fixed because of its larger screen.

It was dead apart from a click from the standby relay and a red light. I found numerous dry-joints, but the main fault turned out to be nothing more than burnt-out relay contacts – when in standby the mains supply is switched off completely by the relay. A replacement got it going, and the cab firm owner paid up with the comment "that'll keep the boys happy, they can watch their er . . . films on a bigger screen now." A.J.R.

Zenon 9009KDR

This brand and model were totally new to me, and I was none the wiser when I removed the back. The standby LED came on but nothing else happened. I soon discovered that the 4.7 Ω , 5W surge limiter resistor in series with the bridge rectifier was open-circuit while the 2SD1710 chopper transistor was short-circuit. Oddly, the 2A mains fuse was intact.

The resistor wasn't a problem, but I didn't have a 2SD1710 transistor. Typically, the customer did not want to spend much. When I consulted the equivalents book I found that the BU508AF was an excellent match. Once I'd fitted one of these I checked around and couldn't find anything else amiss. I switched on, with bated breath, and was rewarded with an excellent picture. After a two-day soak test I pronounced it fit. Does anyone know who made this set? A.J.R.

Philips 21PT5322 (MD1.2 chassis)

The customer complained that interference appeared on the pic-

ture when the volume was advanced above number 42 on the bar display. This is a pretty high level, which made fault-finding rather awkward. But the customer was right. When I tapped around on the SSP (Small Signal Panel) I obtained a similar effect. After some investigation an area of the board was localised. At worst, a light tap here with a ballpoint pen was enough to cause flickering, which could occasionally be seen as no luminance.

When the panel was hinged down to the service position I saw a small panel designated CTI. Tapping this produced the fault, so it was removed for investigation. With a strong bench light and magnifier I noticed that one pin of the edge connector was dry-jointed. But you really had to look for it. The pin had to be cleaned before it could be resoldered. All the pins were treated in the same way. When I refitted the board and tested the set it was OK. A.J.R.

Philips G90AE Chassis

This set needed a power supply rebuild. Once the kit had been fitted, I connected a dummy load in place of the line output stage and ran the set up using a variac. It refused to start, though the green LED came on. The HT remained at 0.8V.

I checked around the protection circuit, including the three series-connected zener diodes that monitor the HT supply, but all was well. With the dummy load removed the HT rose to 68V. But when the mains input was increased above 160V the power supply started to trip and make a rather nasty clicking noise.

Further checks showed that the drive waveforms around the slow-start and switch-off transistors were all wrong. Once I'd replaced the BAS32 diodes D6611, D6613 and D6614 everything worked all right. I don't know what was wrong with the original ones: they measured OK. A.J.R.

Philips 29PT828 (GFL2.20E chassis)

The customer complained about intermittent sound from the right-hand speaker. The set was left running for ages, and at one point the RH channel sound went off for a matter of seconds. But no amount of tapping around on the audio panel would instigate the fault. The set was again left. When the RH sound next went off a slight

tap on the cabinet, near the speaker, restored it.

For want of something better to do I ordered and fitted a new speaker, which made no difference. Eventually, after many hours, I discovered that slight movement of the cable near its plug connection to the speaker would sometimes produce the fault. It seemed possible that one of the crimped connections might be intermittent, so I dismantled the plug, remade the cable end and reassembled it. The set then ran with no further problems. **A.J.R.**

Akura CX25

I'd got this set going by 'cloning' the EEPROM from another one. But the picture had what looked like the kind of purity errors you get when the scan coils have been dislodged away from the flare of the tube – there was green at one side and yellow at the other. Monochrome pictures were displayed perfectly however.

I found that the VCO setting was locked to the wrong frequency. In fact when I set it up in accordance with the instructions in the manual it appeared to lock at several points. I eventually found that the correct setting was 249, but this may not apply with all sets.

To enter the service mode, press S901 at the front of the PCB and 'display' on the handset simultaneously. Then use 8 and 9 on the handset to cycle through the adjustments, and vol+/- to set each one. Store each setting, by pressing P, before moving on to the next one. **C.J.G.**

Ferguson T49N (TX91 chassis)

This set has one of those arty-f**ty cabinets and contained what was a new chassis to me. The job card said "no memory". In fact the set would quite happily search all day for a station and find nothing. The tuning voltage was stuck at 30V because the surface-mounted transistor TF01, which integrates the squarewave tuning output from the microcontroller chip, was open-circuit base-to-collector. Once this had been replaced the original tuning was all restored and needed no setting up. Field engineers! **C.J.G.**

Hitachi G7P Mk 2 Chassis

There was buzzing on sound and the picture looked flat. The cause was the video detector coil L202.

A replacement obtained from a scrap chassis restored correct operation. **C.J.G.**

Hitachi C2519

All this set produced was a slow, cyclic tripping noise. The TDA3654 field output chip had gone was short-circuit. **C.J.G.**

Mitsubishi CT29AT5

This very heavy 29in. set didn't do anything other than carry out degaussing at switch-on. The power supply was working however, but the line output stage was not. The cause of the trouble was L551, a tiny 3.3µF choke that's in series with the base of the line output transistor. Fortunately I found an identical choke in a scrap Panasonic chassis. **C.J.G.**

Philips G90AE Chassis

There was a bright raster with poor field linearity. The common factor was the 163V supply, which is derived from the line output stage. It was low at 90V because R3570 (8.2Ω) was open-circuit. A diode (D6560) between the 163V and 95V HT line was providing the 90V. Very confusing. Anyway a new resistor cleared both symptoms. **C.J.G.**

Salora M Chassis

One of these sets produced an odd-looking, spotty picture. The cause turned out to be the VCU2133 video codec chip ICB201. **C.J.G.**

Bush 2420/Alba CTV702

The problem was sound muting on some stations and the search tuning not stopping at stations. The sound is designed to mute when there is no signal, but with this set it muted intermittently depending on the picture content. Fortunately this occurred often enough for me to be able to check voltages and view waveforms.

The pulses at the collector of Q403 were varying in amplitude. Q403 produces them from the sync pulses and sends them to the microcontroller chip. Q403 turned out to be OK, the cause of the trouble being its 750kΩ base bias resistor R424 which was open-circuit. **D.F.**

Quickies

Hitachi C1414T: There was no sound or vision and the red LED didn't light. The 82kΩ, 0.5W start-up resistor R901 in the power supply was open-circuit.

Matsui 1496T: No sound and

vision and the red LED not alight. R108 (220kΩ) in the power supply was open-circuit. It's part of a potential divider that's connected to pin 2 of the TDA4605 chopper control chip. **D.F.**

Mitsubishi CT25MITX

After three-four minutes the picture would start to fluctuate rapidly. A check on the HT line showed that the voltage was low at 107V instead of 112V. The culprit was C906 (47µF, 25V 105°C) but we replaced C905 as well. **D.F.**

Sony KVM2131U (BE1 chassis)

If, after replacing the field output chip IC501, you find that the 24V line is high at 28.5V and the 119V HT line is high at 135V, don't waste time as I did trying to find out why. The 'high' voltages are correct.

Unable to control the sound though the on-screen display says you can? One cause was reported in the March 1994 issue – leakage in diode D201 (1SS133). Here's another – leakage in C076 (4.7nF).

With one set we had the following intermittent symptom: six coloured lines a third of the way down the screen, two each red, blue and green. The cure was to resolder dry-joints at the pins of the field output chip IC501. **D.F.**

GoldStar CI14A80 (PC31A chassis)

There were dark lines on the picture and a whine came from the power supply. The culprit turned out to be the mylar capacitor C812 (0.22µF, 63V) which had fallen in value. It's connected to pin 7 of the TDA4605-2 chopper control chip IC801 as part of the soft-start circuit. **D.F.**

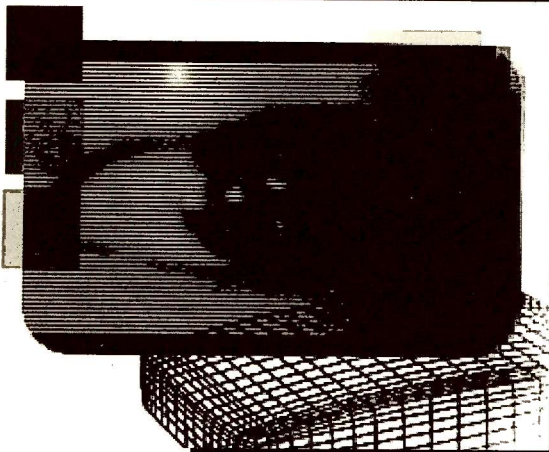
Tatung D Chassis

This set had no picture – there was just a short squeal at switch on. The cause was loss of line drive because R427 (22Ω, 0.5W, 2%) in the feed to the line driver stage had cooked and risen in value to about 4kΩ. As no other fault was found a 1W replacement was fitted and all was well.

With this chassis pin 5 of the line output transformer can be disconnected and a 60W bulb wired in its place to provide a load for the HT supply. This can be a help when tracking down some faults.

We've had this chassis in the **Thorn Model P1482T** and the **Tatung Model VU3DE3**. **A.B.**

Monitors



Reports from
Ian Field
Gerry Mumford
and
Chris Hawkins

AST TE1438R

If the problem is intermittent frame collapse, try giving R443 (1 Ω , 1W) a good tug. The one I tried quite easily pulled out of the solder fillet at one end! **I.F.**

AST TE1464G

Someone had got at this monitor and had damaged the CRT panel by trying to force it off without cutting the blob of glue. But the cause of the dim picture lay elsewhere. The pulse-width modulated EW correction circuit was not providing correct drive. As a result there was low EHT/line scan.

I knew that one of the collection of 8-pin DIL dual operational amplifier chips controlled the PWM regulation, but without a circuit diagram I didn't know which one. So I decided to prod them with a wet fingertip – and was lucky first go! It was IC502. One of its pins had a blob of solder instead of a normal fillet. Resoldering fixed the fault.

The design of this chassis is similar to that of the Microvitec 13 – so watch your fingers when checking around the line driver transformer! **I.F.**

Olivetti CDU1435S/HA81

If one of these monitors sometimes fails to come on, check the start-up resistor R104 (120k Ω). **I.F.**

AST LR14

This monitor had a flooded screen with flyback lines. The cause wasn't the usual one, a dry-joint at the G1

pin on the CRT base. When I checked the voltage here it turned out to be AC. I traced via the ribbon cable to the main PCB then along the track and came to C327 (4.7 μ F, 250V) which was slightly bulged. As I moved it one of its legs fell off. It's the reservoir capacitor for a negative supply obtained from the LOPT via rectifier D316. The diode was OK, and a replacement capacitor restored normal operation.

If the TDA1675A frame output chip blows it will probably take R228 (2.4 Ω , 2W) with it. This occasionally happens when C332 goes up in smoke. **I.F.**

Opus Technology CM1438

This monitor powered up, with its LED on, but there was no picture and it whistled loudly. The cause of the trouble turned out to be a dry-joint at choke L401 in the line output stage. **G.M.**

Siemens Scenic PM150

These Acer-based monitors seem to suffer from brightness problems. For no picture with 180V at the CRT's control grid pin, check D311 (RGP10B) and R345 (1 Ω , 0.25W fusible). The diode goes short-circuit, blowing the fusible feed resistor and removing the 40V supply developed by the LOPT for use in the brightness and frame circuits. For excessive, uncontrollable brightness with -7V at G1, check R203 (220k Ω , 0.5W) which has the habit of going high in value.

If the monitor is dead with the front LED on and pulsing slightly, check D701 (2NU41). It's a rectifier on the secondary side of the power supply and tends to go short-circuit. It can be replaced with the more readily available UF5408 device. **G.M.**

Escom EM1438LR

This monitor was dead with the mains fuse blown. The cause was nice and simple – the mains positioner was short-circuit. As a rule of thumb, if a positioner rattles when you shake it it's faulty.

These monitors tend to suffer

from dried-up capacitors on the secondary side of the power supply. Each capacitor produces a different symptom. For a shadowy line down the left-hand side of the picture, suspect C121 (470 μ F, 16V) – it smooths the CRT's heater supply. For buzzing and line tearing, suspect C117 (470 μ F, 35V) which smooths the supply to the line output stage drive. This often starts just after replacing a short-circuit SGSE444 line output transistor (Q403) and BDT61C regulator (Q405). It's the main reason why they die, and will kill them again quickly.

These monitors whine loudly when the line output stage is inactive because of short-circuit transistors.

You also find these monitors badged EM, CompuAdd and Harvard. **G.M.**

Opus Technology CM1450MLR

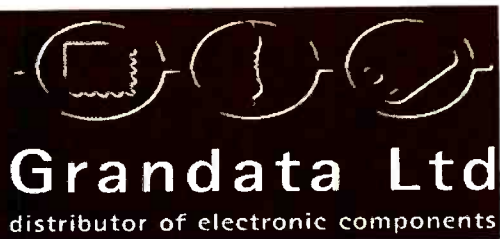
There was a milky picture and the brightness control had no effect. I found that the negative supply to the brightness control was missing because R937 (27k Ω , 0.5W) had gone open-circuit. **G.M.**

Compaq 420

The only signs of life were ticking sounds that came from the overloaded power supply. Checks in the line output stage showed that the 2SC3883 line output transistor Q301 was short-circuit. When a replacement had been fitted the power supply stopped ticking and the EHT returned, but the integrated EHT part of the LOPT was arcing to the exterior. Fortunately we had another transformer in a scrap machine, thus reducing the damage to the customer's pocket. **C.H.**

MTC KTM1428

The cause of failure to start was a short-circuit diode, D508 (UF3010), in the power supply. In addition the 2SB857 transistor Q502 had clearly been getting excessively hot. We used a BY399 to replace the diode and a BD244C to replace the transistor. **C.H.**



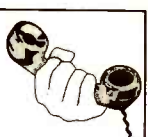
Grandata Ltd distributor of electronic components

TRANSISTORS/LINEAR ICs

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
BC107	8p	BD434	30p	BU126	65p	BUV48AF	325p	MJ4502	300p	4N35	50p	LINEAR ICs		AN6340	600p	BA335	55p	BA7004	200p
BC108	8p	BD435	31p	BU128	125p	BUV48C	250p	MJ1012	300p					AN6341	200p	BA338	80p	BA7007	200p
BC109C	10p	BD437	28p	BU137	150p	BUV61	1000p	MJ1065	250p					AN6342	325p	BA340	75p	BA7021	180p
BC140	20p	BD438	36p	BU180	100p	BUV70	100p	MJ11016	300p	RECTIFIER DIODES				AN6344	440p	BA343	60p	BA7022	350p
BC142	20p	BD439	40p	BU184	100p	BUV90	175p	MJ11032	800p					AN6345	400p	BA336	175p	BA7055L	100p
BC143	20p	BD440	40p	BU204	85p	BUV93	375p	MJ15004	300p					AN6350	610p	BA401	60p	BA7107	475p
BC147	8p	BD441	40p	BU205	70p	BUV11AF	200p	MJ15015	250p					AN6352	450p	BA511	145p	BA7212S	200p
BC159	8p	BD533	50p	BU206	100p	BUW11A	125p	MJ15016	350p					AN6355	400p	BA514	180p	BA7252S	150p
BC160	30p	BD534	38p	BU207	150p	BUW12	125p	MJ15022	400p					AN6359	500p	BA518	150p	BA7515L	150p
BC171	10p	BD535	38p	BU208A	75p	BUW12A	150p	MJ15023	400p					AN6360	320p	BA518	150p	BA755	250p
BC172	10p	BD537	40p	BU208B	200p	BUW12F	250p	MJ15025	700p					AN6362	400p	BA521	100p	BA767AS	155p
BC178	14p	BD643	50p	BU208D	130p	BUW48	550p	MJE340	25p					AN6363	375p	BA524	240p	BA8521B	350p
BC179	14p	BD645	50p	BU209	90p	BUW49	550p	MJE350	80p					AN6367NK	400p	BA526	180p	BA8521B	350p
BC182	7p	BD647	50p	BU225	120p	BUW50	400p	MJE350T	85p					AN6368	275p	BA527	25p	BA8521B	350p
BC182L	7p	BD649	50p	BU225	120p	BUW50	400p	MJE355T	65p					AN6371	350p	BA529	95p	BA8521B	350p
BC183L	7p	BD676	40p	BU225	120p	BUW54	75p	MJE13004	100p					AN6375	400p	BA534	220p	CN562A	80p
BC184	7p	BD677	38p	BU325	55p	BUW85	85p	MJE13005	60p					AN6380	100p	BA536	150p	CN562A	80p
BC184L	7p	BD678	40p	BU326A	75p	BUX10	150p	MJE13006	60p					AN6381	100p	BA537	150p	CN562A	80p
BC212	7p	BD679	40p	BU406	85p	BUX11	200p	MJE13007	100p					AN6382	100p	BA538	150p	CN562A	80p
BC212L	7p	BD679	40p	BU406D	85p	BUX12	200p	MJE13008	100p					AN6383	100p	BA539	150p	CN562A	80p
BC213	7p	BD681	45p	BU407D	75p	BUX20	350p	MJE15028	200p					AN6384	100p	BA540	150p	CN562A	80p
BC213L	7p	BD682	45p	BU408	60p	BUX21	450p	MJE15029	200p					AN6385	100p	BA541	150p	CN562A	80p
BC214	7p	BD705	60p	BU408D	75p	BUX22	450p	MJE15030	250p					AN6386	100p	BA542	150p	CN562A	80p
BC214L	7p	BD707	60p	BU409	85p	BUX23	900p	MJE15031	400p					AN6387	100p	BA543	150p	CN562A	80p
BC237	7p	BD709	60p	BU412	120p	BUX27	220p	MJE18004	175p					AN6388	100p	BA544	150p	CN562A	80p
BC238	7p	BD711	50p	BU413	175p	BUX40	210p	MJF18204	350p					AN6389	100p	BA545	150p	CN562A	80p
BC239	7p	BD736	60p	BU414B	250p	BUX41	210p	OC28	350p					AN6390	100p	BA546	150p	CN562A	80p
BC300	20p	BD826	50p	BU415A	170p	BUX42	200p	OC29	250p					AN6391	100p	BA547	150p	CN562A	80p
BC301	20p	BD828	60p	BU426A	70p	BUX47A	220p	OC35	350p					AN6392	100p	BA548	150p	CN562A	80p
BC302	20p	BD839	55p	BU432	120p	BUX48A	150p	OC36	250p					AN6393	100p	BA549	150p	CN562A	80p
BC303	20p	BD857	60p	BU500	100p	BUX55	80p	S2000A3	175p					AN6394	100p	BA550	150p	CN562A	80p
BC304	25p	BD859	50p	BU500D	225p	BUX80	180p	S2000AF	90p					AN6395	100p	BA551	150p	CN562A	80p
BC327	7p	BD977	60p	BU505	90p	BUX81	160p	S2055A	175p					AN6396	100p	BA552	150p	CN562A	80p
BC328	7p	BDX33	60p	BU505D	90p	BUX84	50p	S2055AF	175p					AN6397	100p	BA553	150p	CN562A	80p
BC329	7p	BDX37	100p	BU505DF	90p	BUX85	50p	S2530A	100p					AN6398	100p	BA554	150p	CN562A	80p
BC341	28p	BDX47	60p	BU508	70p	BUX86	50p	TIP29	15p					AN6399	100p	BA555	150p	CN562A	80p
BC446	8p	BDX54C	75p	BU508DF	100p	BUX88A	350p	TIP29A	22p					AN6400	100p	BA556	150p	CN562A	80p
BC477	18p	BDX62C	150p	BU508A	60p	BUZ71	75p	TIP29E	25p					AN6401	100p	BA557	150p	CN562A	80p
BC516	22p	BDX63C	175p	BU508AF	60p	BUZ71AF	100p	TIP30	25p					AN6402	100p	BA558	150p	CN562A	80p
BC546	25p	BDX65	80p	BU508PH	100p	BUZ72A	100p	TIP30C	25p					AN6403	100p	BA559	150p	CN562A	80p
BC547	8p	BDX66C	175p	BU508D	85p	BUZ72AF	100p	TIP31A	22p					AN6404	100p	BA560	150p	CN562A	80p
BC548	8p	BDX67C	275p	BU508DR	130p	BUZ73A	60p	TIP31C	27p					AN6405	100p	BA561	150p	CN562A	80p
BC549	8p	BDX71	70p	BU508V	110p	BUZ73AF	60p	TIP32	24p					AN6406	100p	BA562	150p	CN562A	80p
BC550	8p	BDX77	175p	BU508VF	100p	BUZ76A	110p	TIP32A	21p					AN6407	100p	BA563	150p	CN562A	80p
BC558	8p	BDW24	55p	BU526	70p	BUZ80AF	200p	TIP32C	28p					AN6408	100p	BA564	150p	CN562A	80p
BC559	8p	BDW93	50p	BU536	100p	BUZ83	200p	TIP33	50p					AN6409	100p	BA565	150p	CN562A	80p
BC560	8p	BDW94	50p	BU546	125p	BUZ90A	180p	TIP33C	65p					AN6410	100p	BA566	150p	CN562A	80p
BC627	20p	BDY29	225p	BU603	125p	BUZ91A	200p	TIP34	65p					AN6411	100p	BA567	150p	CN562A	80p
BC639	20p	BDY56	225p	BU608D	120p	BYT11	25p	TIP35C	65p					AN6412	100p	BA568	150p	CN562A	80p
BC640	20p	BDY58	500p	BU626	120p	IRF120	225p	TIP36C	65p					AN6413	100p	BA569	150p	CN562A	80p
BCY33	20p	BDY90	125p	BU705	130p	IRF130	475p	TIP41A	22p					AN6414	100p	BA570	150p	CN562A	80p
BCY34	20p	BDY92	170p	BU706DF	175p	IRF140	550p	TIP41A	22p					AN6415	100p	BA571	150p	CN562A	80p
BCY46	30p	BF127	35p	BU724A	100p	IRF240	425p	TIP42A	20p					AN6416	100p	BA572	150p	CN562A	80p
BCV71	16p	BF167	30p	BU801	70p	IRF250	375p	TIP42C	20p					AN6417	100p	BA573	150p	CN562A	80p
BCV72	16p	BF181	30p	BU806	70p	IRF330	60p	TIP47	40p					AN6418	100p	BA574	150p	CN562A	80p
BD115	50p	BF183	20p	BU807	60p	IRF340	325p	TIP48	40p					AN6419	100p	BA575	150p	CN562A	80p
BD124P	50p	BF195	7p	BU807F	75p	IRF450	650p	TIP50	60p					AN6420	100p	BA576	150p	CN562A	80p
BD131	50p	BF200	30p	BU808DF	210p	IRF450	650p	TIP51	80p					AN6421	100p	BA577	150p	CN562A	80p
BD132	25p	BF200	30p	BU810	110p	IRF510	110p	TIP52	70p					AN6422	100p	BA578	150p	CN562A	80p
BD133	50p	BF225	30p	BU824	80p	IRF520	110p	TIP105	65p					AN6423	100p	BA579	150p	CN562A	80p
BD135	50p	BF240	30p	BU826	120p	IRF530	120p	TIP108	65p					AN6424	100p	BA580	150p	CN562A	80p
BD136	20p	BF245	25p	BU826A	160p	IRF540	120p	TIP109	65p					AN6425	100p	BA581	150p	CN562A	80p
BD137	20p	BF255	18p	BU830	110p	IRF610	120p	TIP110	110p					AN6426	100p	BA582	150p	CN562A	80p
BD139	20p	BF256	18p	BU903	110p	IRF611	120p	TIP111	110p					AN6427	100p	BA583	150p	CN562A	80p
BD140	20p	BF257	18p	BU910	80p	IRF620	160p	TIP112	35p					AN6428	100p	BA584	150p	CN562A	80p
BD144	90p	BF259	18p	BU912	100p	IRF630	110p	TIP112H	50p					AN6429	100p	BA585	150p	CN562A	80p
BD166	30p	BF262	18p	BU920	100p	IRF640	300p	TIP113	30p					AN6430	100p	BA586	150p	CN562A	80p
BD175	30p	BF273	15p	BU930	130p	IRF650	200p	TIP116	30p					AN6431	100p	BA587	150p	CN562A	80p
BD177	30p	BF311	21p	BU932	170p	IRF710	150p	TIP117	30p					AN6432	100p	BA588	150p	CN562A	80p
BD179	32p	BF336	20p	BU941	250p	IRF720	150p	TIP120	37p					AN6433	100p	BA589	150p	CN562A	80p
BD181	30p	BF347	20p	BU950A	100p	IRF730	100p	TIP121	35p					AN6434	100p	BA590	150p	CN562A	80p
BD182	60p	BF348	20p	BU2508AF	100p	IRF740	125p	TIP122	35p					AN6435	100p	BA591	150p	CN562A	80p
BD184	60p	BF362	30p	BU2508D	130p	IRF820	110p	TIP125	30p					AN6436	100p	BA592	150p	CN562A	80p
BD187	30p	BF367	13p	BU2508DF															



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



LINEAR ICs

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
HA13001	650p	LA2800	350p	LA7096	200p	LF353	48p	MC3302	50p	SAB3029	625p	STK3102 II	830p
HA13002	200p	LA3120	200p	LA7113	275p	LF355	60p	MC3401	45p	SAB3035	275p	STK3106	2500p
HA13006	400p	LA3150	200p	LA7116	125p	LF357	70p	MC3423P	100p	SAB3036	725p	STK3122 III	725p
HA13007	300p	LA3160	120p	LA7123	1300p	LF398	300p	MC3488AP	250p	SAB3037	700p	STK3152 II	900p
HA13108	280p	LA3210	85p	LA7120	100p	LF2426S	600p	MC34033AP	300p	SAB3042	825p	STK3156	500p
HA13117	175p	LA3220	65p	LA7121	100p	LN24	35p	MN1220T	600p	SAB3064	130p	STK4017	400p
HA13118	140p	LA3226	80p	LA7124	150p	LN311	29p	MN1226	600p	SAB3210	250p	STK4019	480p
HA13119	140p	LA3246	75p	LA7220	125p	LM319	165p	MN1228	600p	SAB3210	250p	STK4021	360p
HA13127	350p	LA3300	140p	LA7222	110p	LM324	30p	MN1276	1300p	SAB6456	125p	STK4024 II	550p
HA13128	400p	LA3301	110p	LA7224	150p	LM325	120p	MN1280	700p	SAB8048	225p	STK4025	530p
HA13130	450p	LA3361	100p	LA7225	250p	LM339	35p	MN3004	600p	SAB8048	225p	STK4026	480p
HA13135	500p	LA3365	70p	LA7232	260p	LM348	50p	MN3005	2000p	SDA2003	450p	STK4028	550p
HA13139	600p	LA3370	70p	LA7234	200p	LM358	45p	MN3011	4000p	SDA2004	325p	STK4032 II	1080p
HA13150A	1150p	LA3373	70p	LA7295	160p	LM380	80p	MN310	110p	SDA2005	700p	STK4034 X	925p
HA13151	875p	LA3375	300p	LA7297	120p	LM381	150p	MN3102	110p	SDA2007	300p	STK4036	470p
HA13403	400p	LA3376	80p	LA7305A	350p	LM382	130p	MN3207	375p	SDA2008	400p	STK4038	680p
HA13406W	400p	LA3380	300p	LA7308	70p	LM386	60p	MN3208	950p	SDA2112	450p	STK4040 II	650p
HA13408	350p	LA3390	250p	LA7311	120p	LM387	100p	MN3208	950p	SDA2120	200p	STK4042 II	800p
HA13412	800p	LA3400	250p	LA7320	200p	LM389	100p	MN3208	950p	SDA2120	200p	STK4044	950p
HA13426	500p	LA3401	90p	LA7323	325p	LM389N	105p	MN3208	950p	SDA2131	225p	STK4048	800p
HA13432	400p	LA3410	150p	LA7330	350p	LM393	100p	MN3208	950p	SDA2131	225p	STK4048	800p
HA13441	450p	LA3430	135p	LA7331	250p	LM393	100p	MN3208	950p	SDA2131	225p	STK4048	800p
HA17524	100p	LA3600	80p	LA7332	225p	LM431	50p	NE555	20p	SDA4211	775p	STK4060	510p
KA2102	100p	LA3905	100p	LA7340	225p	LM741DIL	18p	NE555	110p	SDA5243-2	450p	STK4065	650p
KA2130	110p	LA4030	180p	LA7346	150p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KA2206	150p	LA4031	140p	LA7351	150p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KA2209	125p	LA4032	140p	LA7352	150p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KA2210	230p	LA4051	160p	LA7353	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KA2212	65p	LA4100	85p	LA7354	160p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KA2213	130p	LA4101	85p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KA2214	100p	LA4102	100p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KA2224	50p	LA4110	120p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KA2244	75p	LA4120	270p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KA2261	100p	LA4138	105p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KA2263	100p	LA4140	80p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KA2264	100p	LA4142	85p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KA2284	100p	LA4142	85p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KA2309	175p	LA4160	100p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KA2401	150p	LA4162	110p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KA2412	225p	LA4178	150p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KA2912	125p	LA4180	150p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KA2913A	175p	LA4182	180p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KA2914A	200p	LA4190	300p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KA2247	100p	LA4192	100p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KI46213S	60p	LA4200	130p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KI46218H	400p	LA4201	120p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KI46201M	250p	LA4260	230p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KI46283K	150p	LA4261	300p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KI46299K	210p	LA4265	125p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KI4727CP	200p	LA4270	300p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
KI47313	45p	LA4282	350p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
LA19V	300p	LA4420	140p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L165V	250p	LA4422	130p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L200	200p	LA4425A	200p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L21	100p	LA4430	130p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L272M	100p	LA4440	110p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L290B	225p	LA4445	200p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L291B	200p	LA4446	170p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L292	75p	LA4460	120p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L293B	225p	LA4461	120p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L293D	225p	LA4466	125p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L293E	250p	LA4470	300p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L294	475p	LA4475	225p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L295	450p	LA4480	225p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L296	525p	LA4485	300p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L297	400p	LA4495	250p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L485A	400p	LA4496	250p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L482	400p	LA4498	275p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L497B	525p	LA4500	200p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L702B	400p	LA4505	220p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L702N	325p	LA4508	200p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L722	150p	LA4510	100p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L722	150p	LA4510	100p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L4960	325p	LA4550	200p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L6203	600p	LA4555	120p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L6210	250p	LA4557	150p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L6221AS	300p	LA4558	125p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
L6506	300p	LA4570	130p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
LA1130	240p	LA4571	150p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
LA1135	120p	LA4581	175p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
LA1145	200p	LA4597	125p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
LA1150	150p	LA4620	400p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
LA1170	90p	LA4630	325p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
LA1177	130p	LA4700	350p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
LA1180	75p	LA4705	400p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
LA1185	150p	LA5005	90p	LA7355	175p	LM741MET	55p	NE555	110p	SDA5243-2	450p	STK4065	650p
LA1186	35p	LA5112	200p	LA735									

JAPANESE TRANSISTORS

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
2SC1675	90p	2SC2261	70p	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	30p	2SC2270	60p	2SC2724	15p	2SC3269	50p	2SC3808	70p	2SD291	250p	2SD889	35p	2SD1330	50p	2SD1765	70p	2SK320	120p
2SC1684	30p	2SC2271	60p	2SC2726	20p	2SC3270	50p	2SC3811	80p	2SD313	25p	2SD892A	75p	2SD1337	50p	2SD1769	110p	2SK323	130p
2SC1685	30p	2SC2272	60p	2SC2728	20p	2SC3271	75p	2SC3831	250p	2SD315	75p	2SD894	35p	2SD1340	65p	2SD1773	100p	2SK332	175p
2SC1729	90p	2SC2275	50p	2SC2750	300p	2SC3272	280p	2SC3832	135p	2SD325	30p	2SD895	100p	2SD1348	150p	2SD1776	70p	2SK359	40p
2SC1730	100p	2SC2278	70p	2SC2751	270p	2SC3273	30p	2SC3833	100p	2SD330	65p	2SD896	200p	2SD1376	60p	2SD1783	70p	2SK363	50p
2SC1735	70p	2SC2280	700p	2SC2752	75p	2SC3280	200p	2SC3851	250p	2SD348	300p	2SD898B	225p	2SD1378	80p	2SD1785	160p	2SK364	40p
2SC1740	100p	2SC2282	1000p	2SC2753	300p	2SC3281	200p	2SC3852	200p	2SD350	320p	2SD900	400p	2SD1379	100p	2SD1789	210p	2SK367	40p
2SC1741	35p	2SC2284	40p	2SC2769	400p	2SC3282	600p	2SC3853	220p	2SD357	40p	2SD905	450p	2SD1380	100p	2SD1796	120p	2SK369	40p
2SC1755	90p	2SC2288	35p	2SC2773	70p	2SC3283	600p	2SC3855	220p	2SD358	50p	2SD916	130p	2SD1382	60p	2SD1802	75p	2SK369	40p
2SC1756	35p	2SC2307	300p	2SC2774	500p	2SC3288	85p	2SC3857	520p	2SD359	50p	2SD917	300p	2SD1384	50p	2SD1806	75p	2SK373	30p
2SC1758	30p	2SC2308	10p	2SC2785	40p	2SC3289	120p	2SC3858	560p	2SD361	100p	2SD921	320p	2SD1390	350p	2SD1812	45p	2SK374	45p
2SC1760	70p	2SC2312	300p	2SC2786	20p	2SC3300	400p	2SC3866	275p	2SD362	100p	2SD923	360p	2SD1391	250p	2SD1815	50p	2SK386	600p
2SC1775	10p	2SC2314	70p	2SC2787	10p	2SC3303	100p	2SC3868	100p	2SD371	240p	2SD946	120p	2SD1392	85p	2SD1825	60p	2SK389	115p
2SC1781	20p	2SC2316	150p	2SC2791	500p	2SC3306	130p	2SC3870	200p	2SD380	650p	2SD947	100p	2SD1395	85p	2SD1827	120p	2SK400	700p
2SC1789	100p	2SC2320	10p	2SC2792	220p	2SC3307	600p	2SC388A	25p	2SD381	50p	2SD950	300p	2SD1397	120p	2SD1843	70p	2SK405	450p
2SC1809	40p	2SC2324	120p	2SC2793	700p	2SC3309	150p	2SC3883	210p	2SD382	75p	2SD951	200p	2SD1398	100p	2SD1846	350p	2SK414	550p
2SC1810	250p	2SC2328A	50p	2SC2808	40p	2SC3310	125p	2SC3884A	20p	2SD386	70p	2SD957A	520p	2SD1399	120p	2SD1847	275p	2SK415	500p
2SC1815	10p	2SC2310	25p	2SC2810	360p	2SC3316	280p	2SC3885	250p	2SD388	150p	2SD958	60p	2SD1399	300p	2SD1848	280p	2SK423	75p
2SC1819	70p	2SC2315	175p	2SC2812	40p	2SC3317	350p	2SC3885A	290p	2SD389	60p	2SD965	35p	2SD1400	225p	2SD1850	325p	2SK427	50p
2SC1826	60p	2SC2329	480p	2SC2814	40p	2SC3326	60p	2SC3886A	275p	2SD400	14p	2SD970	170p	2SD1402	120p	2SD1853	30p	2SK430	200p
2SC1827	60p	2SC2230	300p	2SC2824	75p	2SC3327	50p	2SC3890	150p	2SD401	50p	2SD972	40p	2SD1403	225p	2SD1856	40p	2SK430	200p
2SC1829	500p	2SC2331	50p	2SC2825	900p	2SC3328	50p	2SC3892A	250p	2SD402	120p	2SD973	60p	2SD1405	80p	2SD1857	75p	2SK430	200p
2SC1833	27p	2SC2333	200p	2SC2826	200p	2SC3330	20p	2SC3893	225p	2SD414	45p	2SD973A	70p	2SD1406	60p	2SD1858	40p	2SK431	450p
2SC1834	50p	2SC2334	80p	2SC2827	130p	2SC3331	25p	2SC3895	325p	2SD415	55p	2SD982	90p	2SD1407	60p	2SD1863	35p	2SK431	450p
2SC1841	12p	2SC2335	55p	2SC2832	300p	2SC3333	120p	2SC3896	400p	2SD424	350p	2SD985	120p	2SD1408	125p	2SD1864	85p	2SK432	160p
2SC1844	50p	2SC2336A	125p	2SC2834	280p	2SC3345	100p	2SC3897	400p	2SD426	150p	2SD986	120p	2SD1409	170p	2SD1877	175p	2SK432	160p
2SC1845	15p	2SC2344	150p	2SC2837	250p	2SC3346	130p	2SC3907	250p	2SD427	35p	2SD998	70p	2SD1411	85p	2SD1878	160p	2SK434	700p
2SC1846	35p	2SC2347	35p	2SC2839	40p	2SC3352	200p	2SC3927	250p	2SD438	35p	2SD1010	40p	2SD1412	75p	2SD1879	275p	2SK437	900p
2SC1847	45p	2SC2353	120p	2SC2853	70p	2SC3353	280p	2SC3940	40p	2SD467	15p	2SD1012	40p	2SD1413	60p	2SD1880	350p	2SK438	350p
2SC1855	85p	2SC2360	120p	2SC2873	60p	2SC3355	50p	2SC3943	75p	2SD468	15p	2SD1020	40p	2SD1415	190p	2SD1881	300p	2SK444	30p
2SC1856	25p	2SC2361	150p	2SC2877	120p	2SC3356	120p	2SC3944	80p	2SD471	20p	2SD1021	120p	2SD1417	75p	2SD1884	350p	2SK444	30p
2SC1865	700p	2SC2362	50p	2SC2878	20p	2SC3358	50p	2SC3950	120p	2SD476	100p	2SD1022	250p	2SD1425	260p	2SD1886	300p	2SK454	30p
2SC1870	700p	2SC2365	280p	2SC2879	3200p	2SC3376	300p	2SC3953	50p	2SD525	50p	2SD1024	850p	2SD1426	135p	2SD1887	225p	2SK454	30p
2SC1871	425p	2SC2369	100p	2SC2882	60p	2SC3377	50p	2SC3955	60p	2SD526	70p	2SD1027	850p	2SD1427	160p	2SD1889	300p	2SK455	225p
2SC1875	220p	2SC2371	25p	2SC2883	60p	2SC3378	120p	2SC3964	100p	2SD545	18p	2SD1030	75p	2SD1428	180p	2SD1895	225p	2SK455	225p
2SC1881	70p	2SC2373	210p	2SC2898	200p	2SC3379	1200p	2SC3972	250p	2SD549	120p	2SD1031	70p	2SD1430	200p	2SD1910	175p	2SK456	500p
2SC1890	15p	2SC2383	50p	2SC2899	50p	2SC3381	130p	2SC3973	210p	2SD551	300p	2SD1036	600p	2SD1431	280p	2SD1911	300p	2SK457	400p
2SC1895	500p	2SC2389	45p	2SC2909	60p	2SC3383	80p	2SC3975	210p	2SD554	225p	2SD1046	200p	2SD1432	400p	2SD1913	50p	2SK458	600p
2SC1904	125p	2SC2407	110p	2SC2910	25p	2SC3393	80p	2SC3987	160p	2SD555	500p	2SD1047	180p	2SD1433	300p	2SD1929	50p	2SK459	600p
2SC1906	15p	2SC2408	120p	2SC2911	80p	2SC3397	20p	2SC3996	600p	2SD556	225p	2SD1051	130p	2SD1438	60p	2SD1930	50p	2SK460	580p
2SC1907	20p	2SC2412K	50p	2SC2912	120p	2SC3399	50p	2SC3997	1250p	2SD558	200p	2SD1055	60p	2SD1439	165p	2SD1933	45p	2SK461	475p
2SC1909	250p	2SC2440	200p	2SC2921	650p	2SC3400	35p	2SC4008	800p	2SD560	50p	2SD1060	130p	2SD1441	220p	2SD1939	60p	2SK462	70p
2SC1913	90p	2SC2458	10p	2SC2922	480p	2SC3401	50p	2SC4096	100p	2SD571	20p	2SD1062	150p	2SD1442	80p	2SD1941	350p	2SK462	80p
2SC1914	30p	2SC2459	50p	2SC2923	75p	2SC3402	40p	2SC4020	150p	2SD575	530p	2SD1063	200p	2SD1445	200p	2SD1944	50p	2SK464	950p
2SC1921	15p	2SC2466	55p	2SC2928	550p	2SC3405	130p	2SC4023	325p	2SD592	25p	2SD1064	250p	2SD1446	300p	2SD1958	80p	2SK465	110p
2SC1922	175p	2SC2486	275p	2SC2929	280p	2SC3409	40p	2SC4029	350p	2SD596	25p	2SD1065	160p	2SD1451	60p	2SD1959	210p	2SK469	100p
2SC1923	10p	2SC2492	50p	2SC2934	75p	2SC3416	30p	2SC4043	45p	2SD600	30p	2SD1069	150p	2SD1451	200p	2SD1978	50p	2SK470	300p
2SC1929	180p	2SC2470	65p	2SC2937	250p	2SC3417	90p	2SC4046	40p	2SD601	40p	2SD1073	350p	2SD1452	275p	2SD1984	60p	2SK474	500p
2SC1940	110p	2SC2481	120p	2SC2939	400p	2SC3419	120p	2SC4056	200p	2SD602	60p	2SD1088	150p	2SD1453	140p	2SD1991	50p	2SK475	500p
2SC1941	27p	2SC2482	10p	2SC2944	300p	2SC3420	80p	2SC4059	400p	2SD612	50p	2SD1094	375p	2SD1455	250p	2SD1994	200p	2SK476	425p
2SC1942	350p	2SC2483	120p	2SC2958	50p	2SC3421	45p	2SC4064	140p	2SD613	70p	2SD1110	225p	2SD1457	165p	2SD1996	45p	2SK477	475p
2SC1944	350p	2SC2484	185p	2SC2962	800p	2SC3422	75p	2SC4106	150p	2SD617	300p	2SD1111	20p	2SD1458	50p	2SD2006	75p	2SK479	400p
2SC1945	350p	2SC2485	400p	2SC2979	160p	2SC3423	65p	2SC4107	175p	2SD633	70p	2SD1113	225p	2SD1459	60p	2SD2010	25p	2SK479	400p
2SC1946	1500p	2SC2491	20p	2SC2987	250p	2SC3425	65p	2SC4123	230p	2SD636	15p	2SD1128	200p	2SD1468	40p	2SD2011	60p	2SK480	300p
2SC1947	450p	2SC2498	50p	2SC2988	150p	2SC3446	150p	2SC4124	200p	2SD637	15p	2SD1133	65p	2SD1487	225p	2SD2012	50p	2SK480	300p
2SC1953	45p	2SC2500	25p	2SC2989	60p	2SC3447	130p	2SC4125	25p	2SD638	15p	2SD1135	75p	2SD1494	150p	2SD2018	65p	2SK482	200p
2SC1957	70p	2SC2502	40p	2SC2989	50p	2SC3456	200p	2SC4137	40p	2SD639	350p	2SD1138	40p	2SD1496	300p	2SD2023	80p	2SK487	800p
2SC1959	10p	2SC2503	60p	2SC3001	1400p	2SC3457	125p	2SC4138	200p	2SD640	18p	2SD1140	40p	2SD1498	300p	2SD2026	100p	2SK487	800p
2SC1962	175p	2SC2512	20p	2SC3019	320p	2SC3459	180p	2SC4157	400p	2SD645	350p	2SD1142	350p	2SD1497-02	230p	2SD2061	200p	2SK491	225p
2SC1967	1300p	2SC2517	120p	2SC3020	1450p</														

REPLACEMENT VIDEO HEADS

Model	Price	Model	Price	Model	Price	Model	Price	Model	Price
AKAI		VHSAN3	800P	HRD750, HRD830, HRD860	1900P	NVFS 100	4500P	TL51100	3100P
VS105, 112, 115, 116, 120, 125, 126, 201, 202, 205, 220, 240, 244, 245, 247, 248, 250, 301, 303, 304, VSP8, VSP82	850P	VHSAY3	1200P	3V32, 8942, HR7655	1800P	NVFS1	4200P	VHR1200, 130, 14, 141, 143G, 14SP, 151, 15, 16, 17, 21, 22, 23, 24, 274, VHR310, 330, 4100, 4105, 4200, 430, 4300, 4400, 4500, 5080, 5100, VHR2500, 5600, 6850, 7100, 7200, 7250, 7300, 8070, 8100, 8101, 8200, VHR7800, 70, 80, 800SP, 8801SP, VHR4400, 4410, 4500, 4600, VHR4610, 6700, 4800	4250P
VP7100, VS9300, VS9500	950P	VHSBH1, VHSCH1	850P	HRD180, 190, 230, 610, 3V58, FV12L, FV20B, 26, 30, 32, 33, VC141L	1600P	N.E.C.		TLR2000	4500P
VP7200, VS9700, VS9800	800P	VHSBP1	2600P	HRD370, HRD430, HRD470, 3V58, FV13H	1800P	N9011, 9012, 9013E, 9014E, 9014G, 9015, 9016, 901A, 902A, 9033, N9034, 9040, 9053, 9054, 9055, 9056, 9063, 9065, 9066, 906, 9077, N9096, DX1000, 1600, PX1200	850P	VHR3500E	2150P
VS1	900P	VHSBY3	1400P	HRD530, HRD700, HRD840, HRD870	2300P	N911A, 914C, 915A, 916A, 917, 9110, 9120	2400P	VHR5300	4500P
VS2	900P	VHSD52	1600P	HRD250, HRD257	2800P	PVC600, 740, 744, 754, 763E, 764, PV2300, 2400, 760, 794, 770, 774	1650P	VHR1200, 130, 14, 141, 143G, 14SP, 151, 15, 16, 17, 21, 22, 23, 24, 274, VHR310, 330, 4100, 4105, 4200, 430, 4300, 4400, 4500, 5080, 5100, VHR2500, 5600, 6850, 7100, 7200, 7250, 7300, 8070, 8100, 8101, 8200, VHR7800, 70, 80, 800SP, 8801SP, VHR4400, 4410, 4500, 4600, VHR4610, 6700, 4800	4250P
VS10	1350P	VHSEH2, VHSDD2	1400P	GRC, GRC2, 3 V41	2300P	N834, N835, N836	550P	VHR5300E	2150P
VSP1	900P	VHSEY1, VHSFY2	1300P	BR9060, HRD330, 337, 440, 441, 637, 641, 660, 670, 720, 730, 740, 820	1600P	N830, N831, N830, N831, N832, N833, N834, N835, N836	550P	VHR1200, 130, 14, 141, 143G, 14SP, 151, 15, 16, 17, 21, 22, 23, 24, 274, VHR310, 330, 4100, 4105, 4200, 430, 4300, 4400, 4500, 5080, 5100, VHR2500, 5600, 6850, 7100, 7200, 7250, 7300, 8070, 8100, 8101, 8200, VHR7800, 70, 80, 800SP, 8801SP, VHR4400, 4410, 4500, 4600, VHR4610, 6700, 4800	4250P
V533, 35, 37, 38, 38EOG MKII, 53, 55, 66, 765, 766, 767, 768, 865, 867, V5F30, 33, 4, 400, 410, 420, 430, 440, 441, 450, 455, 480, 490, 497, V5S51, 54, 55, V5X450, V5X5470	1600P	VHSTJ3, VHSJ3	1300P	HRJ200, HRJ205	1900P	DX4000, N9610, NS7000	2400P	VHR5300E	2150P
V5512, V5515, V5516	2250P	VHSTJ3, VHSJ3	1300P	HRJ300, HRJ305, HRJ315, HRJ315E, HRJ318E	3750P	N9652, N9530, DX2000	1700P	VHR5300E	2150P
V5462, 465, 467, 467EOG2, V5F12, 15EK, 15EOH, 300, 301, 310, V5F230, 330, 340, 350, V5G30, 33, 34, 35	2300P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	VPC1, VPC2, VPC3, 240, 744, 744, 764, 764	1400P	VHR5300E	2150P
V511, VS12	1000P	VHSTJ3, VHSJ3	1300P	HRJ315E, HRJ318E	3750P	D56000	3500P	VHR5300E	2150P
V56, V58, V59	2250P	VHSTJ3, VHSJ3	1300P	HRJ400, HRJ405, HRJ407MS, HRJ41	4500P	D56000	3500P	VHR5300E	2150P
V5A1100, 1110, 650, V5F500, 510, 550, 560, 580, 590, 600, 650, V5G60, 64, 65, V5G70, 73, 74, 75, V5S580, 580	3600P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
V515, VS165	2300P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
V520, 22, 23, 24, 25, 26, 27, 422, 425, 426, 427, 485, V5F10, 11, 180, 190, V5F200, 210, 220, 221, 222, 230, 240, 260, 261, 262, 265, 270, 275, 280, V5F290, 510, 550, V5G20, 204, 205, 206, V5G21, 211, 212, 215, V5G21EOG, 23, 24, 25, 405, 411, 415, 417, V5P 100, 105E, 110, V5P88, 88KC, 8111, V5P9, V5R100, 100EDG, 100EM, 110, V5X400	1250P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
V5R9	1300P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
V59, V58, V5603, V5606, V5607	2500P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
V575	2500P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
V5965, V5967	3450P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
V5F400, 410, 420, 430, 440, 441, 450, 455, 480, 490, 497, V5X450, 470	2850P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
V5G20, 204, 204, 205, 206, 20, 21, 211, 212, 215, 217, 225, 23, 24, 25, V5P100, 110, 88, V5R100, 110, V5X400	1300P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
V5G415, V5G71	2800P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
V575, V577	2700P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
V5F1000, V5F1010, V5F1030	5800P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
ALBA		VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VDR3000, VCR4000, VCR5000, VCR6000	1650P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VCR7100	1000P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VTV900, 7800, 8000, 8800	1100P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
AMSTRAD		VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VCR4500, VCR5200, VCR9000	900P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VCR7000	1000P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VCR1000, 2000, 6000, 61000, 62000, 8600, 8602, 8700, 9005, DD8900, DD8904, TVR4	1100P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VCR2, TVR3, VCR4600, VCR4600 MKII, VCR4700	1100P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VCR8000, VCR8800, VCR9340	2100P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VCR8603, VCR8604, VCR8704, VCR8714	1870P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VCR9140, VCR9142	2550P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VCR9340	3650P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VCR9244	3450P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VJF202, 22, VCR3000, 3002, 9500	1750P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
FISHER		VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
FVHP420, 510, 520, 530, 615, 618, 620, 622, 710, 711, 715, 716, 720, FVHP721, 722, 730, 830, 905, 906, 907, 908, 910, 911, 915, 916, 918, FVHP5000, 5001, 5005, 5050, 5075	1100P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VBS3500, 7100, 7500, 7600, 9300, VBR330	1800P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VBS7000, VBS7100, VBS9000	2000P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VFPH500, 711, 715, 721, 722, 730, 830, 5100, FVHD720	1100P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VFPH725, VFPHP830, VFPHP980	2500P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VFPHP980	2700P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VFPHP975	2400P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VFDH407, VFDH140, VFP11, VFP1P10, VFP1P20	1150P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VFDH230, VFP1100, 1200, 130, 1340, 1140, 2000, 200, 210, 300, VFP1310, 410, 420	1800P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VFDH250, 270, 370, VFP11500, VFP1250	2700P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VFP1320, 1400, 1440, 320, 440, 445	3550P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VFP14705, VFPHP475HV	4800P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VFP1250, VFPHP430S	1950P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
GOLDSTAR		VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
8000 3HSSDB, GHV121, RQ2011, 2031, 2051	1900P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
GHV51, GHV122, VCP4000, VCP4100, VCP4200	1100P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
GHV1232, 1233, 1242, 1243, 1244, 1245, 1246, 1266, 1290, 1291	1100P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
GHV1295, 1296, 1891, 8210, 8215, 1221, 1240, 1241, 1247, 1248, 2145	1100P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
VCP400, VCP410, 4300, 4301, 4305, 4306, 4310, 4311, 4315, 4316, VCP4320, 4321, 4325, 4326	900P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P	D56000	3500P	VHR5300E	2150P
C211, GHV1392P, 1393P, 1900P, 1290, 1291PQ, 12931Q, 1295P, GSE1295PQ, GSE1296, 1297, 1891, 1910, 2005, 2000, GSEC200, GSEC205, 211, 2301, GSEG2301, GSEQ12, 204, 20, 22, P416P, P500P, QUISY22, QUISY24, RC205P, RG11P, RG20, RG2001, RQ20, RQ204HP, RQ241, VCP100P, GSEGI10	1300P	VHSTJ3, VHSJ3	1300P	HRJ600EG, HRJ600EK, HRJ605EG, HRJ605UK, HRJ610EK	7100P				

PINCH ROLLERS

Model	Price	Model	Price	Model	Price	Model	Price	Model	Price
AKAI VS10, VS9300, VS9500, VS9700, VS9800, VP7100, VP77	140p	FVHP615, 618, 620, 622, 710, 711, 715, 716, 720, 721, 722, 725, 730, FVHP810, 830, 840	140p	BR5600, 605, 747, 777, 920, 925 HR510	140p	NS7000	140p	681, 682, 684, 685, 693, VC699, 700, 772, 750, 779, 780, 781, 7810, 782, 782MK2, 7822, 783	
VS12, VS15 VS102, 112, 115, 116, 120, 125, 126, 155, 165, 205, 220, 240, 244, 245, VS247, 248, 250, 512, VS515, 516, VS93	140p	FVHP905, 906, 907, 908, 910, 911, 915, 916, 918, 970, 975, 980, 990, FVHP 5000, 5005, 5050, 5075, 5100	140p	PHICH ROLLER ASSEMBLY HRD140, 141, 142, 143, 150, 152, 157, 158, 160, 565, 566, 725, 755, HRP50	1100p	VC11, VH2 VC150, 160, VH3, 33, 200, 201, 205, 212, 250, 254, 288, 300, 303, 312, VH404, 555, 700, 704, 712, 770, 780, 844, 900, 1000, 2940, 3030, 3312 CNAH, VR2948	140p	VC785, 786, 787, 793, 800, 7810, 7822, VCT72, VC6F3, VC6V3, VCA100, 102, 104, 131, 140, 170, 202, 203, 211, 234, 303, 501, 502, VCA602, 5011, VCD801, 802, 851, 852, 881, 882, VCM73, VCT73, VCT72, VCT80	
VS93 VS201, 301, 303, 304, 603, 606, 607, VSP8, VSP82, VP58, VP82	140p	FVHD230, 250, 270, 700, 2000D, FVHP3, 210, 250, 300, 310, 1100, FVHP1200, 1250, 1300, 132, 1334, 1340, 1400, 1410, 1440, 1500, 200, FVHP320410, 420, 430, 440, 445, 470, 475, FVSP2905, 495, 2905	140p	PINCH ROLLER ASSEMBLY HRD150, 510, 520, 521, 522, 525, 527, 560, 600, 610, 620, 637, 641, HRD650, 720, 830, 840, 910, HRJ205, HR5500	1350p	ORION VH1500, 16000, HV03, LVH50, 140V, NEVHM, NEVHML, TVP230RC, VCP VH04, 30, 103, 300, 358, 360, 362, 400, 416, 512, VH530, 532, 535, 536, 600, 630, 635, 640, 666, 730, 735, 744, 774, 790 VH800, 820, 850, 888, 893, 900, 930, 940, 942, 974, 1012, 1040, 1050, VH1060, 1070, VH1100, 1120, 1204, 1440, 1500, 1660, 1800, 2004, VH2151, 2308, 22042400, 2500, 2600, 2700, VH2960, 2970, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4300, 5020, VP 10, 200, 220, 225, 245, VR821, 925, 1032, 2948, 2959, 2957, 2966, 2979, 2980, VTV300, VXL20, 25, 30	140p	VC821 VCA10, 30G, 60, 103, 105, 106, 111, 113, 131, 211, 244, 254, 33, 35, 36, VCA37, 39, 40, 42, 454, 46, 47, 48, 50, 505, 51, 52, 53, 54, 55, 57, 58, 505, VCA60, 605, 615, 62, 63, 67, 68, 1031, 11613, VCB311, 320, VCB597, VCD805, 806, 810, 816, VCH80, 81, 865, 910, VCS 1000, VCT310, VCT410, 610, VCT 1314, 5313, VCT90	140p
VS125, VS155, VS165, VS220, VS240, VS250, VS512	140p	FVHD140, 40, 55, FVHP1, 10, 25, 30, 40, 4000, FVHS10, 30	140p	HRD470, 500, 530, 700, 750, 950, HR55000, 5500, 9000	350p	PHILIPS VR640 VR6920 VR2020, VR2021, VR2022, VR2023, VR2024 VR6711 VR6540	140p	VC821 VCA10, 30G, 60, 103, 105, 106, 111, 113, 131, 211, 244, 254, 33, 35, 36, VCA37, 39, 40, 42, 454, 46, 47, 48, 50, 505, 51, 52, 53, 54, 55, 57, 58, 505, VCA60, 605, 615, 62, 63, 67, 68, 1031, 11613, VCB311, 320, VCB597, VCD805, 806, 810, 816, VCH80, 81, 865, 910, VCS 1000, VCT310, VCT410, 610, VCT 1314, 5313, VCT90	140p
VS22, 23, 25, 35, 37, 38, 33, 34, 55, 66, 75, 422, 425, 426, 427, 462, 465, 467, VS485, 765, 767, 768, 865, 867, 965, 967, VSA77, VSA650, VSF10, 11, 12, 15, 180, 190, 200, 210, 220, 221, 222, 230, 240, 30, 33 VSF330, 4, 500, 550, VSP88, VSR100, VSX400, 450, 470	140p	PINCH ROLLER ASSEMBLY GOLDSTAR GHV51, 1221, 1232, 1233, 1240, 1241, 1242, 1243, 1244, 1245, 1246, 140p GHV1247, 1248, 1250, 1266, 1290, 1291, 1295, 1296, 1392, 1393, GHV1891, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV210, 8215, 8430 GHV1240, 1241, 1247, 1248, 1290, 1291, GHVP1295, 1296, VCP4000, 4100, 4130, 4200, 4300, 4301, 4305, VCP4306, 4310, 4311, 4315, 4316, 4320, 4321, 4325, 4328, 4350, GSE12910, 1291, 1295, 1296, 1297, 1891, 1910, 20005, 2000	140p	MATSUI VK6000, 730, 735, 750, 755, 765, 800, 850, VS898 VK1000, VK2000, VK2500, VK3000, VK6000A	140p	VR6540 VR656, 586, VR702, 703, 6485, 6585, 6589, 6785, 6980, 6948 VR445, VR642, VR6542, VR6643, VR6843 VR6943, 445B9 VD464, 662, VR2220, 2300, 2324, 2330, 2334, 2340, 2350, 2414, VR2480, 2485, 2486, 2489, 2490, 2498, 2840, 6462, 6463, 6464, 6560, VR6660, 6860, 6861, 6862, 6863 N-1700, VR2870 VR2025, VR6580, VR6581 49586, VR3260, 6349, 6448, 6449, 6548, 6648 PRESSURE ROLLER ASSEMBLY PS403-40205 DV186, 190, VR211, 2115, 212, 213, 223, 286, 291, 292, 311, 312, 313, VR3210, 3219, 322, 3229, 323, 3535B0, 486, 471, 562, 582, 571, 761, VR201, 202, VR203, 302, 303, 305, 6180, 6182, 6185, 6285, 6290, VR6291, 6293, 6362, 6367, 6390, 6391, 6393, 6467, 6468, 6470, 6561 VR6760, 6581VR6670, 6676, 6710, 6760, 6761, 6762, 6870, 6970, VR6975, 6681, 63587, 68584, 71584, 71585, 72588, 72588, 925B31, 20DV1, 20DV2, 20RW7, 21DVI, 21DV2, 25801, 25802, 25811, 25812, 30DV2, 31DVI, 31DV2, 31DV335B02, 35B03, 35B05 35B11 35B12 35B13 VR231, 232, 332, 422, 4229, 512, 5229, 722, 7229, 723 VR501	140p	VC821 VCA10, 30G, 60, 103, 105, 106, 111, 113, 131, 211, 244, 254, 33, 35, 36, VCA37, 39, 40, 42, 454, 46, 47, 48, 50, 505, 51, 52, 53, 54, 55, 57, 58, 505, VCA60, 605, 615, 62, 63, 67, 68, 1031, 11613, VCB311, 320, VCB597, VCD805, 806, 810, 816, VCH80, 81, 865, 910, VCS 1000, VCT310, VCT410, 610, VCT 1314, 5313, VCT90	140p
VS22, 23, 25, 35, 37, 38, 33, 34, 55, 66, 75, 422, 425, 426, 427, 462, 465, 467, VS485, 765, 767, 768, 865, 867, 965, 967, VSA77, VSA650, VSF10, 11, 12, 15, 180, 190, 200, 210, 220, 221, 222, 230, 240, 30, 33 VSF330, 4, 500, 550, VSP88, VSR100, VSX400, 450, 470	140p	PINCH ROLLER ASSEMBLY HITACHI VTR 11, 14, 16, 17, 18, 19, 33, 34, 35, 350, 38, 39, 88, 300, 600, 4200, VT5000, 5030, 5560, 6500, 6800, 7000, 8000, 8300, 8500, 8700, 930, VT9500, 9700, 9900, VPM600	140p	MITSUBISHI HS12, 5300, 5424, 5600, HSB11, 12, 16, 21, 27, 31, 32, 41, 51, 52, 82, HSE12, 16, 17, 21, 22, 27, 31, 32, 41, 51, 52, 82, HSM1000, 110, 120, 15 0, 16, 170, 190, 210, 23, 25, 250, 27, 33, 34, 35, 36, 37, 370, 880, 45, 450, 5, 4, 5, 55, 57, 58, 59, 68, HSM2, 9, HSS11, 14, 15, 17, 19, 25, 5600, HV F125, 150, 303, 85, SV8900, 8930 PINCH ROLLER ASSEMBLY PART NO: 948D20010 HSE11, 12, 16, 17, 21, 22, 27, 31, 32, 41, 51, 52, 5300, 5424, 5600, HSB11, 12, 16, 21, 27, 31, 32, 41, 51, 52, 82, HSM1000, 110, 120, 150, HSM16, 170, 18, 190, 210, 23, 25, 250, 27, 33, 34, 35, 36, 37, 370, 880, 45, 450, 5, 4, 5, 55, 57, 58, 59, 68, HSM2, 9, HSS11, 14, 15, 17, 19, 25, 5600, HVF125, HVF150, 303, 85, SV8900, 8930	140p	VR6540 VR656, 586, VR702, 703, 6485, 6585, 6589, 6785, 6980, 6948 VR445, VR642, VR6542, VR6643, VR6843 VR6943, 445B9 VD464, 662, VR2220, 2300, 2324, 2330, 2334, 2340, 2350, 2414, VR2480, 2485, 2486, 2489, 2490, 2498, 2840, 6462, 6463, 6464, 6560, VR6660, 6860, 6861, 6862, 6863 N-1700, VR2870 VR2025, VR6580, VR6581 49586, VR3260, 6349, 6448, 6449, 6548, 6648 PRESSURE ROLLER ASSEMBLY PS403-40205 DV186, 190, VR211, 2115, 212, 213, 223, 286, 291, 292, 311, 312, 313, VR3210, 3219, 322, 3229, 323, 3535B0, 486, 471, 562, 582, 571, 761, VR201, 202, VR203, 302, 303, 305, 6180, 6182, 6185, 6285, 6290, VR6291, 6293, 6362, 6367, 6390, 6391, 6393, 6467, 6468, 6470, 6561 VR6760, 6581VR6670, 6676, 6710, 6760, 6761, 6762, 6870, 6970, VR6975, 6681, 63587, 68584, 71584, 71585, 72588, 72588, 925B31, 20DV1, 20DV2, 20RW7, 21DVI, 21DV2, 25801, 25802, 25811, 25812, 30DV2, 31DVI, 31DV2, 31DV335B02, 35B03, 35B05 35B11 35B12 35B13 VR231, 232, 332, 422, 4229, 512, 5229, 722, 7229, 723 VR501	140p	VC821 VCA10, 30G, 60, 103, 105, 106, 111, 113, 131, 211, 244, 254, 33, 35, 36, VCA37, 39, 40, 42, 454, 46, 47, 48, 50, 505, 51, 52, 53, 54, 55, 57, 58, 505, VCA60, 605, 615, 62, 63, 67, 68, 1031, 11613, VCB311, 320, VCB597, VCD805, 806, 810, 816, VCH80, 81, 865, 910, VCS 1000, VCT310, VCT410, 610, VCT 1314, 5313, VCT90	140p
VS22, 23, 25, 35, 37, 38, 33, 34, 55, 66, 75, 422, 425, 426, 427, 462, 465, 467, VS485, 765, 767, 768, 865, 867, 965, 967, VSA77, VSA650, VSF10, 11, 12, 15, 180, 190, 200, 210, 220, 221, 222, 230, 240, 30, 33 VSF330, 4, 500, 550, VSP88, VSR100, VSX400, 450, 470	140p	VT250, 255, 258, 260, 400, 405, 410, 413, 414, 415, 416, 418, 420, 425 VT426, 428, 430, 431, 435, 438, 450, 498, 510, 515, 517, 518, 520, 525, VT526, 530, 535, 536, 540, 545, 546, 548, 570, 575, 576, 580, 585, 588 VTF40, 830, VTF660, 665, 70, 770, 774, 775, 780, 785, 860, 861, 865, VTL30, 1000, 2000, VTLCS50, VTM598, 620, 622, 625, 626, 630, 635 VTRM36 640, 645, 646, 720, 722, 725, 726, 727, 728, 730, 731, 735 VMTM36, 740, 745, 746, 748, 753, 754, 820, 821, 822, 825, 830, 831, VMT835, 838, 840, 841, 845, 920, 921, 922, 925, 930, 931, 935, VTS80, 85, 890, 895VM200, 2300, 2380, 3200, 3280, 500, VMS7200	140p	NATIONAL PANASONIC NV100, 180, 300, 330PX, 332, 333, 340, 366, 600, 688, 777, 788, 3321, AG6010, 6015, 6100, 6200, 6400, 6800, 7450	140p	SANYO VHR1100, 1110, 1150, 1200, 1300, 1500, 2100, 2300, 2370, 2500, VHR2700, 3330, MVR220	140p	VC821 VCA10, 30G, 60, 103, 105, 106, 111, 113, 131, 211, 244, 254, 33, 35, 36, VCA37, 39, 40, 42, 454, 46, 47, 48, 50, 505, 51, 52, 53, 54, 55, 57, 58, 505, VCA60, 605, 615, 62, 63, 67, 68, 1031, 11613, VCB311, 320, VCB597, VCD805, 806, 810, 816, VCH80, 81, 865, 910, VCS 1000, VCT310, VCT410, 610, VCT 1314, 5313, VCT90	140p
VS22, 23, 25, 35, 37, 38, 33, 34, 55, 66, 75, 422, 425, 426, 427, 462, 465, 467, VS485, 765, 767, 768, 865, 867, 965, 967, VSA77, VSA650, VSF10, 11, 12, 15, 180, 190, 200, 210, 220, 221, 222, 230, 240, 30, 33 VSF330, 4, 500, 550, VSP88, VSR100, VSX400, 450, 470	140p	VTRM36, 740, 745, 746, 748, 753, 754, 820, 821, 822, 825, 830, 831, VMT835, 838, 840, 841, 845, 920, 921, 922, 925, 930, 931, 935, VTS80, 85, 890, 895VM200, 2300, 2380, 3200, 3280, 500, VMS7200	140p	NATIONAL PANASONIC NV100, 180, 300, 330PX, 332, 333, 340, 366, 600, 688, 777, 788, 3321, AG6010, 6015, 6100, 6200, 6400, 6800, 7450	140p	SANYO VHR1100, 1110, 1150, 1200, 1300, 1500, 2100, 2300, 2370, 2500, VHR2700, 3330, MVR220	140p	VC821 VCA10, 30G, 60, 103, 105, 106, 111, 113, 131, 211, 244, 254, 33, 35, 36, VCA37, 39, 40, 42, 454, 46, 47, 48, 50, 505, 51, 52, 53, 54, 55, 57, 58, 505, VCA60, 605, 615, 62, 63, 67, 68, 1031, 11613, VCB311, 320, VCB597, VCD805, 806, 810, 816, VCH80, 81, 865, 910, VCS 1000, VCT310, VCT410, 610, VCT 1314, 5313, VCT90	140p
VS22, 23, 25, 35, 37, 38, 33, 34, 55, 66, 75, 422, 425, 426, 427, 462, 465, 467, VS485, 765, 767, 768, 865, 867, 965, 967, VSA77, VSA650, VSF10, 11, 12, 15, 180, 190, 200, 210, 220, 221, 222, 230, 240, 30, 33 VSF330, 4, 500, 550, VSP88, VSR100, VSX400, 450, 470	140p	VTRM36, 740, 745, 746, 748, 753, 754, 820, 821, 822, 825, 830, 831, VMT835, 838, 840, 841, 845, 920, 921, 922, 925, 930, 931, 935, VTS80, 85, 890, 895VM200, 2300, 2380, 3200, 3280, 500, VMS7200	140p	NATIONAL PANASONIC NV100, 180, 300, 330PX, 332, 333, 340, 366, 600, 688, 777, 788, 3321, AG6010, 6015, 6100, 6200, 6400, 6800, 7450	140p	SANYO VHR1100, 1110, 1150, 1200, 1300, 1500, 2100, 2300, 2370, 2500, VHR2700, 3330, MVR220	140p	VC821 VCA10, 30G, 60, 103, 105, 106, 111, 113, 131, 211, 244, 254, 33, 35, 36, VCA37, 39, 40, 42, 454, 46, 47, 48, 50, 505, 51, 52, 53, 54, 55, 57, 58, 505, VCA60, 605, 615, 62, 63, 67, 68, 1031, 11613, VCB311, 320, VCB597, VCD805, 806, 810, 816, VCH80, 81, 865, 910, VCS 1000, VCT310, VCT410, 610, VCT 1314, 5313, VCT90	140p
VS22, 23, 25, 35, 37, 38, 33, 34, 55, 66, 75, 422, 425, 426, 427, 462, 465, 467, VS485, 765, 767, 768, 865, 867, 965, 967, VSA77, VSA650, VSF10, 11, 12, 15, 180, 190, 200, 210, 220, 221, 222, 230, 240, 30, 33 VSF330, 4, 500, 550, VSP88, VSR100, VSX400, 450, 470	140p	VTRM36, 740, 745, 746, 748, 753, 754, 820, 821, 822, 825, 830, 831, VMT835, 838, 840, 841, 845, 920, 921, 922, 925, 930, 931, 935, VTS80, 85, 890, 895VM200, 2300, 2380, 3200, 3280, 500, VMS7200	140p	NATIONAL PANASONIC NV100, 180, 300, 330PX, 332, 333, 340, 366, 600, 688, 777, 788, 3321, AG6010, 6015, 6100, 6200, 6400, 6800, 7450	140p	SANYO VHR1100, 1110, 1150, 1200, 1300, 1500, 2100, 2300, 2370, 2500, VHR2700, 3330, MVR220	140p	VC821 VCA10, 30G, 60, 103, 105, 106, 111, 113, 131, 211, 244, 254, 33, 35, 36, VCA37, 39, 40, 42, 454, 46, 47, 48, 50, 505, 51, 52, 53, 54, 55, 57, 58, 505, VCA60, 605, 615, 62, 63, 67, 68, 1031, 11613, VCB311, 320, VCB597, VCD805, 806, 810, 816, VCH80, 81, 865, 910, VCS 1000, VCT310, VCT410, 610, VCT 1314, 5313, VCT90	140p
VS22, 23, 25, 35, 37, 38, 33, 34, 55, 66, 75, 422, 425, 426									

VIDEO SERVICE KITS

<p>AMSTRAD VCR700 <i>Contents</i> BELT SET, PINCH ROLLER, REEL IDLER, VIDEO LAMP Order Code: SK41 £5.50</p> <p>FERGUSON & JVC 3V42/43 HRD455/HR0725 <i>Contents</i> BELT SET, PINCH ROLLER, CLUTCH MECHANISM, TENSION BAND Order Code: SK37 £16.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, SUPPLY CLUTCH, TAKE UP CLUTCH Order Code: SK38 £9.00</p> <p>3V58/59/64/65 HRD170/180/210/230/300/320/370/400/430/530/700/750 HR55000 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER ARM, TENSION BAND Order Code: SK44 £7.00</p> <p>3V29/3V30 HR7200/7300/7350 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK05 £5.00</p> <p>3V35/36, 38/39/49 HRD110/111/120/225 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK04 £5.00</p> <p>3V31/3V42 HR7600/7610/7650/7655 <i>Contents</i> BELT SET, T/U REEL TABLE TYRE, PINCH ROLLER, REEL IDLER, T/U CLUTCH, T/U IDLER, TENSION BAND, VIDEO LAMP Order Code: SK33 £11.00</p> <p><i>Economy Kit Contents</i> BELT SET, T/U REEL TABLE TYRE, PINCH ROLLER, REEL IDLER TYRE, T/U IDLER TYRE, T/U CLUTCH Order Code: SK34 £5.00</p> <p>3V35/36/38/39/49 HRD110/111/120/121/225 <i>Contents</i> BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, T/U CLUTCH, T/U IDLER, REEL IDLER, TENSION BAND Order Code: SK35 £10.00</p> <p><i>Economy Kit Contents</i> BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, T/U CLUTCH, T/U IDLER TYRE, REEL IDLER TYRE Order Code: SK36 £5.50</p> <p>3V29/3V30 HRD7200/7300/7350 <i>Contents</i> BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, REEL IDLER, T/U CLUTCH, T/U IDLER, TENSION BAND, VIDEO LAMP Order Code: SK31 £10.00</p> <p><i>Economy Kit Contents</i> BELT SET, T/U REEL IDLER TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, REEL IDLER TYRE, T/U IDLER TYRE, T/U CLUTCH Order Code: SK32 £5.00</p> <p>3V44/45/48/53/54/55/57 HRP50/HR0140/150/158/160 HRD250/257/565/566/755 <i>Contents</i> BELT SET, PINCH ROLLER, CLUTCH MECHANISM, TENSION BAND Order Code: SK39 £15.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER Order Code: SK40 £9.50</p> <p>FISHER FVHP905/906/907/908/910/911/916/918 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER, GEAR IDLER UNIT, TENSION BAND Order Code: SK57 £13.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK58 £5.00</p> <p>FVHP615/618/620/622/710/711/715/716/720/721/722/725/730/830/840 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER, GEAR IDLER UNIT, TENSION BAND Order Code: SK58 £11.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK69 £3.00</p>	<p>HITACHI VT11/VT33 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK08 £5.00</p> <p>VT11/VT33 <i>Contents</i> BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, FF/REW IDLER, CLUTCH PLATE, TENSION BAND Order Code: SK45 £13.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, FF/REW IDLER Order Code: SK46 £3.75</p> <p>VTS2/61/62/63/64/65/66/640 <i>Contents</i> BELT SET, PINCH ROLLER, FF/REW ARM, CLUTCH PLATE, TENSION BAND Order Code: SK49 £14.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, FF/REW IDLER Order Code: SK50 £3.00</p> <p>VT400/405/410/13/14/15/18/420/252/267/284/301/315/40/450/498/510/520/25/26/530/35/36/540/545/48/48/570/75/576/580/85/88 <i>Contents</i> TIMING BELT, PINCH ROLLER, FF/REW ARM, CLUTCH BASE, TENSION BAND Order Code: SK52 £9.75</p> <p>VT100/110/111/113/115/118/120/125/128/130/135/138/145/150/175/220/225/250/255/258/260/VTL30 <i>Contents</i> BELT SET, PINCH ROLLER, FF/REW ARM, CLUTCH PLATE, TENSION BAND Order Code: SK51 £14.00</p> <p>PANASONIC NV2000/NV2010/NV7000/NV7200/NV7800 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK03 £5.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK02 £5.00</p> <p>NV300/NV330/NV333/NV340/NV366 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRE Order Code: SK01 £5.00</p> <p>NV2000/NV2010 <i>Contents</i> BELT SET, PINCH ROLLER, FF IDLER, PLAY IDLER, TENSION BAND, VIDEO LAMP Order Code: SK13 £5.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE, PULLEY TYRE Order Code: SK14 £3.50</p> <p>NV7000/NV7200/NV7800 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER UNIT, PLAY IDLER, TENSION BAND Order Code: SK11 £8.50</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE, CLUTCH TYRE Order Code: SK12 £3.25</p> <p>NV300/NV330/NV333/NV340/NV366 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER UNIT, PLAY IDLER, TENSION BAND Order Code: SK15 £7.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE, PLAY IDLER Order Code: SK16 £3.25</p> <p>NVG7/NVG9/NVG10/NVG11/NVG12/NVG14/NVG15/NVG16/NVG18/NVG30/NVG120/NVG130/NVG400/NVH65(PX/AC)/AG1810(PX) <i>Contents</i> LOADING BELT, CAPSTAN BELT, PINCH ROLLER, IDLER, TENSION BAND Order Code: SK27 £5.00</p> <p><i>Economy Kit Contents</i> LOADING BELT, CAPSTAN BELT, PINCH ROLLER, IDLER TYRE Order Code: SK28 £3.00</p> <p>NV332 <i>Contents</i> BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND, FF/REW TYRE Order Code: SK29 £12.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, PLAY IDLER TYRE, FF/REW IDLER TYRE Order Code: SK30 £5.10</p> <p>NV230/250/260/280/430/450/460/470/650/810/890/AG1200PK/AG1500PK <i>Contents</i> BELT SET, PINCH ROLLER, IDLER, TENSION BAND, IDLER TYRE Order Code: SK23 £5.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK24 £3.25</p>	<p>NV600/NV688 <i>Contents</i> BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND Order Code: SK25 £12.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, PLAY IDLER TYRE, FF/REW IDLER TYRE Order Code: SK26 £5.00</p> <p>NV730/NV770 <i>Contents</i> SLOT IN BELT, LOADING BELT, PINCH ROLLER, IDLER UNIT, TENSION BAND Order Code: SK19 £5.50</p> <p><i>Economy Kit Contents</i> SLOT IN BELT, LOADING BELT, PINCH ROLLER, IDLER TYRE, TENSION BAND Order Code: SK20 £3.00</p> <p>NV370/NV380/480/630/780/830/850/AG2100PK/AG2200PK <i>Contents</i> BELT SET, PINCH ROLLER, IDLER, TENSION BAND Order Code: SK21 £5.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK22 £2.75</p> <p>NV777/NV788 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER UNIT, TENSION BAND Order Code: SK17 £5.00</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK18 £4.00</p> <p>SHARP VC381 <i>Contents</i> BELT SET, PINCH ROLLER, REEL IDLER, TENSION BAND, VIDEO LAMP Order Code: SK47 £8.00</p> <p><i>Economy Kit Contents</i> REEL IDLER TYRE Order Code: SK48 £3.25</p> <p>VC500/VC571/VC581/VC582/VC583/VC584/VC5F3 <i>Contents</i> BELT SET, PINCH ROLLER, REEL IDLER, TENSION BAND Order Code: SK60 £9.50</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, REEL IDLER Order Code: SK61 £5.00</p> <p>VC781/VC7810/VC7822/VC785/VC786/VC793/VC800/VC100/VCA102/VCA104/VCA202 <i>Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT, TENSION BAND Order Code: SK64 £13.50</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT TYRE, TENSION BAND Order Code: SK65 £3.75</p> <p>VC681/VC682/VC684/VC685/VC683/VC689/VC6F3/VC700 <i>Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT, TENSION BAND Order Code: SK62 £13.50</p> <p><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT TYRE Order Code: SK63 £5.00</p>
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FOR MORE DETAILS OF OVER 500 TYPES OF SERVICE KITS... PLEASE RING US!

SERVICE KIT & UPGRADE FOR ONWA TV CHASSIS

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

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

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

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

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

ORDER CODE : ONWAKIT PRICE: 1200p

* SOME MANUFACTURERS HAVE ALREADY TAKEN STEPS TO UPGRADE THE POWER SUPPLY

REPLACEMENT VIDEO CASSETTE HOUSINGS

Name	Models	Code	Price	Name	Models	Code	Price	Name	Models	Code	Price
AKAI	VS35, VS53, VS55, VS56, VS75	CH18	3200p		FV31R	CH19	4300p		VCA103, 103GV, 106, 106GVM, 254GVM	CH23	2500p
GRANADA	VHS0P1, VHSYJ2	CH05	1100p		HRD515, 520, 527, 540, 550, 580, 600, 610, 620, 660, 670, HR0830, 840, 850, 860, 4050, 6800, FV37H	CH20	2200p		VCS211, 244, 5055, 605, VCB230, VCO8066, 8106, VCT212, 310,		
GOLDSTAR	GHV1290P, 1291P, 1295P, 9400, 73401, GSE1295P, GSE1891P, 20001Q, 20051Q, VCP4200, 4300, 4301, 4305, VCP4306, 4311, 4315, 4316, 4320, 4321, 4325	CH25	2000p		HRD540, 580, 830, 860, 910, 960, HR0970, HRD20, FV57H	CH27	2400p	TELEFUNKEN	4106, 610	CH24	2500p
	GHV51, 1221, 1232, 1240, 1241, 1242, 1244, 1246, 1248, GHV8000, 8200	CH26	2900p	FERGUSON	VR3805, VR3905	CH01	2800p		VR2970	CH02	2800p
FERGUSON & J.V.C.	3V38, 3V39, 8943, 8944, 8951, 3V35, 3V36, 3V49, HRD 110, 111, 120, 121, 225	CH01	2800p	I.T.T.	VR3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948	CH02	2800p	THDMSDN	V320, 321, 323, 326, 4200, 4300	CH01	2800p
	3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V57, 8945, 8947, 8948, HRD 140, 141, 150, 157, 158, 160, 250, HRD257, 455, 565, 566, 725, 755	CH02	2800p		VR3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948	CH02	2800p		V342, 343, 352, 353, 360, 364, 368, 4210, 4230, 4260, 4400, V5500,		
	8948, 8950, FV10B, 12L, 13H, 14T, 20B, 21R, 22L, 26, 395, HRD230, 430, 530	CH03	2800p	NATIONAL PANASONIC	NV730	CH06	4300p	TOSHIBA	6000, 8540	CH02	2800p
	3V58, 3V59, 3V64, 3V65, FV11R, 8950, 8951, HRD170, HRD180, HRD370	CH04	2800p	N.E.C.	N830EG, N831EG, N831EG, N832, N833EG, N895	CH01	2800p		V55, V57	CH01	2800p
					N895	CH02	2800p		V65, V66	CH02	2800p
				PHILIPS	CASSETTE LIFT ASSEMBLY (69120366)						
					OV186, 190, 286, 471, 562, 761, VR6180, 6182, 6185, 6285, VR6290, 6291, 6293, 6362, 6367, 6393, 6467, 6468, 6470, VR6561, 6670, 6760, 6761, 6870, 6970	CH05	1100p				
					VR6443	CH22	2900p				
					VR6448	CH23	2500p				
					495B6	CH24	2500p				
				SHARP	VCA100, VCH851, VCH852	CH22	2900p				

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AMSTRAD MOD KIT

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FITS :
VCR 4500, 4600, 4700, 5200, TVR 1,2,3

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PRICE : £2.25 + VAT each

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MODE SWITCH

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

AUDIO CONTROL HEADS

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

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

Replacement Audio Control Video Sound Head for National Panasonic

PART NUMBER	MODELS	PRICE
VBR 0091	NVG7 etc	875p
VBR0050	NV300, NV340 etc	875p
VBR0061	NV777 etc	875p
VBR0103A	NV250, NV450 etc	625p
VBR0125		625p

VIDEO TOOLS

VIDEO CLEANING STICKS

Price 17p each 15p each pack of 10pcs
 13p each pack of 25pcs
Order Code: SP14

VIDEO MAINTENANCE TOOLS

Set of 8 Allen keys packed in a plastic wallet
Order code: TOOL 9, Price 125p
 Specifically designed for video maintenance

UNIVERSAL HEAD EXTRACTOR

Hand tool designed for extracting hard to remove heads without damage to either the head or the mounting assembly. Adjustable so as to suit various heads.
Order code: TOOL 8, Price 600p

VCR ALIGNMENT KIT

CONTAINS: SET OF 7 HEAD & TAPE PATH ALIGNERS

- RCA TYPE AUDIO & CONTROL HEAD POSITIONING TOOL
- RCA ADJUSTMENT TOOL FOR TAPE GUIDE POSTS
- RCA TYPE BACK TENSION TOOL
- TENSION ADJUSTMENT TOOL FOR VARIOUS USES
- VCR ADJUSTMENT TOOL

SET OF 8 ALLEN KEYS

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

3 REVERSIBLE SCREWDRIVERS
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 BATTERIES

PHILIPS

Part Nos: 138 - 101138, 138 - 10313 1.2v 90mAH
 Order Code: BB01
 Part Nos: 138 - 10229, 2.4v 100mAH
 Order Code: BB02

Price: 70p

Price: 135p

FERGUSON

Part No: 00E6 - 067 - 001 1.2V 100mAH
 Order Code: BB03
 Part Nos: 00E6 - 606 - 8001 2.4V 100mAH
 Order Code: BB04

Price: 90p

Price: 150p

SATELLITE PSU REPAIR KITS

MAKE & MODEL	CODE	PRICE
PACE PRD800, PRD900	SATPSU1	600p
PACE SS9000, 9200, 9010, 9210, 9220	SATPSU2	550p
AMSTRAD SRD510, SRD520	SATPSU3	600p
AMSTRAD SRD500	SATPSU4	600p
AMSTRAD SRX340, SRX345, SRX350	SATPSU5	600p
PACE D100/150	SATPSU6	650p
CHURCHILL D2MAC	SATPSU7	650p
PACE MSS100	SATPSU8	1100p

MAKE & MODEL	CODE	PRICE
PACE MSS200/300 APPOLL	SATPSU9	900p
PACE MSS500/1000	SATPSU10	1230p
FERGUSON SRD4	SATPSU11	650p
ECHOSTAR SR5500	SATPSU12	1600p
ECHOSTAR 6500/7700/8700	SATPSU13	2750p
AMSTRAD SRD600	SATPSU14	2600p
MIMTEC (Surensen)	SATPSU15	700p
AMSTRAD SRD700, SR950, SRX100, 301, 501, 502, 1002, 2001, SRD2000 SAT250	SATPSU16	650p

SATELLITE TUNERS

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

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

SWITCH MODE TRANSFORMERS

PACE 9000
 ORDER CODE: PACE9000 PRICE: 800p

PRD800/PRD900
 ORDER CODE: PRD800 PRICE: 550p

SATMETER

The Satmeter is a professional portable satellite strength meter designed for the installation and maintenance of satellite TV systems. The Satmeter can be used as stand alone with powering the LNB as well as in loop.

Through operation with satellite RX powering the LNB.

* Acoustical signal: On signal strength *LED indicator: Vert/Hori

* Frequency Range: 900 to 2050 Mhz *Input impedance: 70 Ohm

* Power amplifier: 18db *Detection Range: -60 to -10 DBM

* Max. input signal: -10 DBM

ORDER CODE: TOOL22

PRICE: 8500p

REPLACEMENT TV SWITCHES

GRUNDIG

PART No: 29703, 29102
 USED ON:
 C7500, C8500, C8502, C8712... ETC
 Order Code: SW1 Price: 100p

PHILIPS

USED ON:
 K30, K35, K40, KT3, KT4
 Order Code: SW13 Price: 95p

SONY

USED ON:
 KV1612, KB1612, KV1614, KV2052, V2056
 KV2062, KV2067, KV2212... ETC
 Order Code: SW5 Price: 130p

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

SONY

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

SONY 2 PIN FUNCTION SWITCH

Order Code: SW9 Price: 35p

FUSES

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
15A	FUSE46	185p
20A	FUSE47	210p

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

20mm CERAMIC TIME LAG

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

38mm CERAMIC TIME LAG

CURRENT RATING	ORDER CODE	PRICE
10A	FUSE48	825p

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

VOLTAGE TESTER

A terminal screwdriver incorporating continuity & voltage with Eurosolt
ORDER CODE: TOOL11 PRICE: 220p

SPRING HOOK

Spring Hook, to unlock springs in audio tape recorders & VCRs
ORDER CODE: TOOL20 PRICE: 265p

FAULT FINDING / COMPARISON BOOKS

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

Video Recorders Edition 5 1997
 Over 300 pages packed with more than 5500 faults for different brands
Price £15.00 - No VAT. Order Code: BOOK01

TELEVISION Edition 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

DESCRIPTION	VOLUME	CODE	PRICE
VIDEO HEAD CLEANER	75ML	SP01	145p
SWITCH CLEANER	178ML	SP02	155p
SILICONE GREASE	200ML	SP03	180p
FREEZE IT	170ML	SP04	295p
FREEZE IT	400ML	SP16	580p
FOAM CLEANER	400ML	SP05	180p
ANTI-STATIC	200ML	SP06	180p
AEROKLEAN	200ML	SP07	200p
AERO DUSTER	200ML	SP08	340p
AERO DUSTER	400ML	SP17	580p
PLASTIC SEAL	200ML	SP09	250p
GLASS CLEANER	250ML	SP10	170p
COLDKLENE	250ML	SP13	235p
EXCEL POLISH 80	250ML	SP18	180p
ADHESIVE 120	400ML	SP19	225p
LABEL REMOVER 130	200ML	SP20	260p
REFURB 140	400ML	SP21	260p
TUBE SILICON GREASE	50 GRAMMES	SP11	225p
TUBE SILICON SEALANT WHITE	75ML	SP22	250p
TUBE SILICON SEALANT CLEAR	75ML	SP23	250p
TUBE HEAT SINK COMPOUND	25 GRAMMES	SP12	150p
DRIVE CLEANER	200ML	SP24	150p
SCREEN CLEANER	200ML	SP25	145p
COMPUTER CARE KIT	-	SP26	2100p

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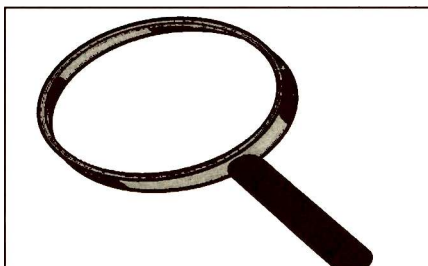
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 ICPN20, ICPN25, ICPN 38,
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AIWA XC007	KSSS151A	1900p
DX-990A, DX-DIA	KSS152A	1600p
CX160, CX166G, CX180, CXN3100, CXN320, CXN3300, CXN360, CXN400, CXN430, CXN640, CXN550G, CXN990, CXN999, CXN9V20, CXSL70, DXZ9100M, FDN636, FDN636, FDN939, LCX60, LCX66G, LCX70M, LCX80, M7400, M75, NSX320, NSX360, NSX400, NSX430, NSX590, NSX929, NSX999, NSXD836, NSXD939, NSXV20, SXFN550, SXFN520, XC300, XC350, XC750, XC900, XC950, XCN992, XG320, XG380, XG400, XG980, ZD3000M, ZD3100M	KSS152A	1600p
CXAP1, CX17, CX18G, CXLC50P, CXZ58, CXM740, DXM75, DXM76, DXM77, LCX50, LCX7, LCX8G, LCXAP1, XC002, XC004, XC005, XC777	KSS210B	2000p
XF31, XF33, XF55, XF80G	KSS210A	2500p
XF8-XF7	KSS331A	3400p
AKAI CD73, CD93	KSS151A	1900p
CD25, CD26, CD27, CD32, CD36, CD37, CD52, CD55, CD57, CD650, CD670, CD69, CD750, CD79, CDM480, CDM600, CDM670, CDM770, CDM959, MX550, MX670, MX680, MX670, MX750, MX950	KSS210A	1900p
DENON DCD15001, DCD1520, DCD23520	KSS151A	1900p
DCD1400, DCD600, DCD800	KSS152A	1600p
DCD1420, DCD2520, DCD610, DCD620, DCD660, DCD810, DCD820, DCD860, DCD910, DCD920	KSS210A	1900p
DCD1015, DCD1290, DCD2060, DCD2060G, DCD315, DCD480, DCD580, DCD615, DCD715, DCD825, DCD890, DCD895, DNC200F	KSS240A	2000p
GOLDSTAR CD952A, CD952AJ, CD952LJ, CD952SJ, FFH101KL, FFH101WL, FFH222AL, FFH272L, FFH333L, FFH373K, FJ606, FR606L	KSS210A	1900p
CD920AL, CD930SL, FFH212AL, FFH212E	KSS210B	2000p
GRUNDIG CD360, CD435	HOPM3	2150p
CD3300, CD101MCD904, MC10, NEW ORLEANS CD	KSS210A	1900p
KRCD100, RR1900CD, RR3100CD, RR4000CD, RR610CD, RR700CD	KSS210B	2000p
CDP60, CDF90	KSS220A	2500p
CDP65	KSS331A	3400p
CD905	OPTIMA5	1600p
HITACHI DAW560	HOPM3	2150p
FX-10	KSS210A	1900p
AXC10	KSS210B	2000p
J.V.C. 1990, 1992, LAITE 1987-1988 - XLE3008K, XLE318K, XLE518K, XLE9008K, XLMES18K, XLV1018K, XLV2118K, XLV228K, XLV3118K, XLV333K, X21010TH, XLZ1118K, XLZ444K, XLZ558K, XLZ6118K	OPTIMA3	4000p
CORDIO CASSETTE, MINI SYSTEMS - DRADLS 1990-1992	OPTIMA4S	6000p
CA-C33, CA-MX308K, CA-MX338K, UX-A5, UX-A6, XL-M309, XL-M4038K, XL-M408, XL-M409, XL-M5048K, XL-M505TN, XL-M508, XL-M509, XL-M705TN, XL-V1318K, XL-V151TN, XL-V2128K, XL-V241TN, XL-Z2428K, XL-Z251TN, XL-Z2528K, XL-Z1050TN, XL-Z551TN, XL-Z5528K	OPTIMA5	1600p
1994 ONWARDS - CAE488K, CAMC07, CAIXX9G, CAS208K, CAS308K, VAS50, CAS908K, MX520, MX530, MX550, PCX106, PCX130, PCX35, RCX320, RCX320, RCX520, RCX620, RCX720, UX4A, UX4AS, UX4AS, UXCT, UXT1, UXT3, XLF115, XLF116, XLF215, XLF216, XLMC100M, XLMXG7, XLMXG9, XLV163TN, XLV1648K, XLV174, XLV263TN, XLV2648K, XLV2748K, XLV263TN, XLV2648K, XLV274, XLTMKG7, XTMXG9, XTS60	OPTIMA6S	1600p
KENWOOD DP47, DP680SG, DP8200, DP87, L1000D	KSS152A	1600p
DP1030, DP1510, DP2010, DP2030, DP3010, DP3030, DP3050, DP4030, DP491, DP5010, DP5030, DP5040, DP520, DP7030, DP7040, DP7050, DP730, DP920, DP930, DP950, DPM650, DPM6630, DPM7130, DPM850, DPM991, DX6620, M225, M25, M450, M850, PD3030, PDM991, RDX25, RXDC3, RXDC3L, UD202, UD302	KSS210A	1900p
DP42, DPC72, DPC77, DPC80, DPC92	KSS220A	2500p
DP1050, DP2050, DP3060, DP501, DP5060, DP722, DP75, DP85, DP89, M77A, PD3060, UD502, UD10, UD101, UD90, XES	KSS240A	2000p
DCP321, DPC521, DPC531, DPC631K, DPC721, DPC731	KSS331A	3400p
DP1080, DP2050, PART No: RCTRHR8136AFZZ	RH8136A	4500p
PANASONIC SLP177A, SLP202A, SLP212A, SLP222A, SLP277A, SLP377A, SLP477AK, SLP477A, SLP6100A, SLP6200A, SLP6400A, SLP6500AK, SLP6500AS, SLPJ24A, SLPJ26A, SLPJ27A, SLPJ28A, SLPJ325A, SLPJ325A, SLPJ37A, SLPJ38A, SLPJ46A	691-30209	6500p

Models & Description	Order Code	Price
SAD30, SLCH9, SLP170, SLP170, SLP200, SLP202, SLP222, SLP230, SLP250, SLP333, SLP370G, SLP400C, SLP555, SLP777, SLP999, SLP1A10, SLP2C10, SLP2C5, SLPJ25, SLPJ26, SLPJ27, SLPJ37, SLPJ45, SLPK23, SLPK26, SLP550, SLP570, SLP5700, SLP5840, SLP5900	SOAAD70A	2350p
PHILIPS AZ830A, CD070, CD080, 690, 910, 920, PART NO. 4822-691-20768	4822-691	3100p
CD100, CD130, CD1380, CD1482, CD200, CD204, CD210, CD300, CD303, CD304, CD380, CD480, CD482, CD500, CD502, CD582, CD583, CD584, CD610, CD620, CD630, CD780, CD781, CD782, CD840, CD883, CD960, CD104, CDMA/19, FCD185	691-30209	6500p
AS440, AS445, AS540, AZ8048, AZ8640, AZ8640, CD070, CD080, CD090, CD163, CD185, CD690, CD710, CD720, CD732, CD740, CD750, CD910, CD920, CD935, FW17, FW21, FW26, FW330, FW36, FW360, FW380, FW40, FW41, FW46, FW56, FW69, FW68	CDM12.1	1800p
CD1210/40	CDM12.4	2200p
AZ8006	KSS210B	2000p
FW11	OPTIMA6S	1600p
PIONEER PDM400, PDM410, PDM500, PDM510, PDM600, PDM610, PDM700, PDM710, PDM730, PDM7303, PDM7403, PDM7503, PDX940M, PDX950M, PDZ560T, PDZ72T, PDZ73T, PDZ81M, PDZ82M, PDZ83M, PDZ960M, XZ25T, XZ254T	KSS151A	1900p
N32, N80M, PD101, PD201, PD32, PD41, PD4500, PD4700, PD52PD5700, PD65, PD6500, PD6700, PD7700, PD8700, PD970, PDCP240, PDCP250M, PDCP520T, PDCP400T, PDCP500T, PDCP800M, PDCP900M, PDM430, PDM450, PDM550, PDM630, PDM650, PDM750, PDM901, PDM710, PDZ, PDZ570T, PDZ74T, PDZ84M, PDZ970M, PXA1349, S125CDT, S135CDT, S303CDM, S303CDT, S605DM, S605DT, S707DM, S707DTM, S989DM, S989DT, XCP410M, XCP410T, XZ254T, XZ255T, XZ264M, XZ264T, XRP310, XRP320	PEA1030	4400p
PDM400, PDM410, PDM500, PDM510, PDM600, PDM610, PDM700, PDM710, PDM730, PDM7303, PDM7403, PDM7503, PDX940M, PDX950M, PDZ560T, PDZ72T, PDZ73T, PDZ81M, PDZ82M, PDZ83M, PDZ960M, XZ25T, XZ254T, XZ255T, XZ262, XZ262M, XZ2630, XZ282	PWW1009	4800p
SAMSUNG CD20	HOPM3	2150p
CD1200, CD1310, SCM-6000, SCM6900	KSS210A	1900p
RCD1200, RCD1300, RCD1350, RCD1600, RCD2600, RCD990, RCD995, SCM6900	SOH9074N	3600p
SANYO DCFS3, DCT55, DCX502, DCX701, DCX702, DCX802, DCX891, DCX891M, MCDZ10, PART No. 6142188855	614218	2300p
DCFS5, MCD450K, 660K, MCD230L, 60F PART No. 6142205006	614220	2500p
DCX1000MD, DCX1003, DCX900MD, DCX903, DCX915	KSS210A	1900p
DCD10, DCD110, DCD20, DCD30, DCD30AT, DCD6, DCD8U, DCM51, DCM51, DCM110, DCM120, DCM210, DCM220, DCM993, DCM994, MCDMS40L, MCDMS50L, MCDMS660L, MCDZ1L, MCDZ2L, MCDZ3L, PART No. 6142391303	614239	3300p
DCD12, PART No. 6450055956	645005	3700p
MCDZ31L, MCDZ41L, MCDZ51L, MCDZ71L	KSS210B	2000p
SHARP CD-111, CD-301, CD-302, CD-304, CD-310, CD-3C, CD-L700, CD-L800, CD-U1, CD-U10, CD-X10, CD-X12, CD-X15, CD-X16, CD-X17, CD-X20, CD-X9, CKL50, CMS95CD, DX-150, DX-160, DX-450, DX-460, DX-461, DX-650, DX-660, DX-989, DX-A3, DX-N45, DX-R54, DX-R7, DX-R75, DX-R750, DX-R77, DX-R770, DX-R820, DX-R840, DX-Z100, DX-Z1000, DX-Z1500, GFC055, 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. RCTRHR8124AFZZ	RH8122A	6750p
QT-50CD, QT-60CD, QT80CD, PART No. RCTRHR8124AFZZ	RH8124AF	2900p
DXR-840B, PART No. RCTRHR8130AFZZ	RH8130AF	2900p
CD5360E, 360H, 370, 450H/E, CMS150CDH, CMSR400CDH, CP150, CPR400, CPS360, 370, PART No. RCTRHR8136AFZZ	RH8136AF	4500p
SONY KSS240A	KSS240A	2000p
KSS121A	KSS121A	3500p
KSS151A	KSS151A	1900p
KSS210A	KSS210A	1900p
KSS210B	KSS210B	2000p
KSS220A	KSS220A	2500p
KSS331A	KSS331A	3400p
KSS380A	KSS360A	2600p
TECHNICS SLP200, SLP230, SLP250, SLP333, SLP477A, SLP777, SLP999, SLP1A10, SLP2C10, SLPJ25, SLPJ45, SLP5700, SLP5900	SOAD70A	2350p

REMOTE CONTROLS

Description	Code	Price	Description	Code	Price	Description	Code	Price	Description	Code	Price
AKAI RC-V10A	RC876	650p	A512120/230	RC900	650p	PANASONIC EUR51200	RC200	650p	SONY RM604, RM605, RM606	RC140	650p
RCV 37 B	RC891	650p	A514790	RC901	650p	TC2200	RC204	650p	32 CHANNEL	RC140	650p
V25A	RC896	650p	A5088470	RC902	650p	VSOQ357/NV730	RC202	650p	RM613	RC141	650p
DECCA RC70	RC894	650p	SCL002	RC904	650p	TNQ1621	RC203	650p	RM632, RM636	RC160	600p
FISHER RC905B	RC879	650p	C2096	RC905	650p	PHILIPS RC5002.5154	RC134	650p	TATUNG FXA	RC877	650p
GRANADA UNIVERSAL TEXT	RC309	650p	A511940	RC906	650p	KT3 NON TEXT	RC135	650p	RC70	RC883	650p
MK4 TEXT, 70155G, 70115G, 70133G	RC880	650p	655602H	RC1920	650p	69117032	RC178	650p	FX70 FASTTEXT	RC894	650p
95288E	RC882	650p	ITT IFB13, 14, 15	RC143	650p	69117194	RC180	650p	TELEFUNKEN FB632	RC632ST	650p
94490D	RC884	650p	FS4	RC148	650p	RC5991-UNIV	RC300	650p	FB639	RC639	650p
GRUNDIG TP160E	RC107	650p	RG305	RC305	650p	RC38	RC301	650p	THORN/FERGUSON 3V35-42	RC342	600p
TP200, TP300	RC380	650p	RG306	RC306	650p	KT3 TEXT	RC5301	650p	3V31-32	RC344	650p
TP400	RC401	600p	FS9/1-10/1	RC307	650p	RC352	RC5375	650p	3V57-58	RC628	650p
TP590-600	RC600	650p	V55 RUK	RC308	650p	RC5375	RC300	550p	TX10 TEXT	RC732	575p
TP390, TP610	RC610	650p	VS4-1	RC308	650p	RC5903	RC5903	650p	TX10 STEREO TEXT	RC738	575p
TP621	RC612	650p	MULTICONTROL (17C20)	RC311	650p	SALORA SERIES L	RC190	650p	TC9-90-100	RC740	800p
TP630, TP650	RC650	650p	LOEWE DC11	RC146	650p	86173	RC882	650p	3V55, FV11	RC783	650p
TP666	RC660	650p	MATSUI 010270801	RC889	650p	SANYO RC218, RC222, RC228, RC238	RC140	650p	TX100 FASTTEXT	RC789	650p
TP661	RC661	650p	VX770	RC892	650p	JXGE	RC878	650p	TX100 ST. FASTTEXT	RC789	650p
HITACHI CLE800-CLE830	RC140	650p	NOKIA SATELLITE	RC550	650p	JXDE	RC884	650p	PROFESSIONAL	RC790	650p
A617402/655602	RC1920	650p	ORION RC53	RC892	650p	VHR2300	RC890	650p	TOSHIBA CT937	RC950	650p
						RC628	RC865	650p	CT9117	RC951	650p

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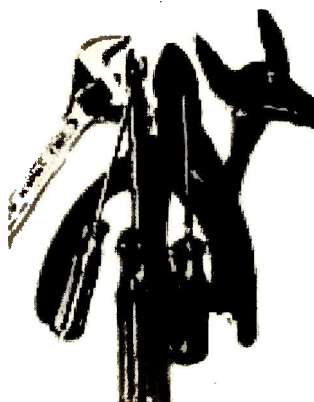
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John Edwards' Casebook



Grundig CUC2410 Chassis

There was sound and text but no programme picture. When the brightness was set at maximum only a blank raster was displayed. Checks revealed that there was no video input at pin 8 of the TDA3566 colour decoder chip, because the BC548C buffer transistor Tr2523 was short-circuit collector-to-emitter. A new transistor brought the picture back.

Hitachi CPT1473 (NP82C2 chassis)

This set would revert to standby intermittently – sometimes two or three times an hour, sometimes only once every two days! Several components were replaced without success. I then decided to replace the STR6020 chopper chip IC901. This put an end to a most frustrating fault.

Sony KVM2131U

Field collapse was cured by resoldering the UPC1488H field output chip, but while I was moving the set to replace the back cover the scanning again collapsed. This time it could be made to come and go by tapping almost anywhere on the PCB. Resoldering the pins of the TDA2579 timebase generator chip cleared this second fault.

Hitachi C2524R (G7PS Mk 2 chassis)

The mains supply got no farther than the bridge rectifier because the 6.8Ω, 5W surge limiter resistor R901 was open-circuit and the BUT12AF series chopper transistor was short-circuit. When these items had been replaced a resistance check showed that there was a short-circuit between the 150V HT line and chassis (across C905). The 180V over-voltage protection zener diode ZD903 was short-circuit. Once this had been replaced the set powered up and operated correctly.

Bush 2057NTX/Nikkai TLG2195

This is one of those Onwa chassis. The set was stuck in standby because the 12V zener diode ZD402 had gone short-circuit, taking the feed resistor R422 with it. There was thus no 12V supply. This is quite common and well known. As the basic cause of the failure can be increased HT from the power supply, it pays to monitor the HT line for a few hours after replacing the zener diode and resistor.

On one occasion recently I had to replace Q901, Q902, Q903, ZD901, ZD902, C909, C910 and R907 to achieve stable power supply operation.

Hitachi CPT2508 (G7P Mk 2 chassis)

“It went off puff, then a trickle of smoke came out of the back – just after the Argie scored. Frightened the life out of the wife” the customer said. A nice quick job for a change. I headed straight for the two blue pulse capacitors in the

chopper transistor's collector circuit, C919 (4.7nF, 1kV) and C928 (2.2nF, 1kV). Their cases were both cracked. Replacements got the set working again.

Orion D1094

This centre-deck machine would try to switch between LP and SP when tapes recorded in the LP mode were being played back. I cleaned the ACE head, which improved matters, but to clear the problem completely I had to remove the deck and resolder its plug/socket connection to the mother board, at the rear.

When you look down at the front of the machine, to the left, you see a PCB that acts as a jumper, connecting the mother board to the power supply board. Dry-joints are common here as well.

Matsui 2160

When this set was switched on hash noise blasted out at full volume while the screen remained blank. The channel indicators worked normally. A faulty line output transformer was the cause of the trouble. At over £70 trade, plus labour, I was surprised that the customer accepted my estimate. Fortunately nothing else was wrong once the new transformer had been fitted.

Hitachi CPT2226 (NP81CQ Mk II chassis)

The top half of the picture was reduced while the bottom half was normal. When I replaced C608 (22μF, 160V), which smooths the supply to the field output stage, there was full scan but flyback lines were present at the top. This was cured by replacing C715 (4.7μF, 250V), the reservoir capacitor for the HT supply to the RGB output stages.

Ferguson TX90 Chassis

The picture was OK but there was no sound. Holding a small screwdriver blade between thumb and forefinger, I touched the base of the audio output stage driver transistor TR120. There was hum from the loudspeaker, so the cause of the fault was prior to this stage. But only just: the audio coupling capacitor C165 (47μF) was open-circuit. A replacement restored normal sound.

Philips KT3 Chassis (later version)

After about two-three hours the colour would fade out to black-and-white. If the set was switched off for say ten minutes then on again, a normal picture would appear and the saga would be repeated. The cause of the trouble was traced to C56 (0.1μF), which is connected to pin 23 of the TDA3560 colour decoder chip IC35. The components connected to pins 23/4 provide filtering for the colour reference oscillator PLL.

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: M50436-511SP micro-controller chip (IC001) for the Sony Model KV21XRTU (SX chassis). Alternatively the main PCB or a complete set. Andy Dyson, 9 Elmsway Drive, Prestatyn, Denbighshire LL19 8SR. 01745 888 889.

Wanted: Unwanted *Television* magazines and TV/video training manuals or similar publications. Will pay air mail postage. Bongani C. Ndlibane, G4934 Goniwe Street, Walmer Location, Port Elizabeth 6070, Republic of South Africa.

Wanted: New or good used LOPT (part no. 7246-005) for the Grundig Model 1500GB. Brian Lawler, 6 Chindit Close, Formby, Liverpool L37 2JH.

Wanted: Power supply for the Philips 31DV3/05 VCR and a LOPT for the Fidelity ZX3000 chassis. M. Payne, 66 Nevinson Avenue, South Shields, Tyne and Wear NE34 8NP. 0191 536 3744.

Wanted: Scrap SRD600 satellite receiver-decoder. Must have undamaged top and front cover. Patrick Gallagher, No. 2 McGoldricks Flats, Rysh Street, Castlebar, Co. Mayo, Ireland. 00 353 94 26094.

Wanted: Does anyone have a circuit diagram or information for repair of a Dell computer power supply, number PS5201-1D Rev L10 200W. I think it's the type for XT mother boards. C. Raynor, 39 Northway, Lymm, Cheshire WA13 9AT. 01925 822 673.

Wanted: Good home for the contents of a TV repair workshop dating back to the 50s/60s. Equipment includes two Ferguson 546T TV sets, boxes of valves and other components and many magazines and circuit diagrams. There's a complete set of *Television* from April 1972-May 1974 and copies of the *Radio and Television Servicing* books from the late 50s. If you are interested in collecting and servicing early electronic equipment, please call

Mervyn Quilter on Plymouth (01752) 702 247.

Wanted: Philips N1500/N1700 VCR, preferably working but would consider one that requires attention. Richard Bell, 91 Kings Road, Melton Mowbray, Leicestershire LE13 1QQ. 01664 563 530.

For disposal: Three VCRs, Fisher FVHP716, Baird 8940 and Philips VR2020, all in working order. Also some spares for the JVC HR7200EK. Offers please. R. Weaver, 37 Chosen-Drive,

Churchdown, Nr. Gloucester GL3 2QS. 01452 716 041 (day), 01452 714 372 (home).

For disposal: For nominal £52 plus carriage: 3675-TXB8-0604/005/001 white Thorn jelly pot

LOPT, pre 1400 chassis; four ITT sealed black three-stick EHT trays, believed to be for the BRC 950 Mk. 1 chassis; Thorn 1400 chassis smoothing blocks, original new; AT2048/11 Thorn 3571 PCB LOPT; two FAT063/00 B&O 3500-6000 and Skantic 32631 Series 2; two FAT309 Autovox 110° 2693/2694; two FAT46/005 Grundig 1500-4050. I require any servicing information for the Ferguson PC1544 (Models 51A2/51A3, TX100 chassis) - the tuning voltage is stuck. R.E. Bailey, 22 Grebe Close, Waterlooville, Hants PO8 9UT. 01705 783 811.

For disposal: National TR505GB portable TV for spares/repair, £5; Maxicamera A gamma camera signal processor type 46-406040G10 for General Electric Nuclear Medical gamma camera, £50; unused Atari 13-pin DIN-to-Sony scart lead £8; Miranda Titan TP30 lightweight photo tripod with air-cushioned column, tilt feet, locking struts, marked angles, two spirit levels, carry handle - slight damage to headstock, hence £15 price. Julian Bohan, 30 Stanley Street, Lincoln LN5 8NG. 01522 514 241.

Wanted/for disposal: Require M56730ASP capstan drive IC for the Akura 160X. Have for disposal resistors in packs of 204, seventeen values from 10Ω to 100kΩ, at £1 a pack plus 50p postage. A. Topping, 2 F.H., Withy Wells, Worcester WR5 1RW.

Wanted: VF457B 334B07601 LOPT for a Mitsubishi back projector. Cathal McHugh, Lower Main Street, Ballybofey, Co. Donegal, Ireland. Phone from UK 00 353 074 31673.

Wanted: TDA1037 audio IC - used in some Grundig portables including the P1422GB. Please phone D.J. Maule on 0121 733 8629 after 7 p.m.

Urgently required: One red tube for a Philips/Pye floor-standing video projector, approximate year of manufacture 1980. Also any other spares and will purchase complete machines working or not. Richard Gifford, 4 Gipsy Lane, Needham Market, Suffolk IP6 8DY. 01449 723 009.

Wanted: Urgently seeking new or used Video Plus handset - original by Gemstar, now about 8-10 years vintage! Or can anyone repair it or supply spares? Steve Lunt, Electronics Dept., West Cumberland Hospital, Whitehaven, Cumbria CA28 8JG. 01946 693 181, fax 01946 523 513.

Wanted: Text board for the Rediffusion Mk 4 chassis/Granada Model C20BY4, PCB assembly index 82999. Also working power supply for the Amstrad SRD540. Ron MacPhee, 6 Boreray Court, Stornoway, Isle of Lewis HS1 2YL. 01851 702 709.

Barco 600 projector: Would the gentleman from Fleet, Hampshire who promised to return my Barco 600 service manual some months ago please do so as our only remaining machine needs attention before it can be used again as part of a

community project. Trevor Wiltshire, Pelican Road, Pamber Heath, Tadley, Hants RG26 3EL. 0118 970 1163, fax 0118 981 4538.

Wanted: Circuit diagram for the Samsung Fax SF2500 power supply module. E.W. Ingarfill, 44 Pitts Lane, Earley, Reading, Berks RG6 1BU. 01189 265 357.

Wanted: Circuit diagrams, service manual and/or fault reports for the B&O Beocord 8800V Video 2000 VCR, circa 1983. Claude Jackson, Thornbury, Sutton-on-Forest, York YO61 1EQ. 01347 810 354.

Wanted: LOPT for the Mitsubishi Model CT2101TX - transformer no. 334B07703. Nigel Stinton, 22 Elizabeth Avenue, Worcester WR3 7HQ. 01905 543 414, mobile 0802 460 238, e-mail Nigel.stinton@Bt.com

Wanted: Knob for the Ferguson Model 59K7. A. Robertson, 261 Warrington Road, Abram, Wigan WN2 5RQ.

Wanted: Circuit diagrams for the Gould 20MHz dual-beam scope Model OS300 and the Samtron SC428VSL monitor. Ed Cox, 86 St.

John's Road, Hedge End, Southampton SO30 4DF. 01489 782 885.

Wanted: Service manual/circuit diagram (photocopy OK) for the original Serviscope valve oscilloscope made by Telequipment Ltd., London. John McClean, 66 Castle Park, Limavady, Co. Londonderry, N. Ireland BT49 0SB. 01504 763 045.

Wanted: Circuit diagram/spares for the Hitachi Model C2558TN (Nicam model). Photocopy OK. Richard Gifford, 4 Gipsy Lane, Needham Market, Suffolk IP6 8DY. 01449 723 009.

Wanted: Mains transformer for the Telequipment D67 oscilloscope. Complete D67 scope considered, working or not. Also any information on spares. J.J. Braun, 91 Parkside Way, N. Harrow, Middx HA2 6DB. 0181 427 3784.

Wanted: Full working power supply for the Ferguson FV77VH VCR. P. Nicholson, 1 Sclegate Road, Carlisle, Cumbria CA2 4LA. 01228 511 392.




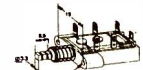
For sale: A number of TV and VCR manuals, including Ferguson,

GEC, Hinari, Sharp, Blaupunkt, Philips, Hitachi, Panasonic, Amstrad and Fidelity, all priced at £3 each plus postage. Phone David Forfar on 01695 735 132 to check on availability and to order.

For sale: Grundig V2000 VCR (last model) plus spare head (new) and new tapes (2 x 4hr). Offers please. C. Martin, Flat 6, Pine Trees Court, Hassocks, W. Sussex BN6 8NW. 01273 846 592.

For disposal: ERT Service Sheets numbers 1032-2005 and 2311-2624, total 1218. Sensible offers for the lot. Also *Radio and Television Servicing* Volume 1 to the 1986-87 volume, 37 in all. Sensible offers for the complete set in good condition. David G. Edwards, Cloud 9, Compit Hills, Cromer, Norfolk NR27 9LJ. Phone/fax 01263 513 640 any time.

Wanted: Spin motor for the Philips CD104 CD player (early Philips chassis) or a complete machine for spares. Martin Webster, 1 Thorn View, Luddenden, Halifax, W. Yorks HX2 6QX. 01422 883 197 evenings, 01133 923 825 day, 01133 926 305 fax.

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Reports from
Philip Blundell, AMIE
Pete Gurney, LCGI
Mike Leach
Martyn Davis
Ronnie Boag
Christopher D. Nunn
Graham Richards and
Keith Evans

Matsui TVR141

This TV-VCR unit had a playback fault: the symptoms were tracking bars and slurred sound, which indicated that the capstan was running slow. The cause of the fault was ripple on the AT5-6V line. It was cured by replacing C523 (100 μ F, 16V) on the TV chassis.

Replacing C523 cures these symptoms with the Aiwa Model VXT1410K as well, but I'm not sure to what extent these models are the same. **P.B.**

Ferguson FV81

There was no remote control operation. In every other respect the VCR worked perfectly. The handset was checked and found to be OK, so attention was turned to the IR receiver block. This had the correct 5V at its supply pin, and produced a healthy 5V pulse train output. But the output didn't appear to be reaching the microcontroller chip. A check along the path showed that the pulses disappeared at link JK01, which is at the top left of the panel, viewed from the print side. There was a barely visible crack at one end of this SMT link: resoldering cured the problem. **P.G.**

Toshiba V711B

This hi-fi VCR seemed to be dead: there was no display and the machine had a half-laced tape stuck in it. Quick checks on the power supply confirmed that it was work-

VCR Clinic

ing, but there was a problem with the power on/off signal at pin 6 of plug 806. It should be at either 0V or 5V but was stuck at about 3.3V. Its source is pin 25 of the timer microcontroller chip. Checks around this chip revealed that the -33V supply at pin 66 was missing. The source is a DC-DC converter, Z801, on the logic servo panel U601.

Circuit protector Z802 in the feed to it from the 6.6V rail had failed, and the converter had a very low-resistance reading at its input pin. When the fuse and the converter had been replaced the display reappeared and the mechanism initialised correctly. So the machine was left on soak test.

After several hours the voltage on the 6.6V rail rose to 8V and the STK5383 chopper chip IC802 was excessively hot. An audible rattle came from the power supply. A scope check confirmed that C808 (330 μ F, 25V) at the input to IC802 was open-circuit.

The excessive voltage on the 6.6V rail had obviously been the cause of the DC-DC converter's failure. Note that this is a 105°C capacitor. To prevent further problems I fitted a low-ESR, 105° type. **P.G.**

Samsung V1611

The E-E signals were severely distorted - playback was OK. In addition the customer complained that he had had to retune the channels almost weekly, until eventually the picture had become unwatchable. A scope check on the tuning supply voltage showed that a considerable amount of AC was present. The cause was the 33V supply's reservoir capacitor C4 (47 μ F). It had gradually dried up during previous weeks: as the voltage had dropped, the customer had retuned the machine to compensate. **P.G.**

Matsui VX2000

The complaint with this machine was that it wouldn't tune in. In fact it was on channel and worked all

right with a video output. Although the test signal appeared, there was no other video output from the RF modulator. Further checks showed that there was no video input to the modulator. There's not a lot to check here. The cause of the problem was filter PF4201, which was open-circuit. It's in the feed to the base of the buffer transistor which, in turn, feeds the modulator. **P.G.**

Panasonic NVG25

If there's no capstan lock and no sound, check C240 (10 μ F, 16V) on the servo board. When there are no control pulses the microcontroller chip mutes the sound. **M.L.**

Hitachi VTM720

If the cassette housing tries to load by itself with no tape inserted and the cassette-loaded light comes on, the most likely cause is a dry-joint at link K2546, which is almost next to pin 11 of plug PG1504 on the main PCB. You may not be able to see the dry-joint, but the chances are that there will be one here.

When one of these machines comes in for service it's worth applying a small blob of solder to the end-sensor connections underneath the deck. On many occasions I've found that the cause of various intermittent loading problems is a broken end-sensor lead just beneath the soldered connection. Remove the old solder first to check the lead length. **M.L.**

Hitachi VTF770

If the problem is intermittent poor playback/worn-head symptoms, check for dry-joints at the head amplifier plug. There could be several there. **M.L.**

B&O 4539

The symptom produced by one of these machines gave the impression that the condition of the hi-fi heads was poor: the sound was very noisy with dropouts. New heads failed to cure the fault, which was caused by the capstan motor. The surface-mounted capacitors in the motor had

dried up and some had leaked. As a result the motor ran erratically. Repair kits are available from B&O, but I think the success rate is only about fifty per cent. It's best to replace the motor. **M.L.**

Orion D1094

The tape would spool out inside the machine in the picture review mode. In this mode only the take-up and supply brakes are both applied. The trouble was caused by the supply-spool brake spring, item 309, which was somewhat over tight. This meant that the clutch had to work harder to drive the spool. The problem was cured by fitting a more elastic spring obtained from a scrap deck. **M.D.**

Panasonic NVSD260

This machine's recorded audio was intermittently low. The cause was traced to C4014 (3,300pF, 100V), which is connected to pins 5 and 6 of T4001. **M.D.**

Hitachi VTF540

Tape was left out of the spools on eject and there was no take-up, fast forward or rewind. Pulley part no. 6823333 had sprung open – a replacement cured the problem. **R.B.**

Toshiba V855B

Grainy pictures were produced in the RF-RF and playback modes. We found that there were dry-joints on the tuner's earths. **R.B.**

Samsung VIK350

This machine produced a grinding noise in play. We had to replace the loading motor block to cure the fault – there were damaged teeth on the gear. **R.B.**

Ferguson 3V31/32

The problem with this machine was persistent white horizontal flecks in the playback mode – a new head didn't make any difference. The cause of the trouble was the video head rotary transformer's windings, which become loose in their channels. You can glue the loose windings back, but make sure that no glue sits proud as this will result in the drum motor binding.

This action cures the fault with no need to replace the expensive drum motor! The **JVC** equivalents are Models HR7650 and HR7655. **C.D.N.**

Ferguson FV61LV

The power supply in this 'dead' machine was working but its outputs

were about 30 per cent of what they should have been. I found that all three legs of the 2SA1020 transistor TP91 on the power supply PCB were dry-jointed. Resoldering them cured the fault. **G.R.**

Panasonic NVJ35B

If the problem with one of these machines is wow and flutter on sound, lines on the picture in the playback mode and a scratchy-type noise from the capstan motor, don't start investigating the mechanics. Check C22 (330µF, 10V, 110°C) in the power supply. A hairdryer helped us with the diagnosis of this one! **G.R.**

Hitachi VTF860

This machine's power supply was inactive. The chopper transistor was OK, and the correct voltage was present across the mains rectifier's reservoir capacitor. Right next to it there's another electrolytic capacitor, C6 (1µF, 250V). It was staring right back at me! So I replaced it. Success! Note that you can replace C6 without removing the power supply assembly. **G.R.**

Philips VR231

This machine is fitted with the Turbo deck. Fast forward and rewind were intermittent, and there was tape looping at eject. A look under the mechanism revealed that a spring was missing. It's normally attached to the brake slider assembly and is the larger of the two springs. A replacement obtained from a scrap machine put matters right. Where did the original one go? We'll never know! **G.R.**

Samsung VIK316/346

When one of these machines is brought in as being dead it's extremely common to find that the outputs on the secondary side of the power supply are low or pulsing. The thing to do is to replace C35 (100µF, 25V) and C38 (470µF, 16V), using types rated at 110°C. **G.R.**

Sony SLV625

The complaint with this Nicam hi-fi machine was that its E-E sound was missing. In fact the audio was present but at a very low level. After wading through the numerous foldable diagrams in the very substantial service manual we came to the hi-fi audio subpanel (HF-22), then found that the processing chip seemed to be running rather hot. Because of the position of the board, taking measurements in situ is virtually

impossible without an extension connector.

The IC in question is a 64-pin beast, so its replacement was carried out with some trepidation. On refitting the subpanel and powering up our fears melted away: we were rewarded with clean, crisp, full-level audio. **K.E.**

Philips VR727

An increasing number of Turbo deck mechanisms have appeared in the workshop of late. They seem to be taking over from the old Panasonic G decks. The complaint with this one was no fast forward or rewind.

When we removed the complete deck assembly we found that the 'pulse roller' was adrift and floating around in the works. A close inspection for any breakages failed to reveal anything amiss, so we clipped the roller back into position and reassembled the machine. A long soak test proved that all was now well. **K.E.**

JVC HRD230EK

"Will record only in black and white" was the customer's plaintive cry. As electronic faults of this nature are quite rare, we set about tracing the cause with some relish! So out with the scope and circuit diagram. Before long we had traced the missing signal as far as bandpass filter BPF302 in the video feed to the decoder chip. It was open-circuit. A suitable replacement was found in a scrap machine.

There's a **Ferguson** equivalent, Model FV12L. **K.E.**

Samsung S13240

A hum-bar type of disturbance on the colour content of the E-E and recorded signals was the symptom this machine produced. Scope checks on the power supplies soon revealed the culprit: the 33V regulator chip IC101. **K.E.**

Hitachi VTM830

This machine burst into life as soon as the operate button was depressed. It would perform the lacing operation without a cassette, while the cassette lift tray would just shuffle back and forth. The problem looked like one you might get with a defective mode switch.

It's always worth checking the tape-end sensors however before you dive in too deep. In this case the take-up end sensor on the subpanel was dry-jointed. While in this area, it's worth resoldering the supply end sensor and the cassette up/down switch connections. **K.E.**

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Mains powering at remote locations

Bill Wright describes a simple method of obtaining low-current mains voltage at some distance from a normal mains supply. It can be used to power TV distribution or surveillance equipment. The power is carried by coaxial cable as low-voltage AC

Aerial contractors often need to power devices at locations where it would be inconvenient or expensive to provide a permanent mains supply. The usual way of going about this is to feed low-voltage power via the coaxial cable that carries the signal, a practice known as line-powering.

Line-powering Techniques

The principle of line-powering is well established. It's probably best known as the means of powering a mast-head amplifier from a small power supply unit at the bottom of the download. A simple choke/capacitor device called a line-power injector is used to connect the power to the coaxial cable. It's often built into the power supply unit. A similar device is used to extract the power at the other end of the cable.

Communal TV systems make extensive use of line-powering, arranged in countless different ways. Remote aerial systems, where the aerial is a long way from inhabited buildings, also make great use of line power. Voltages commonly carried by coaxial cable are 12V, 15V and 24V DC, and 55V AC. Any equipment along the cable run, such as tap-off units or splitters, is designed to pass the power along the trunk cable but block it from spurs.

DC line powering has a serious drawback in practice: the EMP (electromagnetic pulse) from a nearby lightning strike tends to zap line-powered equipment, and often the power supply unit as well. It's a common occurrence where long trunk cables run above the ground, in a loft for example. Presumably the long cable acts as an efficient aerial for reception of the EMP.

For this reason I no longer use DC line powering for

new communal systems. As a consequence I don't line-power equipment that's intended to be run from a local DC power supply. Some manufacturers' channel changers and channelised amplifiers, while not being intended for line-powering, require a 15V DC supply. This normally comes from a power supply in the same housing. But there's a tendency to line-power such items – at the risk of expensive damage next time there's a thunderstorm!

The range of equipment designed to run on line power, either AC or DC, is quite limited: in fact it consists almost entirely of amplifiers. If you need to line-power a channel changer, modulator, satellite receiver or anything else, you have a problem. The range of amplifiers is not all that good either – and for some mysterious reason they tend to be more expensive than their mains-powered equivalents.

Remote Mains-voltage Operation

It was with these thoughts in mind that I considered the possibility of using equipment designed for mains-voltage operation at line-powered locations. The advantages would be considerable. In particular, every manufacturer's full range of amplifiers could be used, as could equipment such as satellite receivers that are available only as mains-powered units.

Since only a minority of the systems I maintain use line-powering, it's not economic to stock a full range of line-powered equipment to be able to deal with every problem that could arise. But when these systems do break down they have to be fixed yesterday – there's no time to send off for spares. What a boon if off-the-shelf mains equipment could be used . . .

This is how I came to build the units shown in Figs. 1 and 2. Conventional AC line-powering uses a transformer to apply a relatively low voltage to a coaxial cable. The equipment at the remote end is designed to work at that voltage. My units simply carry the idea a stage farther, by stepping the low voltage back up at the remote end to provide an approximation of a mains supply. They are extremely basic, but do provide an effective solution to the problem.

I've used twenty or so of them over the past four years, with no problems. More sophisticated arrangements are obviously possible, as readers will, I'm sure, tell me! Likewise there must be lots of applications I haven't thought of for this idea. Personally I think it's great to be able to pick any mains-powered amplifier out of the van and use it at a line-powered location.

Just in case some unwary soul comes along to the line-powered equipment, sees that there is no conventional mains connection, and assumes that only low voltages are present, I always affix a large warning notice - see Fig. 3.

Practicalities

To simplify stock keeping it was obviously important to chose a line voltage and stick to this each time the technique is used. The transformers shown in Figs. 1 and 2 are for line-powering with 40V AC on the coaxial cable. Anyone who follows up this idea might prefer a different value.

If 20VA transformers are used to provide 40V line power, as shown in Figs. 1 and 2, there will be sufficient power for a typical load of say two Taylor TS3048 preamplifiers and two TS2054 output amplifiers. Anyone using this technique should add up the total load in order to decide on the transformer ratings required. If, for example, the equipment to be line-powered includes a couple of satellite receivers (with LNBS), channel changers and amplifiers, 50VA or 100VA transformers may be necessary.

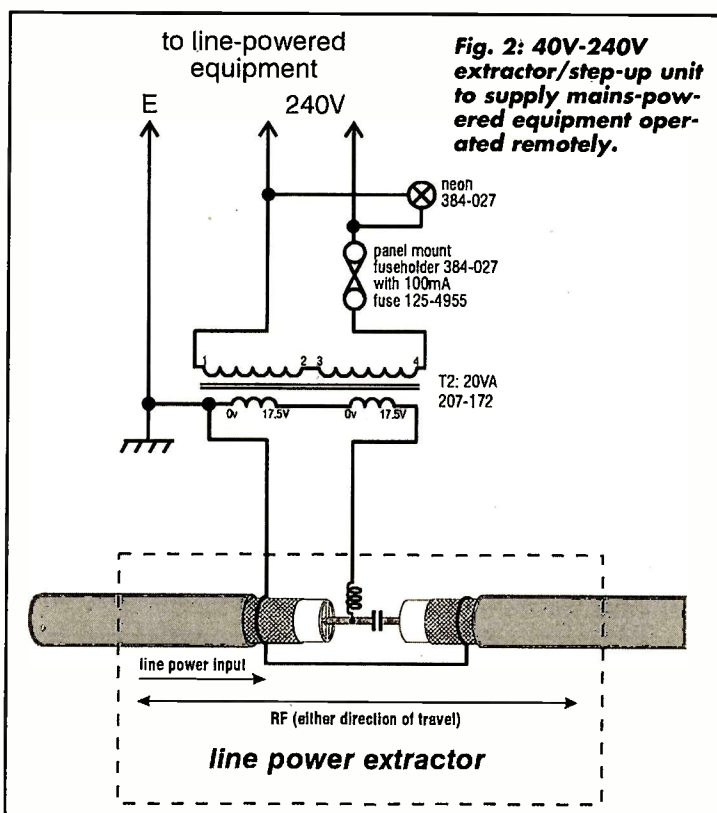
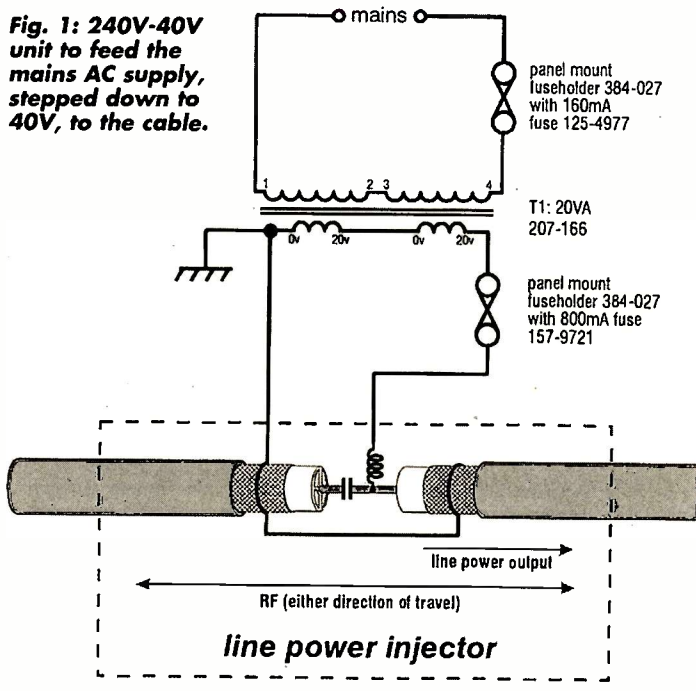
The different transformer ratios at each end of the link compensate for transformer losses and for a coaxial cable resistance of a few ohms. Where the coaxial cable run is exceptionally long, say 500m or more, the compensation will need to be adjusted upwards. The return-path resistance of good-quality distribution cable such as Raydex CT165 is about 1.5Ω/100m. With domestic download cable the figure is about 4Ω/100m.

Where one mains-powered transformer supplies several sets of equipment via separate coaxial lines it's a good idea to fuse each line separately at the transformer, if only to simplify fault-finding. For the same reason, where there are several groups of line-powered equipment along the same line, repeaters in cascade for example, the power to each should be fused at the line-power extractor.


Simple as it is, there's no point in constructing an LPI (line-power injector/extractor) since the manufactured item is inexpensive and has the advantage of incorporating the coaxial connectors. I use a diecast box to house the transformer and fuse(s), and bolt the LPI to its outside.

The LPI should have minimal RF through-loss and good screening. The following are just a few examples of suitable types: Taylor TRPK or TRPK-FS; Labgear CM9027; Wolsey LIU. As shown in Fig. 4, LPIs are available with Belling or F connectors or with direct cable connections. Where a larger transformer is used, check that the LPI used can handle the current.

I've listed RS stock numbers in Figs. 1 and 2. As only small quantities are involved, it didn't seem worthwhile



AC line power
repeater unit



DANGER: this unit produces high voltage derived from line power

Fig. 3: Safety label for line-powered equipment.

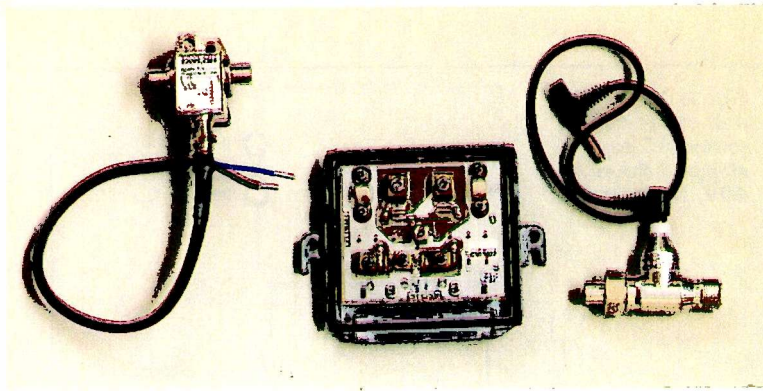


Fig. 4: Some suitable LPIs.

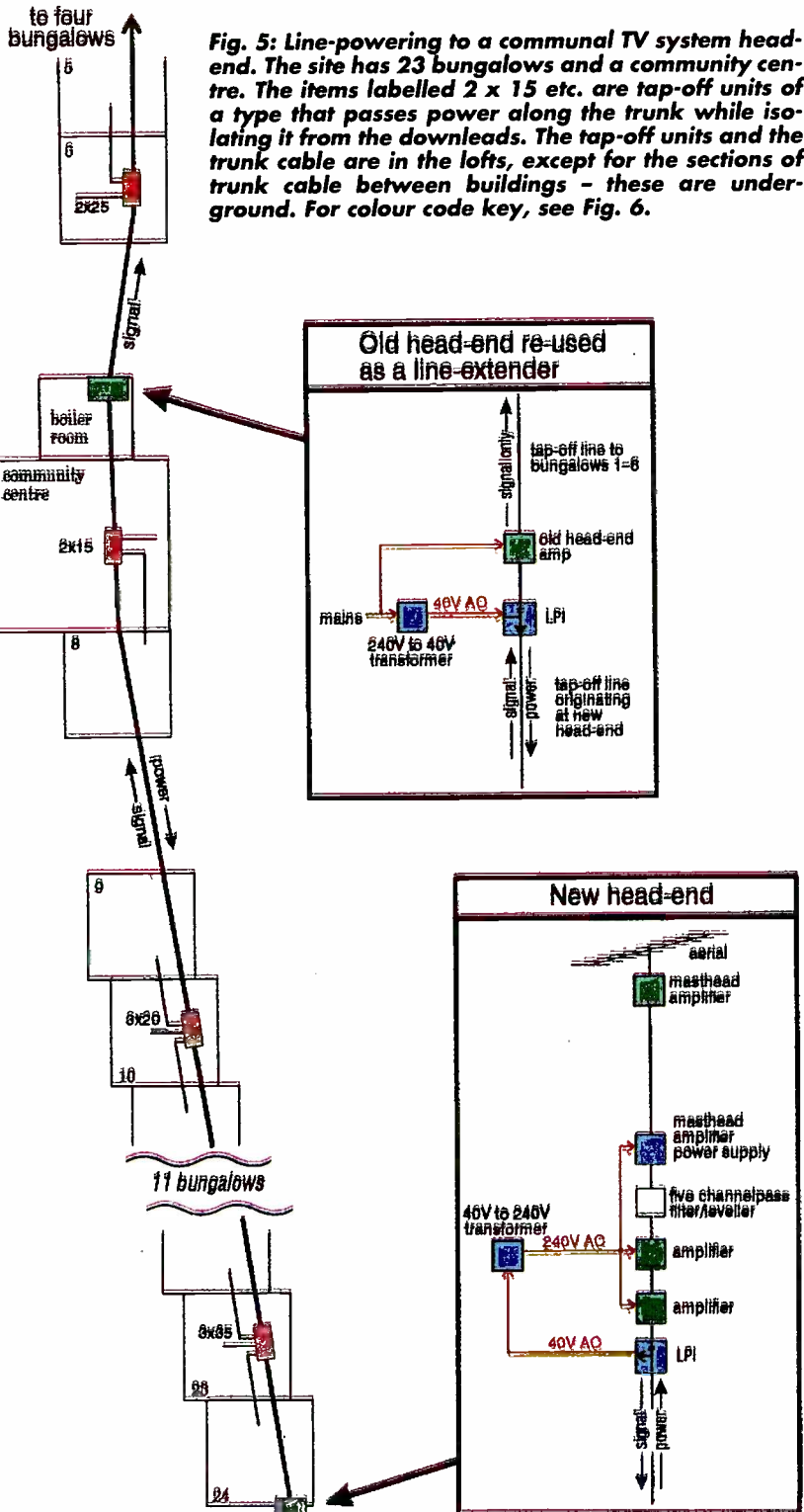


Fig. 5: Line-powering to a communal TV system head-end. The site has 23 bungalows and a community centre. The items labelled 2 x 15 etc. are tap-off units of a type that passes power along the trunk while isolating it from the downleads. The tap-off units and the trunk cable are in the lofts, except for the sections of trunk cable between buildings - these are underground. For colour code key, see Fig. 6.

shopping around to check for lower prices.

To round off this article and possibly provide a better idea of what's involved, I'll describe a couple of examples of the use of the technique.

Line-powered Communal TV Head-end

My very first use of this line-powering dodge resulted in a lot of job satisfaction, because it brought to an end ten years of abysmal TV reception for about sixty elderly people who live in an estate of bungalows shadowed by a massive Victorian church. The church and its surrounding trees are on slightly higher ground and screen almost all the bungalows from the nearby transmitter so completely that good reception was impossible.

Someone had installed a communal system with the head-end at the 'obvious' place, the boiler room adjacent to the community centre. This was probably the worst place for off-air reception, which was appalling. After a lot of experimentation I found that good reception was just possible at the top of a 25ft mast at the very end bungalow - this point cleared a low part of the church roof by about a foot. I installed an aerial here, and reception proved to be reliable. So I turned my mind to the problem of linking it to the system.

It was not feasible to get a cable back from the aerial to the existing head-end - this would have involved digging up the road. A better plan would be to move the head-end to the aerial site and replan the system accordingly.

The problem was how to obtain an electricity supply for the new head-end? The only mains supply available to me was at the old head-end. You can't just plug in to the nearest tenant's supply, for a number of reasons. The electricity company would want an arm and a leg to install a new supply, and would take three months to do it. I would also have to pay a builder to recess a meter cabinet into the wall.

Line-powering was an attractive option. All the tap-off units had to be checked or replaced in any case, because the original installer had done a really bad job. It would be no extra trouble to make sure that they were all power-pass types, and that there were no loose connections. The existing head-end amplifier could be reused as a mains-powered line extender - a line extender is an amplifier used at a tap-off line point where the signal levels would otherwise be too low to supply further outlets.

The system ended up as shown in Fig. 5. The work was carried out over four years ago, and there have been no problems to date.

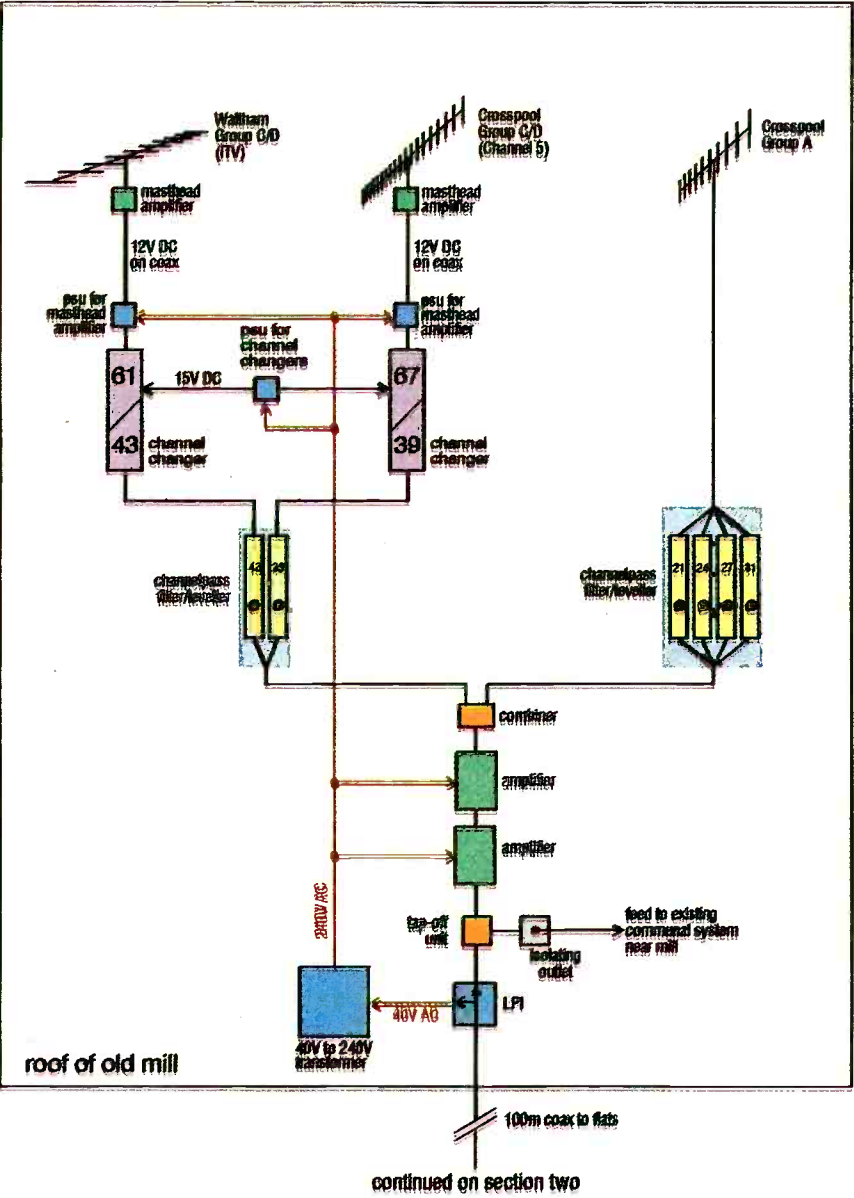
Aerials in a Windmill

When this work was carried out Channel Five was the main problem. A development of low-rise flats needed a communal TV system. Rooftop reception of the four Group A channels was very poor, and C5 on ch. 67 with low power promised to be worse. In addition, reception of Central as well as Yorkshire ITV was wanted.

Nearby, on high ground, there was a derelict windmill - in a perfect position for reception. Negotiations with the owner revealed that he would be perfectly happy for me to fix aerials on his mill - on condition that I provided a feed to his row of barn conversions. These were nearby, but in the opposite direction to the flats. They already had a distribution system but, because the aerial was low down, reception was poor.

As there was no mains supply at the mill, a line-powered head-end seemed like a good idea. C5 and Central ITV were on channels inconveniently high for distribution, so channel changers were required. The final system is shown in Fig. 6. Once again, everything worked very well.

Section one



key	
	wideband amplifiers
	channel pass filter/ combiner/levelers; other filters
	wideband combiners and splitters
	power supplies
	line power injectors and extractors
	channel changers
	component groupings

Section two

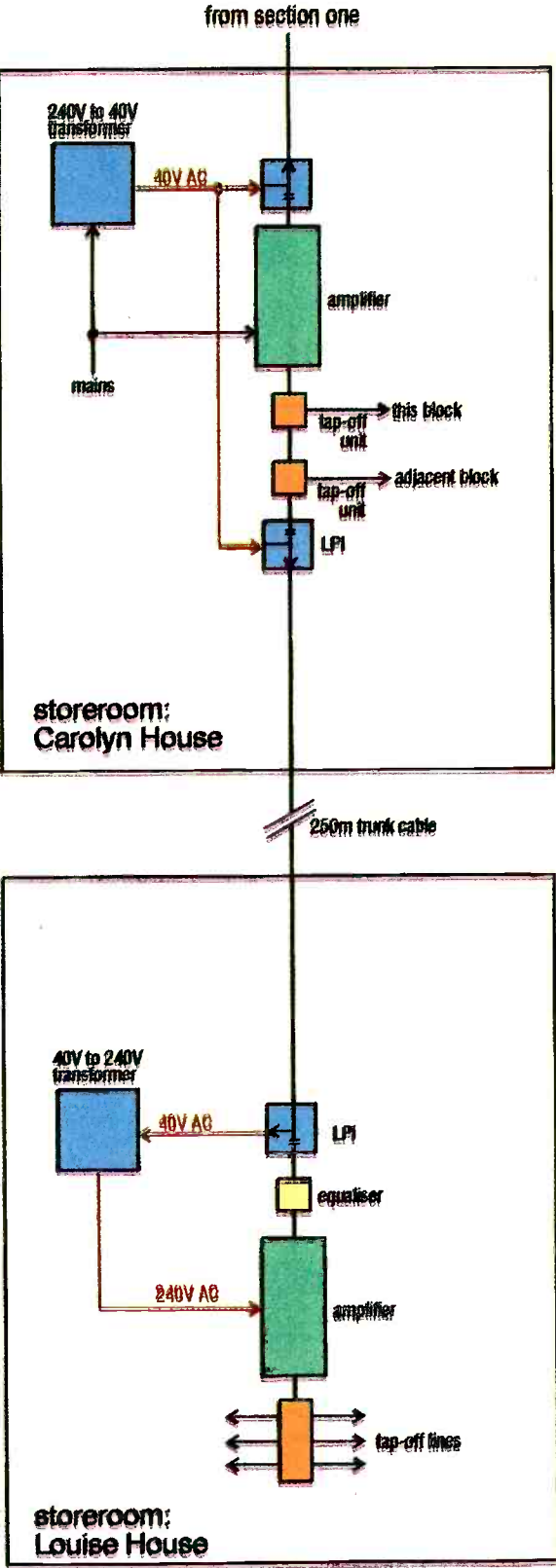


Fig. 6: Line-powering to a head-end system at a windmill. The communal system serves a development of low-rise flats and an existing system near the mill.

DX and Satellite Reception

Terrestrial DX and satellite TV reception. News from abroad and from the satellite belt. The Manhattan LT6300 Plus Mk 2 satellite receiver reviewed. Roger Bunney reports

With the arrival of autumn, terrestrial DX reception has fallen off. But the rising solar activity means that we can hope for higher MUFs (maximum usable frequencies) and super DX via the F2 layer – as a result of the moves to UHF and digital transmission, it's likely that this will be the last opportunity we shall get for F2 DX-TV reception in Band I. The Leonids meteor shower should have occurred by the time this is read: let me know of any signals you receive in this way.

There was some Sporadic E activity in September, while settled high-pressure systems produced tropospheric propagation around the 21st-24th, with signals

Not ch. E3 via SpE this time but instead via Arabsat at 30.5°E.

from Germany and Scandinavia. Signals were received from DR (Denmark), RTL (Luxembourg) and Germany on the 21st. Reception from Scandinavia peaked on the 23-24th, when the Band III channels were full of Norwegian signals. For the most part reception occurred in the east and south east.

Here's the SpE log for the month:

5/9/98	RTS (Serbia) ch. E3; unidentified signals received in chs. R1, R2 and E4.
6/9/98	TVE (Spain) chs. E2 and 3.
7/9/98	RTS E3; Video (Italy) E2; RAI (Italy) IA; unidentified signals received in chs. R1, E3 and E4.
8/9/98	RTS E3; unidentified ch. R1 and R2 signals.
12/9/98	Video E2.
15/9/98	TVE E2.
17/9/98	NRK (Norway) E3.
22/9/98	NRK E2.

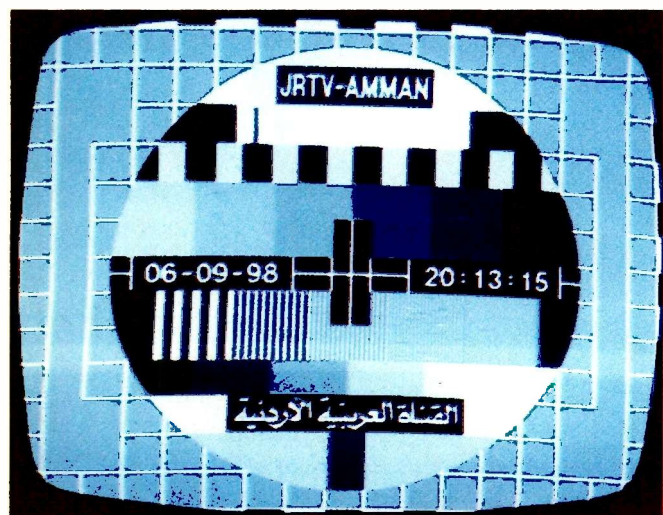
My thanks to Peter Schubert (Rainham) and Cyril Willis (King's Lynn) for their reception reports.

A few months ago Hugh Cocks (Portugal) reported reception of Smile FM, a Philippine (Manila) VHF-FM radio station, at 269.45MHz via a US Navy satcom

bird. If you use a scanner you can hear the station in the UK overnight, from early evening through to the morning when it closes. My ancient AR2002 scanner plus preamplifier, with a discone aerial, resolves the signal quite well. A cut-to-frequency Band III aerial, would give excellent results. Hugh thinks that the relaying satellite is at 70°E, providing low-horizon reception. Hardly DX-TV, but nevertheless interesting.

Satellite Sightings

Hugh Cocks is now using a Nokia Model 9600S for digital reception in Portugal. He mentions that when ITV covers Formula 1 racing in Europe, Intelsat 801 (31.5°W) is used with the main feed to the UK in PAL, avoiding the "brownish-green, jerky digital pictures". A reverse video feed is sent from the UK in digital form. Check out 801 at 11.60GHz vertical. Also check out at 11.160GHz vertical late evenings for a 625-line mess which is internal breakthrough in the satellite from C to Ku band: at 2300 ORTN (Niger) in C band goes to a PM5544 test pattern which can be just made out in Ku band. Another tip: PAS-5 (58°W) often carries Teleglobe Canada at 11.490GHz vertical – also check 11.54 and 11.62GHz vertical for weak carriers.



Roy Carmen has now moved from the Isle of Wight to the Dorking area and expects to be back on the air shortly with a 90cm prime-focus dish.

The Clinton/Lewinsky affair has dominated the satellite news feeds these past few weeks, particularly via Intelsat K (21.5°W) and PAS-3R/6 (43°W). There were other highlights, such as the successful launch of PAS-7 on September 16th, which was carried live via Intelsat K at 0730. PAS-7 is now in operation at the same orbital slot as PAS-4, i.e. 68.5°E.

The electoral defeat of German chancellor Helmut Kohl resulted in a flurry of activity, with the Dutch SNG company INTRAX wheeling out its vehicles. Most feeds were via Intelsat K rather than Kopernikus-2 at 28.5°E.

There are no longer any signs of analogue signal activity from Eutelsat II F4 (7°E), which provided EBU news feeds in analogue form for many years. After threatening to go digital for several years, Eutelsat has finally gone to MPEG 4:2:2, with twenty carrier channels available and the option of scrambling should any programme require greater protection. It's farewell to an old friend!

An interesting programme appeared via Intelsat K on several nights from September 21st, running to four hours into the mid-evenings, from the CDRH TV facility company. Produced by the US Army, the epic Medical Response to Biological Warfare and Terrorism told you all you need to know about inhaled anthrax, with demonstrations, discussions and live phone-ins from around the globe. This NTSC spectacular was at 11.688GHz vertical.

On most days you can see UKI-149-GMTV SNG via Intelsat K at 11.528GHz vertical with various features for the early show - late September featured the Labour Party conference of course. During the evening of September 8th PAS-3R/6 carried the message SGI NEWTWORK TEST EUROPE/S.AFRICA, at 12.696GHz vertical - an NTSC signal. Can anyone explain?

Another analogue signal has departed, Galavision from PAS-1 (45°W) at 11.51GHz.

For me, the sighting of the month was a sparklie-free test card from JRTV, Amman during a

C-band news feed via Arabsat 2B (30.5°E).

Terrestrial News

UK: The first UK RSL TV station, Isle of Wight TV12, uses ch. E54. Transmissions are from Rowridge at 1kW ERP, with horizontal polarisation. The signals should cover most of the island, though relays are planned for poor reception areas such as Ventnor, Brading, Ryde etc. On the mainland the coverage should include Lymington, Gosport, Portsmouth, Southsea and perhaps Selsey. Parts of Southampton that are favourably sited should also receive the signals.

Digital TV: While digital TV providers in the UK have suggested an analogue TV switch-off in ten years' time, the ITC has advised the government that a more realistic date would be about 2018, by which time most people will probably have replaced their TV sets and VCRs. The German government has agreed with manufacturers, broadcasters and the digital working group (ADR) that the analogue switch-off should be in 2010, by which time it's estimated that 54 million digital TV sets will have been sold.

Germany: The Sudwestfunk and Sueddeutscher Rundfunk broadcasting groups have merged to form SWR, which is now the second largest German broadcaster (WDR is the largest). The new group will cover the whole of SW Germany.

Portugal: Digital terrestrial TV is to start in the year 2000. Portugal and Spain have co-operated over the allocation of channels and frequencies. The latest coverage plan is as follows. There will be three national TV channel blocks within channels E60-69, eleven regional blocks within channels E53-65 and 22 extended local TV area blocks within channels E43-68. Portugal's national broadcaster RTP, with two national networks SIC and TV1, will move progressively from existing channels to digital allocations. Spain will keep chs. E66-68 for national coverage and chs. E57-65 for provincial coverage, with a DTT transition time-scale of ten years.

Canary Islands: DTH Europa, which consists of Mexico's Televisa and the Spanish group Sogecable, is likely to be given the regional TV franchise for the Canary Islands.



Ireland: Digital terrestrial TV will consist of thirty channels arranged in six multiplexes. RTE will have one multiplex, which will consist of RTE-1, Network 2 and three new channels; commercial broadcasters TV3 and TnaG will also have digital channel allocations.

End of the US Army biological warfare programme - soldiers in protective clothing beneath captions. Reception was 525-line NTSC.

Aerial Techniques

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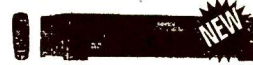
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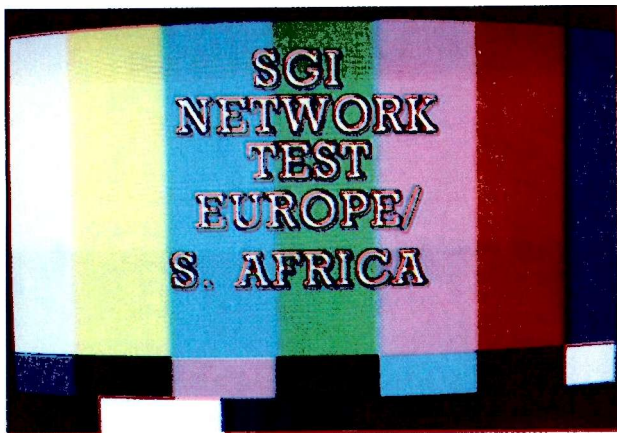
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Seen once via PAS-3R/6 on 8/9/98 and never again! Any comments?

Iran: According to national broadcaster IRIB, 1,500 main and relay stations were opened over the period March 1997-March 1998.

Channel 1 has 94 per cent population coverage, Channel 2 some 88 per cent coverage.

France: TDF is conducting a digital terrestrial TV test programme in Brittany, with sample receivers produced by Nokia and Philips. The test multiplex includes TF1, France 2 and 3, M6 and La Cinquieme. Two other multiplexes will include satellite-originated programming. The transmissions are at UHF from three main sites – Rennes, Lorient and Vannes. DTT is to start in 2000, with an analogue switch-off planned for 2010 – a final date is expected to be announced in December 2000.

There are reports of a pirate station operating in east Paris on channel L36. The PM5544 test pattern carries the identification OSF at the top and Canal 36 at the bottom. OSF stands for Ondes Sans Frontiere – its programming is directed to the poor and homeless.

Hong Kong: Asia Television (ATV) is to relaunch in January, with plans to expand into mainland China. Its English-language World channel will change to a more “infotainment” format. Another HK channel, TVB, has opened a new Mandarin service with a further channel to start shortly.

Satellite News

Much concern has been expressed about possible meteor impacts with satellites during the mid-November Leonids shower, which is expected to be the most dramatic since the Leonids peaked in 1966. This year and next the shower will be enhanced by debris from the Tempel-Tuttle comet. Early evening on November 17th is the crucial time.

The Leo (low-earth orbiting)

satellites now being tested for the Motorola Iridium project to provide worldwide mobile communications via up-market cellphones have hit a snag. Several failures have reduced the number of usable craft to 65, one less than that required for full global operation. This could delay the run up to the new service.

The Arabsat organisation, which operates satellites at 26 and 30.5°E, using mainly band C, plans to launch Arabsat 3A next spring. It will be a totally Ku-band craft with twenty transponders covering the Middle East, North Africa and Europe. Each DTH service will have 8 MPEG channels. Slotting alongside 2A at 26°E, it will duplicate most of the current C-band channels aimed at Arabic communities across Europe.

Orion-2 is likely to be launched next May into a mid-Atlantic slot to provide Ku-band facilities across Europe (into Russia), the Americas and a spot beam to South Africa.

Following extensive losses, the Spanish digital TV operators Via Digital and Canal Satellite have been combined. At the time of writing we don't know the new package and which satellite is to be used.

Television de Catalunya has just started a digital programme service called TVC International, with transmissions to most of the Americas via Hispasat capacity.

A new UK channel, X-Dream International, is to be launched soon. Broadcasting 24 hours a day across Europe, it will feature unusual sports such as skate- and snow-boarding, windsurfing and mountain-bike championships.

The UK SISLink company is to supply ten SNG uplink trucks to ITN. They will be located around the UK over the next five years to give speedy access to breaking news stories. In addition a satellite link has been established between London and the Lyons HQ of Euronews.

Intelsat has leased capacity aboard the 801 satellite (31.5°W) to BT Services France to deliver a French-language DTH service to the Caribbean. The coverage reaches as far as Miami to the North and French Guiana to the south, enabling 60cm dishes to be used in the boresight centre area. The Paris-sourced, encrypted service is uplinked from BT's new facility at Paris-Boulogne. Eutelsat has recently signed up Polish groups TVP, Polsat and Canal+ Polska,

creating a digital service with both national programmes and regional/local coverage.

Review: The Manhattan LT6300 Plus Mk 2

Many satellite receivers are on sale in the UK, and the choice of one for DXing, i.e. for hobby reception rather than just BSkyB, is very difficult. I'm talking about analogue reception for the present – there are still masses of such signals to see! Ask a dozen enthusiasts which is the ideal receiver for the purpose and you'll probably get a dozen different answers.

Not being in the trade I had, when considering the purchase of a more up-to-date receiver, to check advertised specifications and, in the end, took a chance. Fortunately I was lucky with my choice.

My main requirements were fast tuning, frequency readout, threshold extension, decoder output access, variable IF bandwidth and the ability to switch off the supply to the LNB. I didn't want any on-screen displays, since with many receivers the TV screen blanks out or the OSD mixes with the screen sash so that you see neither the OSD nor the weak signal. The receiver should be easy to open up – for power supply repair if necessary – and be relatively cheap in comparison with say the Chaparral Monterey or the Echostar LT8700.

While I was thinking about this, Eurosat introduced a series of three analogue models. The cheapest one was the Manhattan LT6300 Plus Mk 2. The basic information available suggested that it would be suitable and, as a free sample/loan set wasn't forthcoming, I bought one. At trade price it was well under £100. I was lucky, since the receiver is more versatile than I'd expected and, once the IR remote control system had been mastered, I found that it was extremely easy to use.

The LT6300 Plus Mk 2 is the usual compact, anonymous-looking black box with a minimum of front controls (power, channel up and channel down). The LED digital readout at the right-hand side provides the sole indication of your reception. The rear has just dual LNB F input sockets, terrestrial TV input/output sockets (the latter delivers satellite-modulated UHF as well), a couple of phono outputs for audio and three scart sockets for decoder, TV and VCR.

This is not an IRD, so any decoder needed will be an outboard unit. The four-sprung terminal block is for mechanical polariser skew and a 0/12V switching option. The only connection is for the mains supply, with limits 220-240V. A really budget set of options!

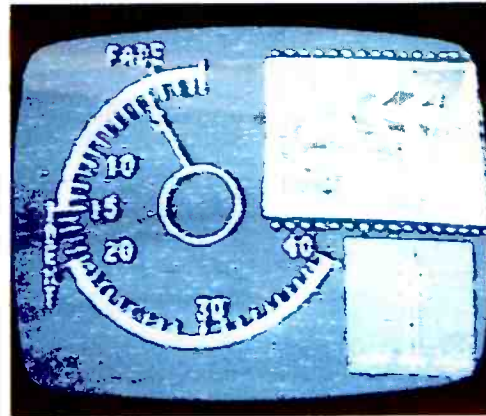
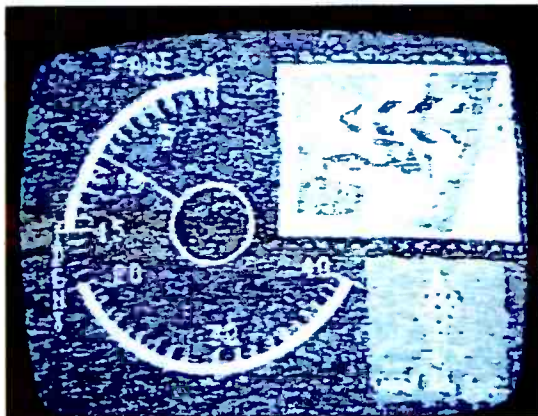
I suspect that there are variations on this model depending on where it originates. For example my receiver doesn't have IF bandwidth switching, though the booklet shows this, and there seem to be variations in the audio de-emphasis options.

The two LNB inputs have selectable 13.5/18V outputs at 0.3A. The tuner's IF response is 900-2,150MHz, the single IF bandwidth (with my receiver) being 27MHz (at the -3dB points). Low threshold extension takes the C/N ratio down to 3.5dB, with 1-32 steps via IR control - this really lifts weak signals. The test signal/UHF modulator output is selected via remote control, not the slide switch shown in the booklet.

Three remote control buttons select most facilities and operate in conjunction with the volume up/down buttons. *System* gives LNB input, A1, A2 etc.; local oscillator selection from 9.750-11.475GHz, universal lo, hi and 5.150GHz for C band; polarisation 14/18V (vertical/horizontal); skew from -90° to +90°; 22kHz tone on/off; 60Hz on/off. *Video* gives IF tuning from 900-2,150MHz; video bandwidth 18/27MHz (though not with my receiver); deviation stepped 1-4; decoder options including MAC and Canal+; and a 0-12V option. *Audio* gives subcarrier tuning from 5.9-9.99MHz; stereo/mono; bandwidth 110/150/280/500kHz; de-emphasis J17/50µ/75µ/DNR.

Remote control operation of the receiver is easy. Tuning across the IF band took 52 seconds in 'scan' while I was checking Intelsat K during the evening of the Clinton tapes. Once depressed the scan button produces a flashing frequency readout, then either up or down. When a signal is found the tuning stops at the centre frequency and the display flashes. Press the up/down button to restart the scan. Setting up for your own LNB is easy.

There are some minus points. Despite what the booklet says, there's no + (C band video) or - (Ku band video) option. But the receiver operates in either band,



Reception of a weak signal with and without threshold extension using the Manhattan LT6300 Plus Mk 2 receiver.

being pre-programmed, ranging from well-known to more exotic satellites. You merely hit a C-band programme memory, say 299, and you are into C-band parameters. For variable tuning you push video down to frequency then the up/down buttons. Audio adjustment is odd, as there is a two-three second delay between the button push and the result - this is irritating. The up/down buttons also provide volume adjustment - this happens only in a programme/memory setting, e.g. P299.

I bought two of these receivers, which both came set to system B/G audio (5.5MHz). Realignment is tricky. The cover is held by three screws. Remove these then more screws that retain the phono and scart connectors and the nut on the tuner's input F socket. About five screws hold the main PCB which, when lifted up at the back to rest, carefully insulated, on the rear panel of the metal case, gives access to the modulator and the intercarrier sound adjustment coil. The slug needs to be screwed about one turn outwards, but check with a satellite signal fed into a terrestrial TV coaxial socket. Unless you are experienced, it's best not to try to do this but to buy the receiver already aligned for system I.

I've had one fault. After about four-five hours the mains transformer in one receiver produced a very sharp, loud buzzing. The lamination clamping was slack. Use of a vice to clamp the metalwork cured the problem - the mains transformer is easy to remove. As with most receivers from East Asia, it runs very warm after several hours. This seems to be the norm nowadays. The case is well ventilated.

To summarise, with the Manhattan LT6300 Plus Mark 2 you have a budget DXing receiver that's an efficient low-signal workhorse in both bands C and Ku. It's easy to use, compact, efficient and versatile. A good buy in fact. I can recommend it for both DXing and general viewing.

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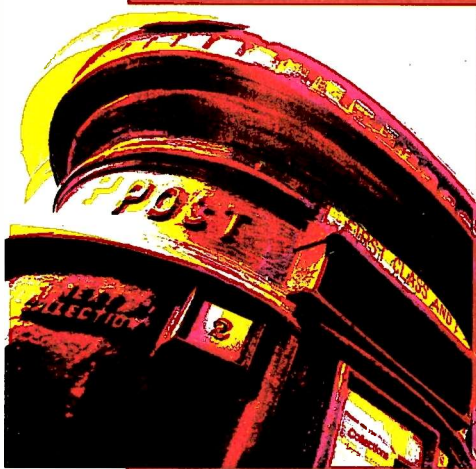
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Recommended Retail Prices

Earlier this year the government announced the end of "recommended selling prices". It seems the government had come to the conclusion that manufacturers had been price fixing and running cartels. But everyone in this trade knows that prices have been falling for years. Every time new products are launched, they are £20-£30 cheaper than their predecessors. This general price reduction, coupled with cut-throat competition amongst retailers, particularly London's West End stores, explains why prices for the same piece of equipment are roughly the same at all outlets – they've been cut to a bare minimum.

I work for a large electronics manufacturing company. For years we had, as other manufacturers did, recommended selling prices that were available to anyone who phoned our customer services department to ask. Pretty well everyone accepted that dealer's prices would be lower, but the RRP provided a guide point. When comparing models, those recommended prices enabled the customer to establish which models were in the upper price bands and which ones were in the lower bands – what we call "entry-level" equipment. There was no price fixing: the public just wanted a guide.

We can no longer provide this, and have to take the flack when a customer cannot understand why we have no price lists. We have to tell

Letters

the customer to go to dealers to find out the prices. They would prefer to go with the knowledge of what the manufacturer felt was an appropriate price for the product. It is now very difficult for a customer to get a range of prices for a type of product.

What is at present happening is that the abolition of RRP is actually increasing prices. Now that the manufacturer can no longer provide a guide, the customer doesn't have a starting point. In the past dealers would be aware that manufacturers' recommended prices were available to the public, and would either charge these prices or something slightly less. Not many would price an item above the RRP, the exception being some catalogue companies who were trying to protect themselves against trading losses because of bad debts.

Now that there are no RRPs, a dealer can price an item at any figure he likes. The competition is still there of course, but if prices start higher there is greater profit all round. This is OK for the trade, but I doubt whether the public would think it acceptable.

At this time of the year manufacturers tend to introduce some new models for the lead-up to the Christmas buying season, while dealers run clearance sales to clear stock. In view of sluggish sales this year there's a lot of stock in the pipeline. But once it has been unloaded, prices will begin to rise. Already the price of many accessories, particularly those used with digital camcorders, has nearly doubled. Here's an example: a Nicad battery that sold for about £36 is now selling for £68. I know – it was the last call I had on a Friday afternoon. The customer wanted to know why our prices were so expensive. I told him to go to Trading Standards, who would explain it, and that it was nothing to do with the manufacturer.

The abolition of RRPs could well give our trade a boost – it's about time traders made a decent profit.

Now that the government has shot itself in the foot, dealers may even be able to pay technicians something near what they are really worth.

*Austin Fairchild,
London SW16.*

Year 2000 Compliance

In his article on a portable service database (October issue) Michael Maurice mentioned the subject of year 2000 software compliance. To avoid the millennium bug, it's essential that any software purchased now is 2000 compatible. But I've had problems with companies when I have asked for a written guarantee that their software is millennium bug free, with money-back compensation should the software fail to work in the year 2000. I've decided to write my own software program to replace an ageing computer with an 086 processor, writing it in Qbasic which is supplied with Microsoft Windows.

For years video has been designed to be millennium compatible, as the year 2000 is an expected event. How can software and computer companies justify selling software in the late Nineties and say that the year 2000 is an unexpected event, that no one realised the change from 99 to 00 would make a PC crash? I'm sure that VCR owners would be more than annoyed if they were asked to pay £50-£100 to make their machines 2000 compatible. I wonder how many VCR owners will be ripped off by cowboys who will advertise that for £50-£100 they will make their machines millennium bug free?

Does anyone know what will happen with Video Plus? Since its codes do not appear to contain the year, is it bug free?

*Francis Beach,
London NW2.*

Flyash Problem

A new township called Hampton has been built near here. People have now started to move in, with their satellite systems etc.

Unfortunately they are all, with the exception of the odd one or two, troubled by sparklies. Various things have been tried, and the cure seems to be a 90cm or 1m dish. Why?

Spectrum analyser and field-strength meter checks showed that the signal strength is low. It was then that attention was turned to the 60cm dishes that were OK. Why? Well, they were at the back of the house, just above the gutter, pointing up the roof. The other dishes were all on front or side walls.

The puzzle was finally solved: the site is a flyash tip. This consists of pulverised rubbish. Incinerated metal cans etc. are mixed with concrete and allowed to set over the years, layer by layer, to fill in quarry and brick pits. Signals reflected from this metallic layer were cancelling out part of the direct signal from the satellite!

Jim Simpson,

Orton Malborne, Peterborough.

Green Hybrid HV2

In the October Monitors section Adrian Spriddell mentioned the green hybrid HV2 IC in the Samsung Model CQA4147L. This device is used in quite a few of the smaller (14 and 15in.) monitors, in particular from AST, Compaq and Samtron, as well as Samsung. It's a B+ voltage regulator circuit that, in conjunction with a power FET, controls the HT supply to the line output stage in multimode designs. Failure can occur when a short-circuit line output transistor kills the power FET and high voltages appear at the pins of the HV2 device, but this is rare. As the HV2 IC usually survives, replacement of the power FET and line output transistor is usually all that's required. Whether the HV2 IC is healthy can be confirmed by powering the monitor briefly while checking the FET's source-drain voltage. About 30V is normal in the 640 x 480 mode, less in the higher modes.

If the HV2 IC has definitely died it can be obtained in small quantities from Logitron (0181 987 7000), but it's not particularly cheap. Those who repair monitors might be interested to know that many semiconductor devices, coils, chokes and transformers that are used in monitors and are not available from usual sources are available from Logitron. *G. Mumford,*
Grantham, Lincs.

Switching Box Design

A single scart socket was once adequate for TV use with a VCR.

Nowadays however many people have a Nicam stereo VCR, a satellite receiver (maybe an analogue and a digital one!) and a surround sound audio system as well. Add to this the need to be able to connect a camcorder, an internet set-top box, a DTT box and the whole thing becomes a nightmare.

RSD Communications is thinking of producing a nice, intelligent AV matrix switching box, remote-control operated as well as partially automatic, with some goodies such as ZCD to get rid of audio clicks, own volume control, possibly adjustable video level and on-screen display, etc. Some audio effects – simulated surround, spatial, 3D etc. – could be added quite cheaply.

Straight AV switching with pin 8 and 16 status following is technically very simple, but RGB/YC switching makes it slightly more involved.

We would welcome a wish-list or suggestions from readers. You can phone us on 01786 450 575, send a fax to 01786 474 653, write to the address below or e-mail to

AV@rsd-communications.co.uk

John A. Ross, RSD Communications Ltd.,
Unit 9, 5 Munro Road,
Springkerse Industrial Estate,
Stirling FK7 7UU.

ESR and Line Drive

In the October issue Colin Guy mentioned a tripping Sharp DV51083, the cause of the fault being C715 (2,200 μ F, 16V). He reports that its capacitance value had fallen to 50 μ F but its ESR value was OK. I wonder what ESR figure he expected? If the ESR figure is correct, the capacitor is OK. An ESR meter such as the Capacitor Wizard will give a capacitor OK beep if its ESR is less than 0.5 Ω or so, and this would be expected with a 50 μ F capacitor. It must be appreciated however that the 0.5 Ω threshold is only a general guide: with the capacitor in question (2,200 μ F) the ESR should be less than 0.1 Ω .

In the same issue John Edwards mentions an overheating Darlington line driver transistor in the Ferguson TX100 chassis, and concludes that a faulty line output transistor was responsible. Now although corrupted line drive can, and often does, destroy a line output transistor, it doesn't apply the other way round. The high turns-ratio of the driver transformer isolates the transistor from what is happening on the secondary side of the transformer.

There's a parallel with valve audio output stages where, as older readers will know, the valve was quite happy when there was a short-circuit across the loudspeaker. John reports that the driver transistor didn't overheat when the secondary winding was disconnected. Although this would be the case, the peak-to-peak waveform at the collector of the transistor would be less if there was a short-circuit present and it would run without any stress.

I am prompted to bring this up because it gives me an opportunity to pass on a related tip. If a power supply is tripping, or the HT voltage is low, there's a quick way of determining whether the line output transformer is the culprit. Short out the line driver transformer's secondary winding – link the base and emitter of the line output transistor – then connect a bulb from the collector of the output transistor to chassis. If the HT is now correct, you can be pretty sure that the output transformer is the cause of the fault.

To return to John's overheating BC372 Darlington transistor, the type markings on most replacements are on the opposite side of the casing to the originals. I have known engineers to – well, we all get things the wrong way round sometimes . . . *Alan Willcox,*
Llanedeyrn, Cardiff.

Safety

Because of what previous 'repairers' have done, the equipment that comes to me for servicing is often in a very dangerous state. Have they no conscience, or have they never read the various safety standards that are there to protect us?

Formal training doesn't appear to help. I gathered my knowledge since my early teens, when I used to repair valve TV sets and radio receivers. I worked and trained in various workshops, acquired a university degree in electronic engineering, was employed as a designer for many years, and also did a stint in quality assurance. None of this qualifies me formally to carry out repairs. Yet I know people who have served apprenticeships, have the relevant qualifications and years of experience at the repair bench, but have little knowledge of electrical safety.

The biggest menace are the dabblers: those who will substitute a ceramic-body wirewound resistor for a fusible type; a 1AT fuse for a 1AF type, or a glass fuse for a ceramic one; a metal-film resistor for a high-voltage type; a plastic-tab

transistor for a metal one; or fit long screws instead of short ones. They will stand a power transistor up in the air, and don't seem to know what a non-spiral resistor is, or what safe extra low voltage means, or about creepage and clearance distances.

Most worryingly, they don't seem to have heard of BS415, BS3456, BS5850, BS6301 or any of the equivalent European safety standards, and aren't even aware of the Consumer Protection Act or the plugs and sockets etc. regulations.

Here's a little challenge. I'll post a crisp tenner to the first person who sends me, by e-mail, the answer to the following question: to one decimal place, what is the maximum value of PELV?

Martin Pickering, B.Eng.,
satcure@netcentral.co.uk

Comments from a TLO

As the resident TLO at NEI for many years, I've had to deal with all sorts of technical queries. One that crops up quite often is when a set reverts to standby unasked. The problem is this: is the microcontroller chip shutting down the output from the power supply; or is the power supply stopping, with the result that the microcontroller goes to standby waiting for the next start-up command?

The easy way to find out is to use a simple voltage-sensing latch. Fig. 1(a) shows the idea. Operation is simple. Connect one side of the relay coil to chassis and the other, via the contact, to the voltage you are monitoring. Start the TV set up and use the momentary-make push button to latch the relay on (contact closed). It will remain in operation until the supply to it is removed. If the relay remains activated when the set goes to standby, the microcontroller chip is more likely to be the cause of the trouble. If the relay drops out, the supply to it has ceased. Several bells and whistles can be added, such as an LED on a separate contact to tell you if the

relay has tripped out.

The circuit could be made using CMOS logic, see Fig. 1(b). This is a set/reset latch: once you have reset it with the push-button, the trigger voltage will flip the latch to its other state until it's manually reset. A small battery can be used with CMOS: it will give almost infinite life.

I am puzzled by this business of electrolytic capacitor failure. It's by no means uncommon for a caller to tell me that he has replaced all the electrolytics in an offending circuit. My usual response is to ask why? What is it about these poor, maligned components?

Capacitors seem to have had a bad reputation since the days when I was a young apprentice. Then, if a TV set had field collapse and there were Hunts capacitors in the field timebase circuit, they would be unceremoniously chopped out and replaced – with RS ones, even though they were probably supplied to RS by Hunts! My boss had the same phobia.

I'm surprised that the capacitor manufacturers haven't been able to get their act together. The demand for more and more compact equipment, such as camcorders, seems to have caused them problems. I would be interested in any meantime-between-failure figures and information on failure modes. But, speaking for NEI, we have had relatively few problems to date with electrolytic capacitors – though we get them from the same Far Eastern suppliers as most other manufacturers.

Denis Mott,
Huddersfield, W. Yorkshire.

Hot Bird on the Cheap

I'm sure that I'm not alone in preferring Euro News and BBC World to Rupert Murdoch's Sky News. You can get them via Hot Bird, and the Amstrad SRX200 is a handy receiver for the satellite's largely unscrambled Ku-band channels. I've bought working SRX200s for a fiver or so – less if ten or more are bought. The sixteen channels are enough for all but the most polyglot viewer.

There's a snag however. All but Euro News and BBC World have 6.6MHz sound, and the SRX200 doesn't tune to this. The textbook solution would be to change X302 to a 17.3MHz crystal, whereupon the correct carrier comes out on AU6. But have you ever tried to buy a 17.3MHz crystal? It will have to be specially ordered, and will

cost more than you paid for the receiver.

The practical solution is to substitute a tuned circuit for the crystal. The 7400 IC oscillator (IC301) in the SRX200 works quite happily with one, and drift is not much of a problem with an FM demodulator. An ideal, ready-made coil is the one used in the tank circuit of most 6MHz intercarrier demodulators. Two types are found in most scrap sets: those with a tuning capacitor fitted inside the can, and those with the capacitor fitted separately. In both cases remove X302 then bring out two 20mm wires topside of the PCB to solder to the coil leads.

The integrated type coil will usually tune unmodified to one third of 17.3MHz, i.e. 5.766MHz: the amplitude of its third harmonic is sufficient to do the job. With coils that have a separate capacitor, you will find that its value is usually about 1,000pF. Substitute a capacitor of about an eighth of this value and the coil will tune to the fundamental at 17.3MHz. 120pF worked well with the one I tried – there is already 13.5pF across the coil points in circuit.

To set up, tune in say TV5, select AU6 then adjust the coil core until sound related to the picture content is found. You will pass through several carriers, so care is needed. Most coils will work, with some experimentation, though I came across one that wouldn't – it probably had a low Q.

Strangely, there was no need to earth the coil can, nor was there any need to fit a blocking capacitor in the coil lead. No picture interference at 5.766MHz has been experienced.

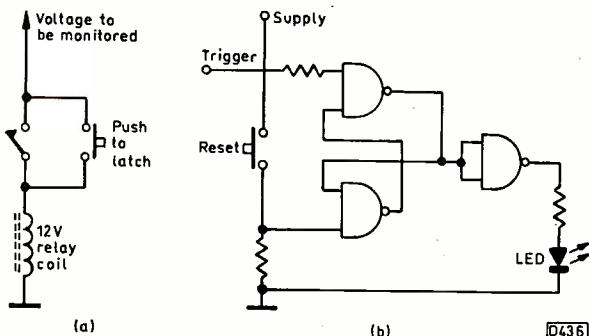
Philip Lane,
Aberaeron, Dyfed.

Spares Offer

I have read in *Television* that TV engineers from this country sometimes go to do servicing in third-world countries, where the TV sets and VCRs are often twenty or more years old. It so happens that I have a quantity of old spares to give away. If any reader is planning to do this sort of work, please write to me at the address below. Many of the models sold in these countries are, I understand, simply different versions of models sold here, so there's a good possibility that a lot of the stuff I have would be usable. All items must be collected.

M. Stephens, 283 Blackburn Road,
Haslingden, Rossendale, Lancs
BB4 5JG.

Fig. 1: Simple voltage-sensing latch (a). Version using CMOS logic (b).



Answer to Test Case 432

- see page 97 -

Technocrat decided that he wouldn't investigate the cause of the second symptom, loss of the playback picture, in any depth: he assumed that there was a control-system fault, and that this was in some strange way also responsible for the initial problem, failure to memorise tuning points. He decided to order and fit a new EEPROM chip, then if necessary a new microcontroller chip. While rooting around in the component stores for a suitable memory chip he bumped into Workshop Sage, who offered to take a look at the troublesome VCR.

Sage consulted the service manual, then got the machine into the test mode. In this condition the model code - software settings and characteristics - should be displayed. With Model VSG240EK the code should read 37563002. Instead, eight seemingly random HEX-code characters were displayed.

Sage entered and stored the correct model code by calling up the memory addresses FC, FD, FE and FF in turn. Once this had been done the machine worked perfectly in every respect - it now knew what it was!

This sort of thing is going to occur more and more often now that the digital era is here. We don't know how the problem arose. After trouble-free operation for a couple of months, it doesn't worry us too much.

NEXT MONTH IN TELEVISION

Servicing the Mitsubishi EE4 chassis

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

Digital TV - the modem

With interactive digital TV we will need to know about modems, which provide the interface with the phone line. K.F. Ibrahim describes their operation and the protocols used.

A visit to LG and the KES

George Cole recently visited LG (formerly GoldStar) at the company's Korean headquarters and at various plants to see recent developments in display technology, including flat-screen TVs, high-definition TV and digital TV. He also had time to take in the Korean Electronics Show (KES), where DVD players, new VCRs and multimedia TV sets were featured.

Monitor specifications

Is EGA, VGA and so on still a bit of a mystery? Monitor standards differ from TV ones. Ray Porter provides some basic enlightenment.

Camcorner

More fault reports and repair tips from David Woodnott.

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Version 6 of the computerised index to TELEVISION magazine covers Volumes 38 to 47 (1988 - 1997). It has thousands of references to TV/VCR fault reports and articles, with synopses. A TV/VCR spares guide, an advertisers list and a directory of trade and professional organisations are included. The software is easy to use and very quick. It runs on any IBM or compatible PC with 640K RAM and a hard disc. Price is £35 (3.5"HD, alternatively 3.5"DD). Those with previous versions can obtain an upgraded version for £15. Please quote the serial number of the original disc.

FAULT REPORT DISCS

Each disc contains the full text for television VCR, monitor, camcorder, satellite TV and CD fault reports published in individual volumes of TELEVISION, giving you easy access to this vital information. Note that the discs cannot be used on their own, only in conjunction with the Index disc: you load the contents of the Fault Report disc on to your computer's hard disc, then access it via the Index disc. Fault Report discs are now available for:

- Volume 38 (November 1987 - October 1988);
- Volume 39 (November 1988 - October 1989);
- Volume 40 (November 1989 - October 1990);
- Volume 41 (November 1990 - October 1991);
- Volume 42 (November 1991 - October 1992);
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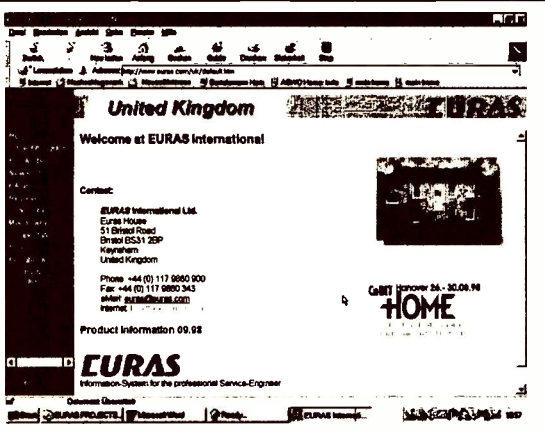
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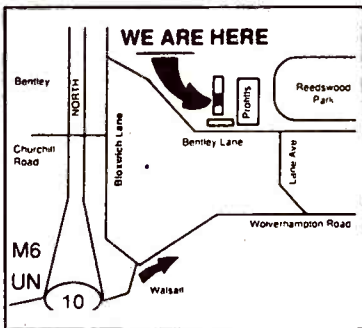
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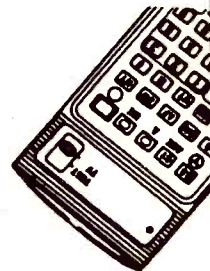
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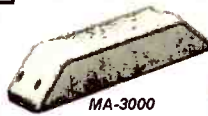
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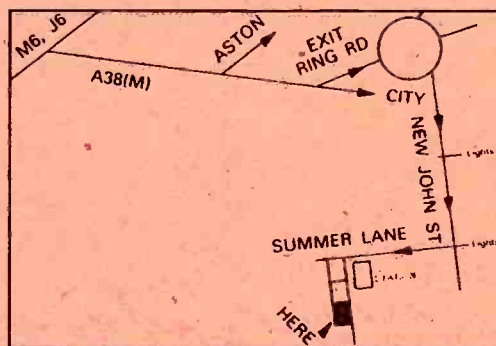
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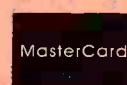
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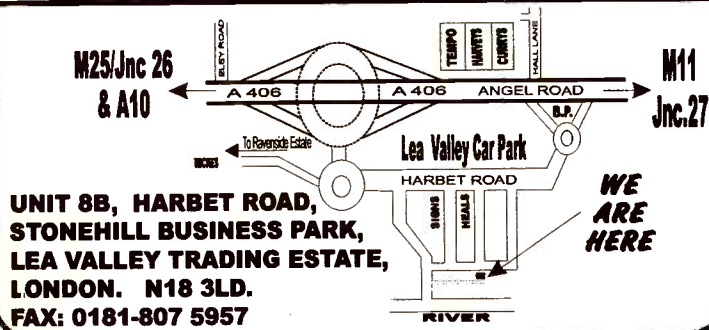
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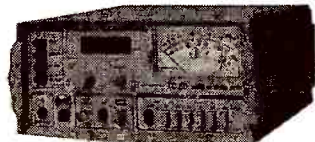
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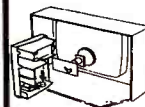
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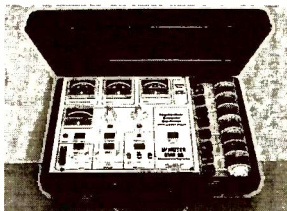
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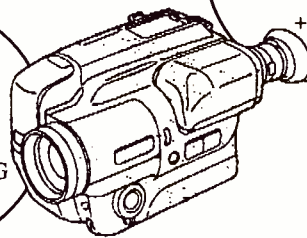
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BURGLAR ALARM SIREN 12 VOLT CAMCORDER-UNIVERSAL BATTERY 9.6V - 1400MA FOR JVC-PANASONIC-PHILIPS CAMCORDER-TRIPOD SHOULDER POD CAPACITORS:-	CAMCORDER LENS 2 OFF - TELE-CONVERSION LENS x1.4 & x0.7 £6.00	HEAD-VCR-VX3000 P/P £5.00ea £16.00	SRD2, SRD3, SRD4 EACH £1.00
1H/2KV, 2N/2KV, 4N/4KV EACH 15p	CARDIOID CAMERA MICROPHONE-VA SUPER 218 TELESCOPIC BOOM & STAND £12.50	HEAD-VSR1500 = ORION D2096 P/P £5.00ea £5.00	7780 TV/SATELLITE WITH FST HITACHI TV/VIDEO - (NO REPLACEMENT) VIDEO RM933E VIDEO PLUS £30.00
5N/6KV, 6N/2KV, 9N/1KV EACH 15p	CHASSIS-TX100 VHF/UHF YELLOW SPOT AND SECAM P/P £5.00ea £20.00	PANEL-MAIN-VSR1500 P/P £5.00ea £5.00	CLE874B £5.00
35V-22UF, 50V/4, 7UF, 50V-100UF EACH 10p	CHROME BOARD-ICCS 1/CS U4647TK FOR HA11498 DECK AND CAPSTAN MOTOR:-	POWER SUPPLY-VSR1500 P/P £5.00ea £5.00	CLE883A = IR8512, CPT2196, CPT2578 TV MODEL C2558 (IR 1820)-CLE883A MATSUI £5.00
CRYSTAL-4MHZ OR 6MHZ EACH 30p	FV61LV, FV62LV, FV67LV, FV68LV EACH £30.00	POWER SUPPLY & REG - TYPE STK5343-VP9501 £8.00	V5R1500 £5.00
CRYSTAL-TV-4.4MHZ OR 8.8MHZ EACH 30p	FV70B, FV71LV, FV72LV, FV74LV EACH £30.00	POWER SUPPLY-SWITCH MODE-150 £3.50	VX3000 £3.00
24 MHZ XTALS DESOLDER PUMP DIGITAL CAPACITANCE METER - CMC200 20PF-20MF £28.00	DECK AND MECHANISM VIDEOSTAR-R2000 P/P £5.00ea £30.00	PHILIPS DECODER-TEXT-K40-K73 £10.00	VX3000 £3.00
DIODES-TV100 MIXED £3.00	DRUM-LOWER-PDM2024A-1 £20.00	IF PANEL FOR CP90-CP110 £5.00	3000/ORION - TV AND VIDEO RC = PACE 900, FERGUSON, SONY, GRUNDIG £5.00
FILTERS - 455 & 480 EACH 20p	DRUM-LOWER-PUS362931-2 £30.00	INFRA-RED RECEIVER - HAND SET TESTER £6.00	MITSUBISHI RM35 - VIDEO £5.00
FOCUS POTS-K40 £2.00	DRUM-UPPER-2043931R £10.00	SOLDER IRON 25W-240V £6.00	RM45 - VIDEO £7.00
FRONT PANELS (PLASTIC) FOR AMSTRAD, PERDIO, FIDELITY, DECCA, TATUNG ALL 1992 MODELS EACH £4.00	DRUM-UPPER-YDM2018B £12.00	TEXAS NICAM BOARDS MK II £6.00	NOKIA RC202 £4.00
FUSES-100 MIXED £3.00	DRUM-UPPER-YDM2037A £12.00	TUNERS IF/TEXT CR-022A TRJ74-007A-ALPS £7.00	ORION TV AND VIDEO VIDEO WITH LCD - 1992/93 MODELS PANASONIC £10.00
GAS SOLDER IRON-PORTASOL, HOBBY HANDSETS-SEE SEPARATE LISTING INFRA RED DETECTOR WIDE/SHORT ANGLE WITH RELAY INFRA RED RECEIVER-MATSUMI MINIATURE LOPTS - SEE SEPARATE LISTING MAGNIFIER - 2X AND 4X MILLI VOLTMETER-ELECTRONIC-LEADER LMV-181A 40V AC 1N-1M VFS INV-300V CALIBRATED - COST £225.00 COLOUR TV BATTERY CONVERTER IN 24VDC TO 240VAC OUT MODULATOR-TUNABLE SATELLITE-TV MODULATOR KIT, 5V TO 12V - FOR ALL CAMERAS MOTORS - SEE SEPARATE LISTING PANEL-CM201 PANEL-IC2-FM2211 STEREO PANEL-CVC80-POWER POSITOR 18 2 PIN POSITOR-2322 662 98009 POSITOR-2322 662 98012 POSITOR-3 PIN P65 TH1451 BLACK TYPE POWER SUPPLY - 12V DC & 24V DC-REGULATED POWER SUPPLY-REGULATED 3-12V 500MA PSU AC 12V 500MA PSU AC 9V 1A QUARTZ HALOGEN - 500W 200V FOR OUTDOOR LAMPS R.S. SAFE BLOC RELAYS-SUB MINIATURE SATELLITE TUNER UNIT - 2427611 - BASE BAND/VIDEO OUT SCART TO 4 PHONO LEADS 1.5M SCART TO 4 PHONO LEADS SCART TO "D" PLUG SCART TO SCART LEADS - ALL PINS CONNECTED - 1.5 METRES SOUND 5.5MHZ MPM 1000 SOUND 6.0MHZ MPM 1000 TRANSFORMER-50W CAPSULATED MAINS 0 120V-0 120V PRI 0 9V-0 9V SEC TRIPLER BG 2032-642-3002 TRIPLER BG 2087-642-1005 TRIPLER KT3/K30 TRIPLER - UNIVERSAL TUNERS - SEE SEPARATE LISTING TUNING POTS - 8 WAY	HEAD AND DRUM-FV31R £12.00	IF/TEXT CR-022A TRJ74-007A-ALPS £7.00	EURS1142 £10.00
AMSTRAD DISPLAY PANEL - LONG CHASSIS - 1992/93 FRONT PANEL FOR ALL 1992 MODELS HEAD AND DRUM - 6000 HEAD AND DRUM - NICAM PANEL - CLOCK DISPLAY - 8.900 POWER SUPPLY WITH FLAP - 8.900 POWER SUPPLY - LONG OR SHORT CHASSIS 1991/1992 MODELS POWER SUPPLY - SWITCH MODE - DOUBLE DECKER 20 OFF MIXED NOKIA I.T.T. SALORA FINLEX SERVICE MANUAL MAINS ADAPTOR 12V AT 500 M/A NEGATIVE CENTRE	HEAD AND DRUM-FV21A £15.00	SATELLITE SXT2302180968 £3.00	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT
25DI1432 £1.00	MODULATOR-SRBI £2.50	SATELLITE WITH BASE BAND MIN SXT2302234 £4.00	EURS1142 £10.00
25DI1453 £1.00	MODULATOR-SATELLITE-T1040-SRD3/4 PANEL-TX89 £10.00	SMALL UHF/VHF VHF/UHF - TEKEA-112A 4944	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT
25DI1576 £1.00	PANEL-10 MIXED FROM TX9 TO ICC5 PANEL-DECODER-ICCS £5.00	U321, U341, U342, U343 EACH £5.00	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT
25DI1777 £2.00	PANEL-FRONT-TX98 £5.00	U344, U411, U412, U944 EACH £5.00	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT
25DI18073 £1.50	T1353E W/INFRA-RED RECEIVER PANEL-FRONT-TX100 £4.00	U743, U744 EACH £3.00	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT
25DI1878 £1.00	PANEL-REMOTE AND POWER SUPPLY FV31R DISPLAY P/P £2.00ea £5.00	AMSTRAD U3E3-101 £3.00	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT
25DI1907 £1.00	PANEL-REMOTE-TX9, TX10 EACH £5.00	FERGUSON IF2105-RE £5.00	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT
25DI1927 £1.00	PANEL-REMOTE-TX10-540/01 £5.00	IF2105-RE £5.00	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT
25DI1930 £1.00	PANEL-REMOTE-TX10, WITH BATTERY AND 4 ICS - 1544-033C £7.00	UHF - ICC5 £5.00	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT
25DI1941 £1.00	PANEL-REMOTE-TX90 - 139.001 ICS M2931B AND MS1000 £10.00	VHR - ICC5 £5.00	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT
25DI1942 £1.00	PANEL-REMOTE-TX100 1/CS M2931B-SAA5012 £10.00	TX85, TX86, TX89, TX90 EACH £4.00	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT
25DI1943 £1.00	PANEL-REMOTE-TX100 WITH STAND-BY BATTERY AND ICS £10.00	TX98, TX99, TX100 EACH £4.00	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT
25DI1944 £1.00	PANEL-T1228B TEXT FOR TX89, TX98, TX99, TX100 £15.00	ORION I500 - UE33 B09 AT2076/78, AT2076/88, AT2078/25 AT2077/81 £4.00	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT
25DI1945 £1.00	PANEL-TUBE BASE-ICCS £5.00	PANASONIC DSTR82B25/47328700 & /40153200 DSTR82B24/400086AD, & /47805200L DSTR186N243473058-01 TFB3035D, TFB3069D, TFB4023AD TFB4039AD, TFB4066AD	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT
25DI1946 £1.00	PANEL-TUBE-TUNING IS09G-TX9-TX10 £5.00	SHARP TUNER AND IF 1810587 PAI UK TATUNG UNIVERSAL 20S OR EQUIVALENT WITH AERIAL SOCKET	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT
25DI1947 £1.00	POWER SUPPLY 12V-3A FOR VIDEOSTAR CAMERA PP3 PUSH BUTTON UNIT-TX85, TX86 - 8 BUTTONS RECEIVER - INFRA-RED - IC5L486-TX100 TRANSFORMERS-SWITCH MODE:- TX85, TX86, TX89 EACH £4.00	HITACHI HITACHI - ACE G4-B to ACE G40-B MICROWAVE TURNTABLE MOTOR MATSUI CAPSTAN I/C NO. M56730 ASP 2 TYPES 1995 TO 1997 MODELS MATSUI VIDEO DECKS WITH CAPSTAN MOTOR AND HEAD	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT
25DI1948 £1.00	TX100 473190-00, 40153000 EACH £5.00	MATSUI MOD MR7-UP32 MOD TMUG3-103A MITSUBISHI CAPSTAN-HSE41-I/C MS1782ASP	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT
25DI1949 £1.00	ICCS 3112-338-326842 £4.00	HANDSETS CPT1408T, CPT2176, CPT2178 EACH £5.00	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT
25DI1950 £1.00	HITACHI DECODER-TELETXT PC232A5 - ISSUE 4 HEAD AND DRUM - 620E MAINS SWITCH WITH STAND-BY MODULATOR No 5587881 OSCILLOSCOPE 20MHZ DOUBLE BEAM - V212	CPT2476, CPT2478 EACH £5.00	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT
25DI1951 £1.00	PANEL-TELETXT GRP - ISSUE 6 £10.00	REPLACES PHILIPS KT3, K30, K4 ETC. UNIVERSAL, REMOTE TV1, TV2, VCR - SAT, AUX, LCD, VIDEO, TV - ALL NEW 10 MIXED FOR ONLY £15.00	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT
25DI1952 £1.00	PANEL-TELETXT PC315-II - ISSUE 7 £15.00	MOTORS HITACHI HITACHI - ACE G4-B to ACE G40-B MICROWAVE TURNTABLE MOTOR MATSUI CAPSTAN I/C NO. M56730 ASP 2 TYPES 1995 TO 1997 MODELS MATSUI VIDEO DECKS WITH CAPSTAN MOTOR AND HEAD	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT
25DI1953 £1.00	PANEL-TEXT-VT753E £20.00	MITSUBISHI CAPSTAN-HSE41-I/C MS1782ASP	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT
25DI1954 £1.00	POWER SUPPLY TV SWITCH MODE STR 4211 ISSUE 10 £8.00	HANDSETS CPT1408T, CPT2176, CPT2178 EACH £5.00	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT
25DI1955 £1.00	POWER SUPPLY VIDEO SWITCH MODE VTM312ELM £10.00	THICK FILM-HM9204A £3.50	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT
25DI1956 £1.00	HOSEN TUBE BASE - Mixed 10 for AA Batteries made by STC Group of Companies 10p each £1.00	VIDEO DECKS AIWA 1500 MATSUI VXA 1100 MATSUI 1500 ORION D1096 ORION D2096 ETC CAPSTAN MOTOR FOR ABOVE DECKS AND HAND SETS 4 HEAD DECK FOR 1500 POSTER EQV 98009 ETC 20 HIGH VOLTAGE CAPS 1500V - 2000V MIXED 100 TRANSISTOR MIXED VIDEO PATTERN GENERATOR MODEL T9535 240V MAINS SMALL - SEND FOR DATA PAL TV ADAPTOR - RGB IN UHF OUT MOTOR 12V	TC1632, TC1642, TC2232, TC2204, TX2200, TX2234, TX2244, TX2300, TX2636, TX3300 RC201 - TV - REPLACES TNQ141/2 PERDIO PV 1188 PHILIPS NEW TYPE UNIVERSAL SAMSUNG HANDSETS, TV & VIDEO - 12 TYPES EACH SANYO UNIVERSAL VIDEO SIEMENS TV/VIDEO - 1994 MODEL THORN 9000, 9600, TX9, TX10, TX100 TEXT AND NON-TEXT

7805 20p	25DI1432 £1.00	BU205 75p	BUT13 £1.00	BYW95C 10p	ID6140815 £1.00
7806 20p	25DI1453 £1.00	BU206 £1.00	BUT18AF £1.00	BYW562A 15p	ID63288B £1.00
7809 20p	25DI1576 £1.00	BU207 £1.00	BUT17R00 15p	100V 8p	IEF4029BP 20p
7812 20p	25DI1777 £2.00	BU208 80p	BUW11 40p	BYX10 10p	IEF4093 20p
25C340 20p	25DI18073 £1.50	BU208A £1.50	BUW84 60p	BYX300 25p	IGA1124A 50p
25C3795 £1.00	25DI1878 £1.00	BU222 £1.00	BUX39 40p	BYX5350 10p	IMP264 50p
25C3973B £1.00	25DI1907 £1.00	BU326 £1.00	BUX84F 50p	BYX55600 20p	ALP-15 £3.50
25C4313 £2.00	25DI1927 £1.00	BU407 40p	BUX84F 50p	BYX7160 20p	IK75T 50p
25C4589 £5.00	25DI1930 £1.00	BU407 40p	BUY49 20p	BYZ106 30p	6391 B1 £3.00
10A/1500V £2.00	25DI1941 £1.00	BU508A £5.00	BUY19 30p	BZW-C110 50p	IN5401 3p
25C7350 15p	25DI1942 £1.00	BU508AF £5.00	BY208-800 8p	BZWR3-C20 3p	IR106A 10p
25D200 £1.00	25DI1943 £1.00	BU508D 80p	BY228 15p	CA3123B 20p	L289N £4.00
25D401 £1.00	25DI1944 £1.00	BU508DF £1.00	BY229 6p	CD4558E 50p	LA7830 10p
25D716 £1.00	25DI1945 £1.00	BU705 20p	BY255 5p	CEK71A £5.00	LA7831 10p
25D787 30p	25DI1946 £1.00	BU801 50p	BY299-200 15p	FE3B 4p	M708A B1 £1.50
25D789 30p	25DI1947 £1.00	BU806A 50p	BY299-800 30p	HA1140 £1.00	M708 L B1 £1.50
25D820 £1.00	25DI1948 £1.00	BU807 50p	BY771-800 15p	HA1185 £1.00	M37204B CSP £1.00
25D868 75p	25DI1949 £1.00	BU824 50p	BY19-30 15p	HA1338SP1 £2.00	MS868P £1.00
25D880 30p	25DI1950 £1.00	BU826 50p	BY228-200 15p	HA1148SANT £1.50	MN650 £1.00
25DI1264 50p	25DI1951 £1.00	BUK444800 £2.00	BYV95C 12p	HA11804 INT £1.50	SI3522V £1.00
25DI1265 £1.00	25DI1952 £1.00	BUK454600 £1.00	BY96D 10p	HA51338SP1 £2.00	SAA1061 £3.00
25DI1398 £1.00	25DI1953 £1.00	BUK454600 £1.00	BYW20-08-9 10p	HC4520 50p	SAA3018 £1.00
25DI1415 £1.00	25DI1954 £1.00	BUT11 50p			

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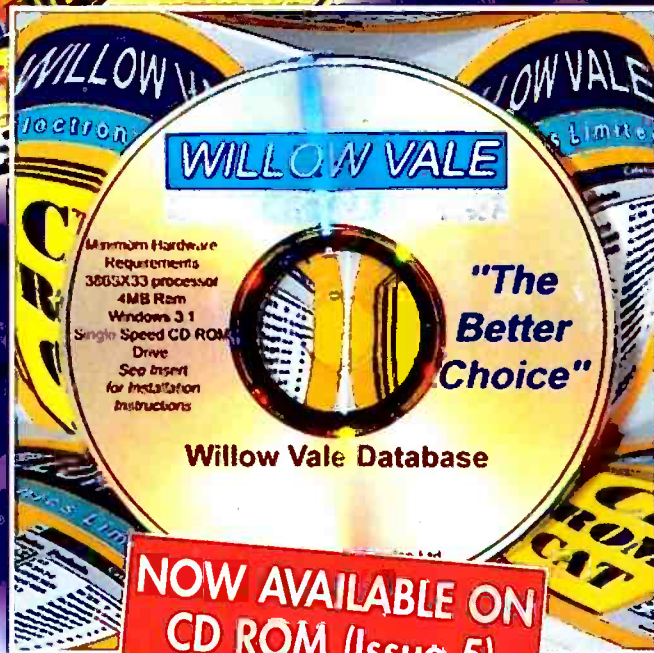
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Source - Marvyn Hamlyn survey 'Independent Retail & Service Engineers' June 1997



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