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# TELEVISION

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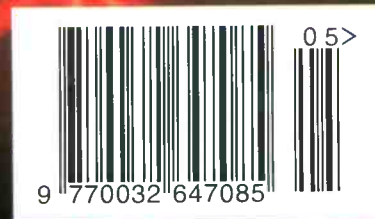
A REED BUSINESS PUBLICATION

**Project:**  
**Mains-operated RC handset tester**

**Installing digital TV**

**Test report:**  
**Digisat meter**

**PC boot-up,  
configuring and  
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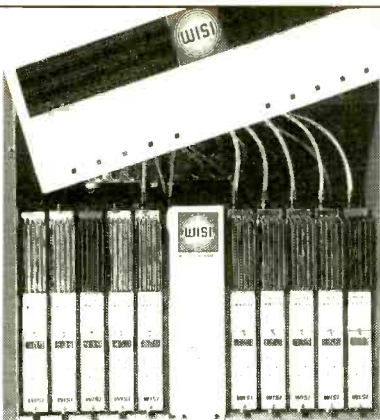
May issue on sale  
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Next issue,  
dated June, on sale  
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\*Because of space problems with this issue, several letters we had intended to publish have had to be held over until next month.

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# TV Machinations

The world of TV was once so simple. It was run, in Western Europe at any rate, by national broadcasters such as the BBC, ORF, ORTF, RTE, RTP, TVE and so on. Then along came the commercial channels, which were operated under fairly close supervision. That more or less filled the channels available. In some countries, particularly the Netherlands and West Germany, cable played a greater role from an early stage, providing increased scope for independent broadcasters and a wider variety of channels.

Pay-TV, as a terrestrial off-air service, started in Europe on November 4th 1984, when Canal Plus began broadcasting in France. It was officially the fourth channel, and soon caught on – its competitors had not been all that successful in their appeal to the viewing public. Subsequently satellite broadcasting became feasible, and in the UK Rupert Murdoch appeared on the scene as a broadcaster. Other entrepreneurs had by that time become active, in particular Leo Kirch in West Germany and Silvio Berlusconi in Italy. During the last decade European TV broadcasting has become a steadily more complex business. Now that digital broadcasting is here, the scope for multimedia firms and others, even Bill Gates it seems, to become involved in TV has greatly increased. It has become a totally different world from that of a few staid national broadcasters. But it is not a world of numerous small broadcasters doing their own thing in local conditions. The 'newcomers' have engaged in takeovers, alliances and joint ventures, with the aim of becoming transnational. In the world of TV broadcasting, it helps to be big.

So far, the European pay-TV moguls have been more successful in dominating their own markets than in becoming truly transnational. Rupert Murdoch dominates pay-TV in the UK, but has to date made no headway on the continent. The French market is dominated by Canal Plus – which got into digital TV well ahead of BSkyB, in April 1996. Kirch Group dominates the German market.

Kirch and Canal Plus both have significant interests in Italy, but Canal Plus has been more successful in extending its European broadcasting interests. It has operations in Spain and, following its acquisition of NetHold (owner of the FilmNet channel) in early 1997, is active in the Scandinavian and Benelux markets. Canal Plus now claims to have some twelve million subscribers.

The overall stakes are enormous. It has been estimated that there were 55m pay-TV subscribers in Europe at the end of 1998, and that the figure will rise to some 97m by the year 2006. Interactive TV operations will extend the revenue streams well beyond payment to view TV programming. One advantage that Murdoch has is his interests in other parts of the globe. He is already global, which tends to make Kirch and Canal Plus look relatively parochial – for the present.

Within Europe, the deals and alliances can be truly Byzantine. Kirch Group and Mediasat, the TV arm of Silvio Berlusconi's Fininvest holding company, recently established a joint venture that will have interests in four countries. Fininvest and Prince Al Waleed of Saudi Arabia are to invest some \$210 each in Kirch Media, the free-to-air

arm of Kirch Group. The latter is separately forming a joint-venture company with Mediasat to hold assets that include Betafilm, Kirch's international film distribution company, and Publieurope, Mediasat's international advertising sales arm. A company called European Television Network is also involved: it will include 29 per cent each of the German channel Sat 1 and the Spanish TV company Telecinco. As part of the agreement, Mediasat is to pay Kirch Media about \$210 to compensate "for lack of balance in the venture's current assets". Is that quite clear?!

At one stage Murdoch was involved in these negotiations, but withdrew in the belief that News Corporation would be able to exercise little control, also because asset valuation was difficult to establish. He withdrew from a subsequent attempt to merge BSkyB with Canal Plus, again on the grounds of who would exercise control. Meanwhile Kirch Group is to increase its stake in the German pay-TV channel Premiere by buying most of a stake held by CLT-Ufa, the TV arm of the German media company Betelsmann. This will give Kirch effective control of pay-TV in Germany.

One wonders what benefits viewers might expect from all this wheeling and dealing. But that's not what it is all about! One thing is certain: the viewer will be expected to pay. It's a far cry from the ideals of those like Lord Reith. What in fact happened to ideals in the world of broadcasting? Maybe we shouldn't worry too much about all this in the UK: public service broadcasting is fortunately still well established here, and the ITV companies are holding their own.

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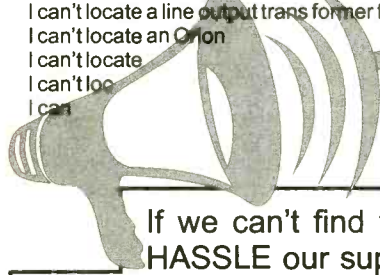
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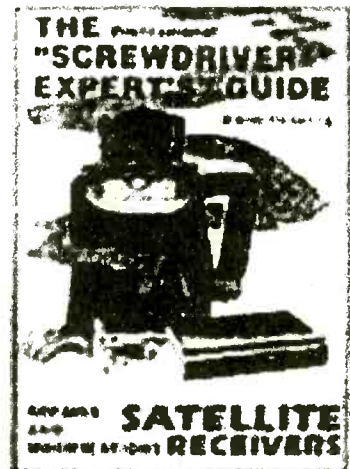


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## SATELLITE FAULT FINDING GUIDE

NEW EDITION No. 5

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



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

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# What a Life!

**A microwave oven, TVs, people and various other problems.  
Donald Bullock's servicing commentary**

**W**hen we arrived at the shop yesterday morning we found old Dr Podwatch at the door.

"Mornin' boys" he started off, "the kitchen tap needs a new washer, and my door creaks when I open it. I'll be at home all day."

"Er, right" said Steven. Podwatch wandered off and we went into the shop.

"Must be ninety" said Steven. "He's been off his head for ages."

The answering machine clicked, having just taken a call. Steven played it back.

"Mr Troutfirst here" it said, "I live in Porchester, just five or six miles away. Bought this new video from Snoddys, but I can't tune it in. Mr Snoddy said you boys are good at it. Could you call today?"

Then nice old Mr Harper drew up. Mrs Harper grinned at us from the passenger seat.

"Hello dears" she sang through the shop door. "Remember that secondhand telly you let us have on the weekly? Sorry we've not paid anything off, like we promised. Only the cat's been poorly and I've been under the doctor. And didn't fags go up? Anyways, we've decided not to go on having it, dear. Our Cyril bought us a new one from Crubbs Foodstore. Comes with a free holiday in Iceland. So would you fetch yours back tomorrow night? Not too early, mind. Give Crubbs time to install the new 'un!"

As they chugged off Mr Cranbourne called.

"Righto then" he started, "now this microwave of mine. It's gone dead. How can I cook with a dead microwave?"

He beckoned Paul to follow him and walked to his car. Paul returned with a Matsui microwave.

## **Microwave Problem**

When we tried the microwave it was indeed dead. The mains fuse had blown violently. Paul tackled it with his meter. Ten minutes later he was still confused. No shorts were evident. He tried a new fuse and the machine came to life. What was up?

"Try the grill" said Steven. It didn't work. A check on the element's continuity showed that it was open-circuit. Paul removed it and found that it had blown open at the corner.

We were quoted £22.60 plus VAT for a new one. So we phoned Mr Cranbourne to give him our estimate. He made a noise like a romantic pigeon.

"Coo, coo, *coo*, coo, coo" he said, "what a lot of money. Still, I just have to have it done."

## **Guitar**

Our next caller had long greasy hair and was dressed in tight-fitting, brass-studded black plastic. He had a huge guitar in one hand and a mess of cable and plugs in the other.

"I expect you've heard of me" he announced. "I'm Rock Romanis." He sounded vaguely Texan. I looked at him attentively.

"Here's the trouble" he said. He took some time to fit his plugs and sockets together, then started to twang at the guitar. "Hupp, hupp, hoo, hupp . . . hoola, hoola, hupp, hupp . . ."

I waved him out as Greeneyes came back from shopping.

"Ooh! Isn't he nice!" she breathed, "just like Elvis. I could go for him."

Steven and Paul came in while she was speaking. "Did you see

heart-throb?" I asked.

"That's Nigel Mogg" Paul said. "Lives behind the gasworks. Unemployed nut. Thinks he's a pop star."

## **I left it . . .**

A tough strode in and stood with his chest out and his feet apart.

"I left my video here ten days ago" he started off, "nuthin' much wrong with 'im. You was supposed to ring me to say it was ready, but you forgot. We got visitors tonight and I wants 'im."

"Your name?" asked Steven. "Mr Botulos" he said, "only I don't like being mucked about, see?"

His VCR was ready. Steven looked at the ticket. "We've telephoned the number several times" he said. "When it was answered they said it was the grammar school. They hadn't heard of you."

"It 'ent me personal like, it's me daughter, Mrs Horn. She cleans there twice a week."

Steven consulted the job card. "Heads and tape transport needed cleaning. Lubricating to. Fifteen pounds" he said.

"What?" echoed Botulos, "do I look as if I'm made of money? You was supposed to ring me first." He threw some notes on the counter, gathered up the VCR and strode out.

## **A Ferguson TX90**

Steven pulled up a Ferguson set and put it on the bench. The card said "dead".

"I wonder why they call it the 'new' TX90" he said. "Causes a lot of confusion."

He soon found that RL24 (2.2kΩ), which is in series with the



line scan coils, had gone open-circuit. "Wonder if it could become a stock fault like R47 in the old 1500 monochrome chassis" he commented. "I suppose that underrated resistor in the sync separator circuit made us more money during the long life of the chassis than all the other stock faults put together."

### Monster Panasonic

The next set for his attention was a monster Panasonic, Model TX2472 (Alpha 1W chassis). The complaint was no sound and just a blank, milky raster. He suspected the TDA4505M IF/timebase generator chip IC101 and, to get the job done quickly, phoned an oppo of ours, Herbert. He'd got one, but said that before going to the trouble of calling to collect it we could, if we had a TDA4505E, use this to prove whether the chip was the cause of the trouble.

"If it restores the picture and sound but refuses to tune in the programmes properly, your diagnosis is confirmed" he explained.

We had one, fitted it, and proved the point. So we fetched the TDA4505M - which is now the N3 version, superseding the original N1.

### A Bush Portable

Mr Bramstead is one of those indecisive fussers. He brought in a Bush colour portable, Model 1433. It looked new.

"Now this set" he started off "is shall we say quite new. But not withstanding that fact it has become shall we say defective, Mr Bullock."

"With you. What's actually wrong with it?" I smiled.

"Well it's, er, shall we say in need of repair." Then he smiled and departed.

When he'd gone I put the set on the bench and switched it on. As it came out of standby it died. A quick check showed that there was no HT output from the power supply. So I switched it off.

"Ah" said Paul, "dies when you switch it from standby? I had one which did that just the other day. Try pulling out the scan-coil plug - PL602 I think."

I did, then switched the set on. It came out of standby.

"It'll probably be the line output transformer then" Paul continued. "I got one from SEME - here's their part number, 4031001906."

He was right, as usual.

### Transistor Mix-up

Ernie Cooter tottered in smoking a

roll-up. He had a canister of fly killer in one hand and a big gas cooker lighter in the other.

"Why the fly killer?" I asked, "there aren't any around yet, are there?"

As I spoke a wasp showed up. Ernie sprayed it. It went. Then he noticed that his roll-up had gone out and lit it with the lighter's six-inch flame.

"Help me out with our neighbour's Hitachi, Don" he said. "Silly ass went to Snoddys. They kept it a month, charged her eighty quid and its lasted half an hour. They won't come back. Oh, and by the way I've had to park up the road."

I put the answering machine on and followed him out to his car. The set was an old Hitachi Model CPT2278, big and heavy. We struggled back with it and I saw that we'd had a call.

I played it back. It was Mr Troutfirst again. "I left a call on your machine this morning, but forgot to ask whether you make a call-out charge. If you do, cancel the call."

I cancelled the call.

"Har, har, har" broke out Ernie, "you certainly gets 'em, don't you? Phone me, Don." And out he went.

The Hitachi set was dead.

Snoddys had fitted a new line output transformer and a BU706 line output transistor. When I checked the transistor I found that it was short-circuit collector-to-base. I fitted another one and the EHT came up. So I connected a signal and tried to adjust the first anode control. As I upped it a picture appeared, but it was wishy-washy, with flyback lines on it. When I turned the control down the screen suddenly blacked out.

Thinking that the faulty transformer might have sent a spike or two about, I replaced the TDA3561A colour decoder chip which, in conjunction with the HA11423 timebase generator chip IC701, is involved with the blanking. It made no difference. I then replaced IC701. Again no difference.

Then I thought about the transistor Snoddys had fitted. I'd used the same device. But the circuit shows the line output transistor as type 2SD1453. I checked with our equivalents book to see if they were comparables. Apparently they were. Perhaps I'd fitted a faulty BU706. It tested all right, but I fitted another one. The fault was still present, and I was puzzled. I looked up the BU706 again, this time in another



"I expect you've heard of me"

reference system. It confirmed that the two were comparables.

I took out another BU706 and a 2SD1453 and used a meter to compare them. The 2SD1453 incorporates an efficiency diode, the BU706 doesn't. So the two aren't comparables. Since the BU706 has no diode, I figured that incorrect flyback pulses were reaching IC701 and upsetting the blanking system.

I removed the BU706 and fitted a 2SD1453, then tried setting up the first anode voltage again. This time everything worked perfectly. After adjusting the set I reassembled it and phoned Ernie.

When he called in he said he'd had to park a bit farther away this time. We went outside. I could just make his car out in the distance. After popping the answerphone on I got Ernie to help me back to the car with his Hitachi CTV.

I then noticed that the answering machine had taken another call. I played it back. It was Mr Troutfirst, who was clearly not amused. "Don't think much of your service" he declared, "you were recommended to me and I've waited and waited and you haven't called. Don't bother. I'll call someone else".

Attaboy I thought. Try Snoddys again.

# TELETOPICS

## The Electrical Retailing Show

Many new and interesting products and developments were presented at the *Electrical Retailing Show 99*, which was held at the National Exhibition Centre, Birmingham during March 28-30th. Digital TV equipment was to be seen on a number of stands. Nokia displayed the Mediamaster 9850T, which is designed for reception of ONdigital's DTT service. The Mediamaster 9800S can be used to receive a wide range of European digital satellite TV and radio services: it incorporates DiSEqC switching, has SatScan motorised dish compatibility and provides a digital audio output.

BSkyB demonstrated its SkyActive sports service, which should be available later this year. It enables viewers to select different camera angles and call up extra information on-screen. The Open interactive TV service operated by British Interactive Broadcasting was also being demonstrated. It's due to start this spring. An e-mail service is to be added around autumn time, using a wireless keyboard

manufactured by Philips. BSkyB has signed a 10-year contract with SES for nine additional transponders, six aboard Astra 2A and three aboard 2B which is due for launch later this year. Its four analogue transponder leases with Astra 1A have been extended to the end of 2002 at least, with an option for a further period.

LG's Model DI28Z12, with a built-in Pace SkyDigital decoder, is the first integrated digital satellite TV receiver to appear. It can provide interactive services such as home shopping. Pace announced that it will be manufacturing Sharp-branded Sky digiboxes, and demonstrated a prototype digital set-top box that could be used by cable companies to provide internet telephony and video services.

A number of IDTVs were featured on the ONdigital stand – the brands included Toshiba, Sanyo, LG, Bush and Philips. DTT receivers from Sony and Hitachi were also displayed.

Toshiba showed ONdigital and SkyDigital set-top boxes and the 32in. Model 32WT98B, which can receive free-to-air DTT broadcasts and ONdigital's programming. It has a Dolby Pro-Logic decoder and three scart sockets. Sharp showed a prototype SkyDigital/DTT free-to-air receiver which should be available later this year. Sony's KV28DS60 and KV32DS60 IDTVs feature Wega flat-screen tubes, 100Hz scanning, a Dolby Pro-Logic decoder, digital picture effects, digital teletext and a common interface slot. The Philips Model 28DW6734 IDTV has a built-in ONdigital conditional access module: a 32in. version, Model 32DW6834, is to be released later this year, also a SkyDigital IDTV.

Hitachi has developed a 24in. IDTV for DTT and, with its 32in. widescreen Model C32W35TN, introduced progressive scanning. This model has a Dolby Pro-Logic decoder and NTSC playback.

Two receivers on the Philips stand provide Dolby Digital and MPEG multi-channel sound from DVD discs. Toshiba also showed a couple of Dolby Digital receivers, one a 61in. rear-projection set (Model 61PJ98B) and the other a 32in. widescreen model (32WD98B). Samsung has introduced a range of widescreen sets that include Model WS32W6HA, which has 100Hz scanning and Virtual Dolby Surround sound.

Many DVD players were on show, including the Hitachi DVP250E which has a disc navigation system. When a DVD is inserted, a guide that shows the contents can be displayed on-screen. A number of discs offer this facility, but Hitachi points out that different players and discs use different ways of displaying the information. The DVP250E also has a zoom facility that offers either two- or four-times magnification.

The Toshiba SD9000 also has variable zoom, with from 1.5-3.5 magnification. It is compatible with the MPEG-2, Dolby Digital and DTS formats. Model SD109 has a twin tray and provides Dolby Digital and MPEG-2 decoding. Samsung's range included a player at under £300. Sharp's DV600H is a mini-sized player that includes a Digital Super Picture circuit: this is claimed to sharpen the outlines of people and objects in the picture. Philips plans to launch Model DVD710, which can handle multi-channel PCM, MPEG-2, Dolby Digital and DTS audio and offers Dolby Pro-Logic and 3D sound. The Sony DVPS70 also provides three multi-channel audio outputs.

One of the most interesting VCR developments was seen on the Hitachi stand: Model VTFX880 incorporates Commercial Advance, which bypasses recorded advertisements. The system works in conjunction with Hitachi's Tape Navigation system. It detects black frames and other parameters that indicate the start and end of an advertisement. When an advertisement is detected the machine

**The Sharp internet viewcam Model VN-EZ1.**



**The Sony DCR-TRV110 Digital-8 camcorder.**





displays a blue screen while moving fast-forwards to the end of the break. The system is similar to one launched by Arista Technology in the USA some years ago, Named Commercial Break – this was used by some Thomson VCRs. The technology is different however.

A Tape Manager system is to be used in several new Philips VCRs that are due for release later this year. It uses PDC to store title and recording information, which can be displayed on-screen, and a Content Scan system for recorded tapes. Philips plans to launch a D-VHS recorder, Model DVR1000, later

this year. The Samsung Model SV627B has a door lock that's released only when a bona fide VHS tape is inserted: the idea is to prevent children shoving objects into the tape slot. Sharp's Model VCME80HM includes VideoPlus Deluxe for satellite and cable control.

Not unexpectedly, Sony was showing off its new Digital-8 models, including the DCR-TR7000, DCR-TRV110 and DCR-TRV510. They record digital video and audio on Hi-8 tape.

Sharp's Model VN-EZ1 is an internet webcam that uses MPEG-4



The Sony Model KV28DS60 IDTV.

data compression to store up to an hour of moving video on a 32Mbyte SmartMedia card. Images can be fed to a PC and sent via e-mail or stored on a web site.

## Digital TV Update

Research commissioned by the ITC and carried out by Castle Transmission International suggests that a considerable extension of DTT coverage should be possible. The current six multiplexes, transmitted from 81 sites, provide coverage that varies from 90 per cent for the BBC multiplex to 73 per cent for multiplex D, one of ONdigital's three. Relay transmitters could extend these coverages to 93 per cent and 85 per cent respectively.

NTL has launched the first (in the UK) interactive service available through a TV-internet set-top box. Information providers include Tesco, ITN, Flextech, Thomson Directories and BBC Worldwide's on-line division beeb.com. The service will also be available via digital cable and DTT later this year.

SDN (which operates DTT multiplex A) and ONdigital have announced plans to launch a joint pay-per-view (PPV) service later this year. Viewers will be able to select movies, sports and other programmes. The service will use five channels in multiplex A. Customer management and conditional access technology are being supplied by ONdigital.

## Trade News

Wizard Distributors' 1999 catalogue is now available, free of charge on request, to trade customers. An impressive range of components, tools and accessories is included, and Wizard is the main European distributor for Tatung non-account customers. Catalogues can be requested by post, phone, fax or e-mail. Wizard Distributors, Empress Mill, Empress Street, Manchester M16 9EN. Phone 0161 872 5438, fax 0161 873 7365, e-mail sales@wizard-distributors.co.uk

SEME has been appointed exclusive distributor of genuine Mitsubishi audio and video equipment spare parts, which are being supplied at current Mitsubishi trade prices. An interesting LOPT tester has been added to the range of servicing equipment stocked by SEME. This one, made by HR Diemen s.a., is specifically designed to test 32kHz diode-split monitor LOPTs. SEME can be reached on 01664 484 001 (general enquiries) or 01664 484 000 (sales hotline).

A substantial catalogue with over 600 pages has just been published by A.R.D. Electronics plc., Shorten Brook Way, Altham Business Park, Altham, Accrington, Lancs BB5 5YL (phone 01282 683 000, fax 01282 683 010, e-mail sales@ard-plc.co.uk). A vast range of components is included.



## DTT Meter

Swires Research has launched the IMdigital-T, a hand-held meter designed for carrying out digital terrestrial TV installations. It has a built-in channel plan for the UHF channels 21-68. The average signal level across an 8MHz channel is first read in dB $\mu$ V then, by pushing the test button, the noise floor is scanned so that the meter can provide a signal-to-noise ratio reading. After extensive testing, Swires Research established that the signal-to-noise ratio is the key factor in assessing the quality of a digital signal. The

results of the level and SNR tests are presented as dB $\mu$ V and dB readings then as a simple pass, marginal or fail readout. It takes under twelve seconds to carry out the test. Inputs in the range 15-70dB $\mu$ V can be handled.

There are two models. The IMdigital-T Slave has channels 21-68 preloaded. To help with site testing, the Master unit is preprogrammed with the complete DTT frequency plan. Instead of selecting UHF channels, transmitter names are chosen: the Master can then be used to send the chosen transmitters to the Slave.

For further information apply to Swires Research, 40 Hornsby Square, Southfield Industrial Park, Laindon, Essex SS15 6SD. Phone 01268 417 584, fax 01268 419 083 or e-mail sales@swires.com

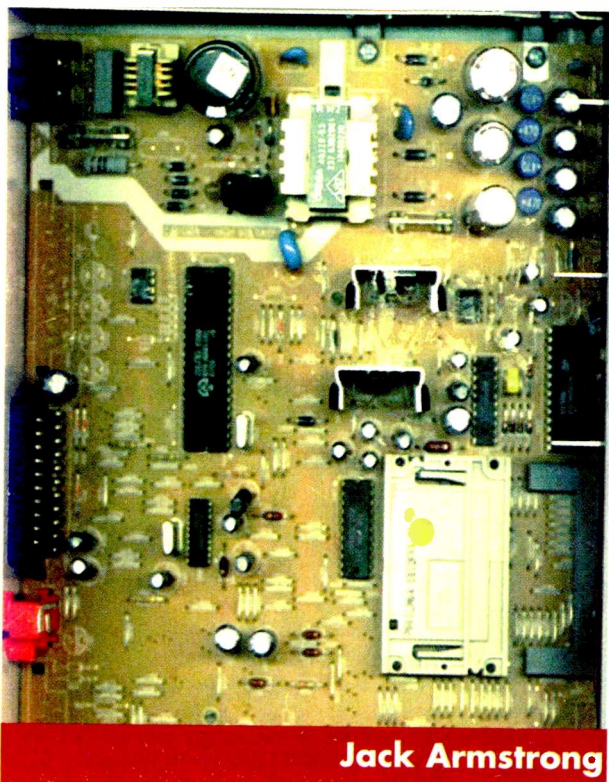
An innovative new product, the TV Messenger, enables a telephone and a TV set to be linked to display caller details. Connection is via a modified scart-to-scart lead between the TV set and an associated

VCR. The name and number of an incoming caller will then be displayed at the upper left-hand corner of the TV set's screen. In addition, the Messenger keeps track of calls in your absence – callers' names, numbers, call dates and times are stored in a log for retrieval when you return. The unit is call-waiting compatible, i.e. a second caller's details will be displayed on the screen while you are dealing with a call.

The TV Messenger is easy to install and costs about £59.95 including VAT. For further details contact Complementary Technologies Ltd., Comtech House, 28 Manchester Road, Westhoughton, Bolton BL5 3QJ – phone 01942 851 800, fax 01942 851 808, e-mail comtech@attmail.com



# Satellite WORKSHOP



Jack Armstrong

## OFFdigital

Some people have been experiencing difficulties with digital terrestrial TV reception – difficulties other than insufficient signal strength, missing bouquets and the general teething problems that are only to be expected with new technology.

The main problem seems to be picture break up when an electrical appliance is switched on or off. As it appears to be worse in some blocks of flats, I am wondering whether the cause could be the fact that the coaxial TV cable has been run alongside the mains power cables. The two are often installed simultaneously, by electricians, before completion of building work. It's quite common for them to be run together in conduit, trunking or embedded in concrete!

"This has nothing to do with satellite TV repairs" I hear you say. Very true. But try telling my customers that. They expect me to be able to solve all their problems, and are quite put out when I suggest that the answer would be to demolish the building and get the cables

installed by someone more competent!

It's strange that the digital terrestrial TV standard has been designed to be extremely robust in the face of reflected signal reception but falls over when someone switches a light on! Didn't we learn anything from the early days of 405-line transmissions?

## Pace PRD800

Frank was frantic. His customers at the Lion and Swan were expecting to watch the big match that evening, but the receiver simply displayed "no decoder messages". There were two grey bars at the top left-hand corner of all scrambled pictures however.

Fortunately I recalled seeing this symptom about three years ago. My notes suggested that the cause was the 40-pin chip U28. Sure enough, after fitting a replacement obtained from a scrap Amstrad SRD400 the PRD800 worked perfectly.

As a precaution I checked the ESR of the electrolytic capacitors in the power supply. Lucky I did that. The ESR of the mains bridge rectifier's reservoir capacitor C2 (47 $\mu$ F, 400V) was way too high – it wouldn't have lasted a week. I also replaced C5, C7 and C8. They sit next to the chopper transistor Q1 which runs quite warm.

If Frank had been a bit less impatient I would have fitted the full Relkit 1. Never mind: he'll be back within six months!

## BT SVS260

A "blank screen but the audio OK" the customer had said. My trusty hairdryer soon traced the cause of the trouble to C166 (220 $\mu$ F, 25V) on the main PCB. This capacitor is part of a video coupling network associated with the VideoCrypt decoder. It's included in Relkit 17, which is available from SatCure (phone 01270 753 311). To avoid bounces because of other symptoms, it's best to replace all the capacitors that come in this kit.

## SS Meter Tip

A signal-strength meter's F connector is not designed for continual

use. The solution is to make a connection lead from good-quality coaxial cable and screw it permanently to the meter. Fit a push-on F adaptor at the other end so that you can connect it easily to an LNB. Keep spare push-on adaptors and replace them frequently as the spring wears out.

## Amstrad/Fidelity SR950

The note attached to this receiver said "won't accept sky sports other sky's OK. card tests OK in another receiver". I gleaned from this literary masterpiece that the receiver was fussy about which channels it would unscramble.

My first check was to ensure that the video bandwidth was set to narrow in the setup menu. But there was no picture whatsoever: clearly something had died after the receiver had cooled down. I removed the cover and lifted out the decoder board. Using the sketch in Relkit 16 as a guide, I connected capacitors in parallel with C66 (22 $\mu$ F), C41, C68 and C69 (all 10 $\mu$ F) in the tuner/demodulator unit. This item is a swine to remove: it's much easier to leave it in place and simply tack new capacitors on the rear (top) face of the board. My repair was successful – the receiver then produced good pictures with all encrypted channels.

## Pace PRD800

A van pulled up outside. The driver unloaded ten receivers, grinned and drove off, leaving me to collect them from the pavement. I do contract work for a pub chain which delivers a load of satellite receivers in this way each month. The pile is allowed to grow in order to keep costs down, and by the time I get them they are all "ultra urgent". This wouldn't be so bad if the company would pay me more promptly!

The first off the pile was a Pace PRD800. A note taped to it read "repaired last month. wurked one day then picter went off. sownd OK". Oops! If my translation was correct, this one could be a bouncer. What had I missed? I soon found out: regulator REG1 must have been knocked, because one



wire was loose in the board. After resoldering it I had the picture back. There was nothing else I could do, except screw it back together, as I had already fitted the appropriate reliability kit. I then wrote "Sorry, my fault – no charge" on the label. I'm always honest.

The second receiver was also a PRD800. The note said "pictor off. sownd OK". Could this be the same problem? No chance! When I connected the receiver it displayed a blue screen. I disabled this and found that there was a picture that rolled vertically. A pity no one thought to fit vertical hold pots to satellite receivers!

As the picture's contrast appeared to be OK, I suspected a sync separator fault. Disconnecting and reconnecting the power supply several times produced a good, stable picture that remained perfect on all channels until the power was disconnected and reapplied. I'd seen this before!

On page 107 of *The Professional "Screwdriver Expert's" Guide* there's a description of the problem and a diagram that shows where to solder an 82µH inductor. Once I'd fitted this item the receiver worked perfectly all the time.

### Too Much Signal

It's not generally appreciated that sparklies can also be caused by too much signal. To point a large dish that feeds a low-threshold receiver at Astra is to ask for trouble: the combined signal energy from all the transponders can overload the receiver's tuner. A high-gain LNB will add to the problem, since its output amplifier is likely to be overloaded: an LNB with a gain of about 45dB should solve this problem. The receiver itself usually won't be overloaded because of the signal loss introduced by the coaxial feeder. With a short cable run however the input to the receiver could be excessive. It can be reduced by fitting an attenuator.

An IF filter whose response is too narrow can cause sparklies on saturated colours. This could happen when a receiver designed for Astra is used with a different satellite system. Sparklies on saturated colour are referred to as truncation noise. Another place where truncation can occur is in the video path. One or more of the video amplifiers may be overloaded, e.g. in a decoder. In some designs the amplifiers can't handle more than 1V peak-to-peak of video, in many cases not even that much. If the

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.

signals should go higher, you get noise on the picture. The AGC system should of course avoid this.

If you have a problem like this, first try an attenuator near the receiver's input. Use the correct type, not one intended for terrestrial reception. If this fails to solve the problem, try a lower-gain LNB. If the problem is limited to decoded channels, the cause may be in the decoder. If the picture is better at RF than via a scart lead, try a scart lead that incorporates video attenuator resistors. If the problem is with the weakest signal amongst strong ones there may be no workable solution.

## Test Case 437

As regular readers will know, while the Test Case workshop usually achieves a diagnosis and a good repair in the end, it can make a lot of mistakes along the way. Sometimes it seems to be staffed by complete idiots. Several local dealers who use us for contract repairs and service must be absolute wallies, or maybe they don't know who we are!

This month's puzzle concerns a Sony SLVE220 VCR that came to us from another dealer. The accompanying message said "tape stuck in, phone customer for more". Well, a jammed tape seems to be a clear enough symptom, but we rang the user anyway – and were rather dismayed to get a potted history of the machine's faults.

The first problem had been intermittent failure to make a timed recording. This had developed into refusal to record at all. The machine would accept the command, but when it tried to carry this out it would shut down to standby. The final stage, now being displayed by the machine as it sat on the bench, was immediate reversion to standby when switched on. The --:-- display on the front panel would flash up momentarily to become bright digits then revert to --:--. This happened with switch on at the front panel or via remote control. Neither the deck mechanics nor the trapped cassette showed the slightest sign of stirring.

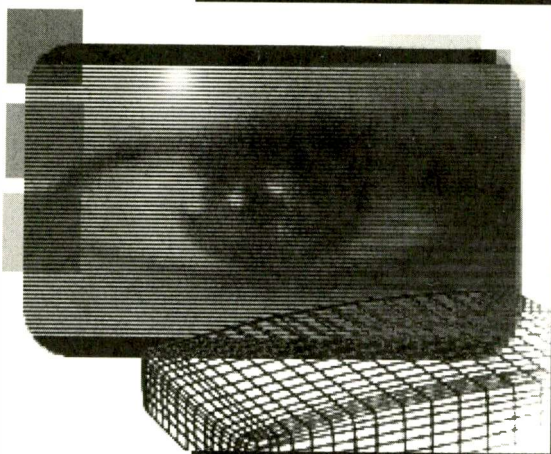
Some VCRs, particularly Hitachi models, do this sort of thing when a mechanical fault is present. So our first step was to remove the covers and check that the motors and mechanisms were free to move. The drum and capstan motors could be turned by hand, and the loading motor and its mechanism were

not jammed. They could be turned by hand, and we found that the cassette could be ejected by applying 5V to the motor – as described in the service manual. With the cassette now out, the control-system fault remained: when the machine perked up and shut down again there were still no signs of drive pulses at any of the motors.

It was time to get into the control section. In the present situation it was not possible to invoke the 'self-diagnosis' feature incorporated in this design. The SLVE220 has a single microcontroller chip, IC300, that provides system control, timer operation and fluorescent display panel drive. So this is where we started.

The 5V operating supply was present at pin 18, there was a reset pulse at pin 12 when mains power was switched on, and the two clock oscillators (pins 13/14 and 16/17) were both running. While these points were all OK, they could be properly checked only in the standby mode – because of the almost instant reversion to this at switch on. Reversion could now be triggered by the front-panel and remote-control keys and by pushing a cassette into the front-loading slot.

These puzzling symptoms suggested that the microcontroller chip, or maybe the EEPROM, was at fault – program-memory chips can cause some very strange effects. As the VCR was still within its year's guarantee, the consensus was that we should order and fit a new microcontroller chip – until, that is, clever-clogs Sage took the machine in hand and found the cause of the trouble with his oscilloscope. It was not in the control section. What was it? For the solution, turn to page 510.



Reports from  
Ian Field and  
Gerry Mumford

### Samsung CSA7571

The complaint was lack of contrast and brightness. In addition the grey-scale was well out – the green display content was particularly poor. When the setting of the first anode control was turned up, the brightness increased at the expense of the already poor contrast. Clearly the CRT was tired.

When this 'multisyncable' monitor is used as a VGA display the analogue level switch will, if incorrectly set, reduce the 'strength' of the display. But correcting its position provided less improvement than required. The customer asked whether anything could be done to "wring the last drops out of the monitor".

I decided to study the CRT's heater supply. This leaves the power supply at 6.8V and is fed to the CRT via R585 (1.2Ω) which provides a voltage drop of 0.5V. So it seemed that a boost transformer could safely be used in its place to increase the voltage by about 10 per cent. The customer readily agreed to this.

R585 serves at least two other purposes. The first is to limit the switch-on surge. So its removal would increase the risk of heater fracture at switch on. The customer felt that this was rather academic, as the tube was towards the end of its useful life. Its second purpose is to act as a fuse. I therefore fitted one, which obviously had to be a T type. 1AT was tried, but the voltage drop was a bit on the high side. Since the

# Monitors

heaters draw nearly 1A, I decided to use a 1.6AT type. I.F.

### VT2498FS

The only clue to the identity of this 14in. SVGA monitor was an inspection label with the Comas legend. It could have meant anything – the same legend appeared on the custom sync decoder chip. The complaint was that the power supply didn't start, which was not surprising – the 120kΩ, 3W start-up resistor R502 read just over 8MΩ. A replacement cured the fault.

The condition of the soldering was difficult to inspect because of a heavy coating of flux. When this was cleaned off the soldering was reasonable but a bit thin in places. I gave it a quick visit with the iron and fresh solder to avoid the possibility of a bounce. I.F.

### Dell D1526T-HS

This Sony-manufactured Trinitron monitor and some variants, which have been marketed under several brand names including Sony, suffer from a stock fault. The heatsink for IC502 is in contact with a hard rubber pad that's stuck to the bowl of the CRT. The idea is to prevent the heatsink hitting the tube when the pedestal flexes the bottom of the cabinet. What happens instead is that the PCB develops tiny hairline cracks around IC502.

With this particular monitor the cracks were so fine that I wouldn't have found them had I not known about the problem. Even after defluxing the PCB and using a powerful magnifier with strong light I could see only two fractured tracks. More could be seen when the green varnish was rubbed away with a fibre pencil. The damage is usually far worse than this – often unrepairably so! By the look of the solder joints, the malleability of the solder had taken much of the force.

It might be worthwhile removing the heatsink and machining a corner off it to provide clearance. But I suspect that this is not the sole

cause of the PCB damage.

Once this damage had been repaired, the symptoms remained as before – no display, with the green and yellow LEDs flashing together. When the 2SC5129 (Q507) line output transistor's collector pin was isolated, a short-circuit to chassis was discovered. The transistor was not short-circuited: it was another case where the insulated encapsulation had carbonised.

Customers should be warned about the fragile nature of this particular monitor. Nothing should be put on top, and these monitors must never be stacked. I.F.

### IBM 6317-002/Digital VRC16HA

The IBM version is much the same as the Digital monitor, the most significant differences being: all user controls are forward mounted, the rotary preset/select switch is replaced by a membrane pad under a front flap, and the video input is via a standard VGA cable and plug instead of the five BNC arrangement on all the versions previously seen from different manufacturers.

A note on the Digital version appeared in the January monitors section. I.F.

### Dell/Royal CN1470

It said Dell on the front, but the rest of the make/model information is taken from the label on the back. Pin 4 (ID) was not present on the VGA plug, suggesting that it was a basic VGA model. The test utilities I use are matched to the video card. They force the equipment list registers using software commands. So if I select an SVGA test pattern from the menu when a VGA monitor is connected, the ID pin status will be ignored and there will be a signal output anyway.

Although the monitor didn't seem to be entirely happy on some of the higher SVGA modes, its successfully locked them all. Some geometry adjustment was needed via the user controls. I had a look at



the mode-decode circuitry on the main PCB: it looked like normal VGA.

Because of the soot marks on the ventilation grille, I completed the repair before powering the monitor and didn't see the original symptoms - the report said "faulty blue - plenty of smoke!" Q613 (2SC2705) and Q612 (2SA1145) had both failed, burning up R665/6 (both 33Ω). A fair-sized crater was left in the CRT panel! R664 (2.2kΩ), L607 (10μH), R653 (2.2kΩ), L610 (0.47μH) and D609 (1N4148) were all smoke-damaged. Although Q611 (2SC2682) checked OK, I suspected that it may have been the culprit and replaced it as well

The burnt PCB area was pretty big and covered several tracks. So I couldn't file it out. Instead, I scraped away the carbonised surface with a scalpel and smoothed it off with a fibre pen - I resisted the temptation to seal the damaged surface with anything that might increase flammability. The components run pretty warm. So ingress of damp is less of a problem! I.F.

**Gateway 2000 CPD15F13**

The symptom was tripping with the green and yellow LEDs flashing. This model is similar to the **Sony CPD15SF1** and the **Dell D825TM**: LOPT failure is common with these models. This monitor had an easier fault however: Q502 (the notorious 2SC5129) had carbonised through its insulated encapsulation where it had been arcing to the heatsink. I.F.

**Olivetti DSM50-148**

There was an EW bowing problem with this monitor. The EW correction parabola was missing at the diode modulator in the line output stage. I checked back towards its source and found that the 10μF, 16V coupling capacitor C323 was open-circuit. G.M.

**Commodore KTC08-WY15E**

This Wyse-based monitor was dead because of a power supply blow up. The UC3842 chopper control chip U101 had died, killing the MTW8N60E chopper FET Q103 which turned out to be virtually

unobtainable and very expensive. Fortunately the STW8NA60 is an identical device, apart from the manufacturer, and is available from Farnell (order code 935-104) at modest cost. It did the trick. G.M.

**Siemens Scenic PM150**

This monitor's display had a rippled, wavy effect that appeared to move slowly up and down the screen. A tap on the main PCB removed the symptom, but it would soon return. The cause was eventually found to be a virtually invisible dry-joint at C210, which is a decoupler for one of the line drive PLL chips. G.M.

**Icer 7133D**

This monitor wouldn't produce a display when cold. If it was left, a display gradually appeared after an hour or two. While probing around on the video board I found that the blanking pulses from the LOPT were badly distorted when the display was missing. The cause of the trouble was C167 (22nF, 50V), which forms part of the damper circuit. G.M.

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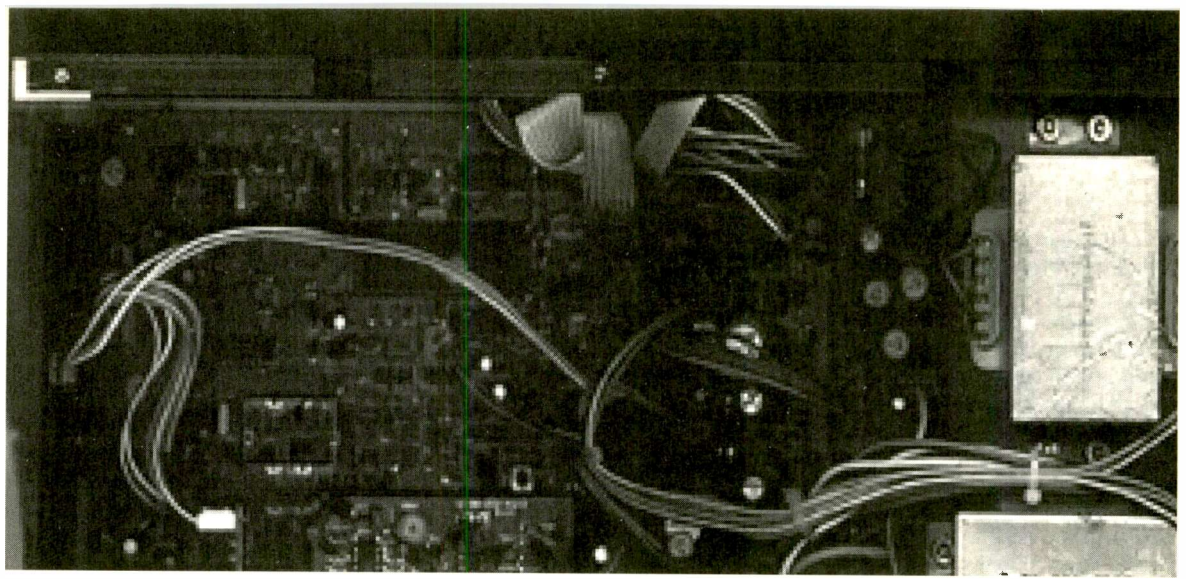
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# Satellite Notebook

**Reports from**  
**Pete Haylor**  
**Christopher Holland**  
**Chris Watton and**  
**Colin J. Guy**

## Digital Interference Problems

I've recently had lots of calls from customers because of interference problems with their analogue satellite systems, which had previously been OK. So far, this has been my 'cures' experience.

(1) Symptom: it looks as if there is a low-gain problem with satellite reception. First step: remove the aerial lead. If the picture is now all right, adjust the satellite receiver's UHF modulator and try again. If OK, leave!

(2) If the above doesn't provide a cure, try fitting a notch filter. Adjust it while watching the worst satellite picture. Beware: it's very easy to miss the crucial point. So adjust the filter slowly.

(3) A second common complaint is that a 'grumble' has appeared on the sound with some Astra channels. The customer has already contacted Sky and been told that the dish is misaligned, call an engineer to adjust it. When you arrive and try to adjust the dish you will find that in most cases nothing happens. If you have a good meter, you will find that the signal strength is about 10dB lower than at similar installations. This is the clue. A new low-noise LNB will usually cure the problem.

(4) The cause of another complaint is usually a pig to find! You will already have tried all the above, but the fault is still present. The worst case to date went like this. After trying the above measures, then a replacement receiver, a replacement coaxial feeder and finally a new dish, success! The

original dish had a very slight warp. Since then I have had to replace three dishes to cure the fault. There was also one case where the arm was not at 90° to the face of the dish.

So, if you install dishes, please handle them with care. **P.H.**

## Fault Round-up Pace MSS500/508/1000

*Lines across the screen:* Replace C216 and check C2, C5, C6, C11 and C12 in the power supply.

*No display:* Cause was C2 on the display PCB.

*Loss of decoder graphics when warm, loss of vision, OK when first switched on from the mains:* Cause was U29. Check/change C201, C204 and C208.

*Skew setting on menu but not adjustable:* Reprogram using Pace Link.

*Screen full of dots:* Replacing C216 cured this.

*Screen with equal-spaced dots:* Cause was U7.

## Pace PRD800/900

*Swirling pictures:* Cause was C23.

*Display missing:* Cause was C15

*No or low H voltage:* Replace C23.

## BT SVS250

*No graphics, no decoding:* Replace C34.

## An odd one!

Our central heater began to play up just as the cold weather came along – the relays started to trip rapidly. The cause was the main smoothing capacitor on the control PCB. **P.H.**

## No Digibox Teletext

The owner of a recently installed SkyDigital system complained that there was no longer a teletext dis-

play on any of the TV sets in the house. Terrestrial TV teletext was OK. On investigation I found that there was no teletext with either an RF or a scart connection to the digibox, which in all other respects – including the on-screen TV guide – worked normally.

The cure was simple, along the lines of past VideoCrypt decoder problems where there was no decoding. Simply disconnect the digibox from the electricity supply then reboot it. I use the computer term reboot for reconnecting the box to the mains supply and waiting for it to come to life because in many ways the box has more in common with a computer than a satellite TV receiver!

I've had similar problems where the electronic programme guide displays "searching for listings, please wait" but no listings appear. Operation of the digibox is otherwise normal, and the programme information box at the bottom of the screen displays correct information when changing channels. Once again, disconnecting the mains supply then rebooting the receiver restores normal operation.

If you remove the viewing card and briefly interrupt the signal from the dish the digibox can crash! **C.H.**

## 'Radio' Generator

We recently took over the maintenance of a large hotel TV system. There are over 150 rooms connected to it, and amongst the dishes on the roof there are two Andrews 4.5m monsters. One of these hadn't been used for several years. We got it back into service, but that's another story!

Several satellite and terrestrial radio services were connected to



the system and distributed in Band III. The TV original sets used had their timebases switched off at VHF, providing just the sound from their speakers. The one off-air Band III TV signal available was upconverted to UHF. A colour-bar generator had been included in the installation to provide 'vision' to accompany the sound when an unmodified TV set was used.

The original sets were coming to the end of their useful life and were replaced with more modern ones. Unfortunately these didn't blank out the vision at VHF, producing a colour-bar picture when they were receiving the radio channels. The management thought that this would lead to unnecessary questions and complaints and wanted it to be replaced.

I had to hand a Pace MSS37 satellite receiver. It's a simple, non-decoder model that could be programmed to produce sync pulses and the word "radio" from its scart socket. The problem was that this receiver has no automatic switch-on facility (self-booting to

use computer terminology). A simple solution was found: if the front panel standby switch is permanently on, the receiver always comes on with channel 1, which was programmed to produce the "radio" picture.

Reprogramming via the remote control unit is not possible with the switch bridged across however. So a simple single-pole, single-throw toggle switch was mounted on the front panel to allow receiver reprogramming with the standby switch in the off position.

Connecting the unit was a simple matter. In place of the BNC plug that had been used to connect the colour-bar generator's output to a small distribution amplifier to feed each radio station's modulator, a scart plug was used to connect to the Pace receiver's TV scart socket. **C.H.**

**Amstrad SRD510**

The customer said that the picture would break up after a while. Actually the power supply was tripping, with the chopper transformer vibrating so much that you

could sense it by touching the receiver's case. The cause of the trouble was TR300 (2SC1740) on the power supply panel. **C.W.**

**Pace SS9200**

There was intermittent loss of the LNB supply. A small choke fitted in position LK20 was the cause - replacement cured the problem **C.W.**

**Uniden UST8008**

This old receiver gave good results but its output would be lost from time to time - the UHF loop-through also went off. The cause was a poor joint at the mains transformer connector. **C.W.**

**Fidelity SR950**

This receiver produced poor pictures. The cure was to replace C68 and C69, both 10µF, in the difficult to get at tuner unit. **C.J.G.**

**Pace SS9200**

This receiver wasn't decoding, nor was there any line sync with its output. The cause was the 503kHz ceramic resonator next to the TEA2029 sync chip. **C.J.G.**

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AN5015 = 250	LA4280 = 250	SDA4212 = 775	STR56041 = 850	T8427K = 350	TDA3580 = 499	TDA5820 = 400	TDA8568Q = 695
AN5256 = 150	LA4282 = 350	SL486 = 375	STR58041 = 250	T8449P = 375	TDA3645 = 385	TDA6101Q = 215	TDA8709 = 600
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AN5321 = 100	LA4446 = 170	STA441C = 220	STRD4412 = 400	T8690AN = 700	TDA3654Q = 080	TDA7222 = 100	TEA1002 = 650
AN5615 = 300	LA4498 = 275	STA901M = 310	STRD4420 = 550	TBA120T = 030	TDA3827 = 200	TDA7245 = 350	TEA1015 = 300
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AN5900 = 130	LA4700 = 350	STK011 = 895	STRD6001 = 515	TBA750C = 150	TDA4050 = 145	TDA7251 = 400	TEA1061 = 250
AN6612 = 080	LA5601 = 110	STK015 = 1440	STRD6108 = 450	TBA820M = 035	TDA4228T = 360	TDA7255 = 400	TEA2014 = 080
AN7178 = 180	LA5700 = 300	STK078 = 1680	STRD6602 = 400	TBA990Q = 200	TDA4420 = 120	TDA7273 = 080	TEA2018A = 110
AN8377 = 400	LA6510 = 150	STK1049 = 700	STRD6802 = 375	TCA650 = 250	TDA4439 = 220	TDA7350 = 300	TEA2026CV = 650
BA3812 = 080	LA7018 = 130	STK433 = 400	STRM6545 = 375	TDA1012 = 120	TDA4442 = 240	TDA7385 = 900	TEA2029CV = 400
BA5115 = 075	LA7223 = 485	STK441 = 650	STRM6546 = 795	TDA1013A = 110	TDA4442 = 899	TDA8138 = 200	TEA2031A = 125
BA5402 = 180	LA7323 = 325	STK457 = 470	STRM6549 = 725	TDA1022P = 330	TDA4443 = 250	TDA8145 = 120	TEA2164 = 160
BA5406 = 180	LA7505 = 500	STK463 = 750	STRM6559 = 900	TDA1035 = 799	TDA4480 = 280	TDA8171 = 200	TEA2260 = 225
BA6222 = 100	LA7696 = 500	STK561 = 450	STRM6571 = 1700	TDA1044 = 110	TDA4500 = 300	TDA8177 = 215	TEA2261 = 345
BA6235 = 050	LA7830 = 090	STK563 = 415	STRS5717 = 500	TDA1054 = 180	TDA4503 = 250	TDA8190 = 299	TEA2262 = 350
BA6247 = 130	LA7832 = 130	STK583 = 500	STRS5741 = 600	TDA1062 = 140	TDA4505A = 300	TDA8195 = 225	TEA5170 = 140
BA6248 = 150	LA7835 = 150	STK2125 = 575	STRS5942 = 700	TDA1085C = 270	TDA4505E = 400	TDA8304 = 400	TEA5610 = 650
BA7258 = 300	LA7860 = 350	STK2240 = 700	STRS6307 = 450	TDA1170N = 135	TDA4505K = 450	TDA8349 = 350	TEA6101 = 525
BA7751 = 125	LB1234 = 225	STK3082 = 550	STRS6309 = 550	TDA1170N-TFK = 850	TDA4556 = 370	TDA8376 = 1200	TFMS1380 = 085
BA2751S = 1450	LB1412 = 300	STK4017 = 400	STRS6525 = 1350	TDA1170S = 135	TDA4560 = 270	TDA8380 = 200	TFMS5300 = 170
CNX62A = 080	LC7011 = 500	STK4060 = 1510	STRS6545 = 725	TDA1220A = 550	TDA4568 = 300	TDA8391 = 675	TFMS5360 = 170
CNX82A = 060	LM317T = 150	STK4211/2 = 600	STRS6707 = 800	TDA1327 = 200	TDA4600-2 = 160		
CNX83A = 080	LM348 = 050	STK4211/V = 800	STRS6708 = 550	TDA1412 = 085	TDA4600-2D = 260		
CNYIT = 225	LM1035N = 350	STK4362 = 450	STRS6909 = 550	TDA1589 = 275	TDA4601 = 120		
DPY2540 =	LM1111 = 180	STK4392 = 500	STRZ21152 = 1000	TDA1771 = 200	TDA4605 = 190		
HA1137 = 150	M105BI = 300	STK4773 = 820	STV2110B = 685	TDA1904 = 199	TDA4605-2 = 395		
HA1199 = 130	M490BBI = 1299	STK4833 = 650	STV9379F = 415	TDA1908 = 299			
HA1377 = 140	M5106P = 550	STK5324 = 450	TAT7075 = 300	TDA1908 = 299			
HA11215 = 299	M5218L = 285	STK5335 = 750	TA7145P = 400	TDA1905 = 080			
HA11847 = 700	M5130SP = 550	STK5337 = 500	TA7210P = 200	TDA1950 = 175			
HA11351 = 765	M5136S = 350	STK5361 = 375	TA7248P = 575	TDA2004 = 150			
HA11412 = 600	M52307SP = 600	STK5431 = 1250	TA7271P = 220	TDA2008 = 100			
HA11702 = 300	M58658P = 699	STK5441 = 400	TA7299P = 200	TDA2161 = 590			
HA11720 = 650	MB3712 = 600	STK5461 = 500	TA7318P = 490	TDA2504 = 200			
HA11744 = 330	MB3732 = 240	STK5466 = 500	TA7324P = 050	TDA2530 = 300			
HA12005 = 180	MC1377P = 200	STK5471 = 630	TA7401P = 250	TDA2542 = 215			
HA12411 = 575	MDA2060 = 350	STK5478 = 380	TA7609AP = 170	TDA2546A = 950			
HA13002 = 200	MDA2061 = 400	STK5481 = 470	TA7616P = 300	TDA2556 = 230			
HA13118 = 140	MDA2062 = 700	STK5725 = 450	TA7636P = 400	TDA2560 = 899			
HA13119 = 140	NE545B = 225	STK6932 = 725	TA7658P = 100	TDA2577A = 200			
HA13151 = 800	NE645N = 1225	STK730-060 = 645	TA7680AP = 275	TDA2578A = 225			
HA13155 = 900	SAA1006 = 300	STK73907 = 599	TA7691P = 165	TDA2579A = 210			
HA17384 = 200	SAA1070 = 550	STR450 = 700	TA7698AP = 400	TDA2581 = 100			
KA2206 = 150	SAA1294 = 1000	STR1195 = 350	TA7719P = 200	TDA2600 = 400			
KA9257 = 120	SAA1293-3 = 515	STR2105 = 550	TA7743P = 600	TDA2611A = 100			
KIA6210 = 400	SAA5010 = 220	STR3215 = 275	TA7772P = 140	TDA2640 = 350			
KIA6281 = 250	SAA5231 = 850	STR6020 = 270	TAB111AP = 210	TDA2680 = 1299			
LA1180 = 075	SAA5250 = 750	STR10006 = 450	TAB200AH = 325	TDA2700 = 550			
LA1235 = 130	SAA7010 = 680	STR11006 = 325	TAB210AK = 275	TDA2790 = 400			
LA1260 = 075	SAA7274 = 600	STR20015 = 450	TAB205AH = 220	TDA2820M = 500			
LA1369 = 200	SAB3034 = 985	STR40090 = 350	TAB210AH = 265	TDA3190 = 375			
LA3155 = 175	SAB3035P = 275	STR44115 = 475	TAB211AH = 200	TDA3500 = 525			
LA3241 = 105	SAB3037 = 1400	STR50020 = 350	TAB215AH = 300	TDA3505 = 275			
LA3400 = 250	SAF1032P = 2099	STR50092 = 260	TAB220H = 500	TDA3530 = 365			
LA4108 = 125	SAF1039 = 699	STR50103A = 260		TDA3562A-ST = 525			

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**Part 2 of K.F. Ibrahim's new series deals with the PC's mode of operation. The booting up process and basic system configuring and customising are described**

# PC

# Operation & Repair

**A** personal computer loads and runs software application packages, for example word processing, computer-aided engineering, Windows or games. Application packages are designed for use with a specific operating system (OS), such as MS-DOS, PS/2, Unix or Windows 95. The operating system provides a suitable computer environment in which different software packages can be installed and run. The link between the operating system and the hardware in the PC is provided by the BIOS, i.e. Basic Input Output System, see Fig. 1 last month.

## BIOS Operation

The BIOS is a set of short programs or routines that are permanently stored in a RAM or EPROM chip. The number of routines and the size of the BIOS depend on the chip manufacturer and its version: later versions contain more complex and sophisticated programs. BIOS routines can be divided into two categories: the start-up routines, and the basic low-level Input/Output routines.

The BIOS start-up routines are initiated when the PC is switched on (cold start) or has been reset (warm start). They include such programs as the initial Power On Self Test (POST) and system initialisation.

The Input/Output routines include programs such as the print routines and disk read/write. They are called up when the operating system or an application package wants to carry out these basic tasks.

The BIOS simplifies application program writing and helps to ensure compatibility between PCs that have different hardware items and different configurations.

Access to the BIOS routines is provided by a system of software interrupts. These halt the operation of the

microprocessor and start a particular BIOS routine. Each interrupt has a four-byte value that's known as a vector: it indicates the routine required. The vectors have four memory locations, into which the BIOS loads the four-byte value during the start-up routine. These interrupt vectors are collected together in a table known as the interrupt vector table. It's loaded into memory locations at the very start of system operation.

## The Boot-up Process

When a computer is switched on, the microprocessor initiates a procedure known as boot-up or start-up. Amongst other things this runs the BIOS and loads the operating system so that the computer is ready for use.

At power up, by turning the mains switch on, the power supply carries out a self-test procedure. If successful, with the correct voltages at the outputs, a Power-Good (PG) signal is sent to the timer chip on the motherboard. This chip responds by taking the RESET control line high to start up the microprocessor (CPU). The following sequence of events then takes place:

**Step 1: BOOTSTRAP.** The CPU searches for the address where the BIOS start-up routine is located. The term bootstrap is based on the idea that the PC 'pulls itself up by its bootstraps'.

**Step 2: POST.** The first action of the BIOS is to test the system, a routine known as POST (Power On Self Test).

**Step 3: INITIALISATION.** Following a successful self-test, the BIOS carries out a system initialising routine.

**Step 4: LOADING** the operating system. The BIOS

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## Processing power: MIPS

The performance or processing power of a microprocessor chip is measured by the number of instructions it can carry out per second, given as MIPS (million instructions per second). Intel's first 16-bit PC processor, the 8086 launched in 1978, had a power rating of 0.33 MIPS. Five generations later came the Pentium with a power rating of 300 MIPS.

Two main factors determine a processor's MIPS rating: the processor's clock frequency and the time in clock cycles required to carry out an instruction. Clock frequencies have increased from 8MHz with the 8086 to 200MHz and over with the Pentium. The time required to carry out an instruction has been reduced from an average of 12 cycles with the 8086 to one cycle with the Pentium.

A more practical measure of the relative processing powers of CPUs is the Intel Comparative

Microprocessor Performance (ICOMP), which combines the effect of frequency of operation, the number of cycles per instruction, the effect of in-built FPU (floating-point units) and on-chip cache memory.

A further method of measuring processor performance has been developed by Intel's competitors AMD and Cyrix. The new rating, known as the P-rating, combines all factors that influence the performance of a PC. It provides a measure of how well the most commonly used application programs are run by a PC with a particular type of processor. This is the most practical rating, taking into account all the factors that affect processor performance.

AMD and Cyrix argue that their processors have a better processing power than comparable Intel devices with the same frequency specification. A P-rating such as P100 indicates that the processing power is equivalent to an Intel device running at 100MHz though it may be running at say 90MHz.

looks for, loads and executes two hidden system files, IO.SYS and MSDOS.SYS. The computer is now under the control of the operating system, in the guise of IO.SYS.

**Step 5: LOADING CONFIG.SYS and COMMAND.COM.** The operating system takes action to establish the operating environment as specified by the user. Customising the environment involves, first, searching the root directory for a file called CONFIG.SYS. When this is found, DOS reads and carries out all its instructions before loading the DOS kernel, which is a file called COMMAND.COM. If CONFIG.SYS cannot be found, COMMAND.COM is loaded regardless. The system is now under the control of COMMAND.COM.

**Step 6: LOADING AUTOEXEC.BAT.** The CPU looks for a batch file called AUTOEXEC.BAT. If it's found, DOS loads it into memory, carries out its instructions and displays the DOS prompt. If AUTOEXEC.BAT is not found, DOS requests the DATE and TIME before displaying the DOS prompt.

The system is now ready for DOS commands and application programs. When Windows 95 is being loaded, WIN command is executed: the 95 logo is displayed on the screen and the routines for installing Windows 95 are run.

### POST

The Power On Self Test (POST) starts with a series of tests, known as core tests, of the motherboard hardware, including the microprocessor, the coprocessor, the timer and clock-generator chip and the DMA (Direct Memory Access) and interrupt controllers. If an error is detected, coded beeps are produced. The code varies with the BIOS manufacturer.

The video adaptor card is next tested. If this test is successful a cursor appears on the screen. If the test fails, a message along the lines of Video ROM Error appears, depending on the nature of the error.

A second series of tests then checks the RAM and ROM devices, the floppy and hard disc drives, the serial and parallel (printer) ports and the keyboard. They use a BIOS routine that sends data to memory locations, registers and port addresses and tests the result by read-

ing back the contents of these locations. For ROM devices a checksum test is performed: the contents of ROM locations are read and a CRC (Cyclic Redundancy Count) known as a checksum is produced and compared with a known good count. Errors are made known by audible coded beeps, displayed messages or both.

This second series of tests is skipped when the boot-up process is the result of a warm start, i.e. the result of pressing the reset button.

On successful completion of both these series of tests a single short beep is produced.

### System Initialising

The second task of the BIOS is to carry out initialisation routines that recognise and configure various parts of the computer system. The BIOS searches through the system and identifies its various features, such as the number and types of ports installed and the type of display adaptor (monochrome or colour). Initialisation involves creating an interrupt vector table and loading specified memory locations and registers with appropriate data, such as the keyboard character style and the start addresses of installed input/output adaptors, to reflect the specific features of the system.

This information is stored in what is known as the BIOS data area.

### CMOS Setup

While it is testing and initialising the system the BIOS needs to know the number and type of peripheral devices installed and the size of memory that has to be tested. The BIOS can be programmed to find this information by itself. This would take time however, while the BIOS carries out a lengthy search.

To avoid such a delay when booting up, PCs hold this vital information in a non-volatile RAM. This is a battery-backed CMOS RAM device, such as a Motorola MC146818, which is known as the CMOS setup chip. A total of 64 bytes stores setup information such as the date and time, the number and types of disk drives installed, cache memory etc. The CMOS setup can be accessed by pressing one key, or a combination of keys, during the boot-up process.

### Search for the Operating System

So far, the initialisation process has not been related to a particular operating system. Any operating system can

**Table 1: Typical MS-DOS DIR/a Listing.**

SHR	C:\IO.SYS
SHR	C:\MSDOS.SYS
R	C:\COMMAND.COM
SHR	C:\DBLSPACE.BIN
A	C:\WINA20.386
A	C:\CONFIG.OLD
A	C:\AUTOEXEC.OLD
A	C:\CONFIG.SYS

now be loaded: the BIOS will look for an operating system and load it.

The operating system is usually on the hard disk, drive C:. An operating system may also be available on a floppy disk, which is in this case known as a system disk, and must be inserted in drive A:.

An operating system is identified by a signature on the boot sector of the disk. It indicates that system files are present on the outside track (track 0). The name and number of the files depends on the operating system. With MS-DOS and Windows 95 there are two system files, IO.SYS and MSDOS.SYS. The files for the two systems have the same name but differ in content. For Windows 95, MSDOS.SYS is a text file that provides a boot-up configuration which can be changed to suit the user.

When the BIOS looks for the operating system it first interrogates drive A:, then drive C: (the hard disk). This A, C sequence, which is known as the boot-up sequence, can be changed by the CMOS setup.

If a non-system disk, i.e. one without the correct boot signature, is detected in A: the following message is displayed:

Non-system disk or disk error  
Replace and strike any key when ready

If the system files are missing from the disk, the following message is displayed:

Missing operating system

The system files have three attributes, S (for system), H (for hidden) and R (for read-only). The R and S attributes protect the files against deletion by mistake. The H attribute ensures that they are not included in the DIR listing.

For hidden files to be listed, a switch /a (for attributes) or /h (for hidden) has to be used. A typical MS-DOS DIR/a listing is shown in Table 1. Notice that the system files are the first two entries in the directory. This is an essential requirement for MS-DOS and Windows 95.

### Loading the Operating System

Once the system files have been located they are loaded into system memory, read and carried out. IO.SYS is loaded and executed first, followed by MSDOS.SYS. These files contain all the information necessary to set up the system, its components and subsystems. This includes resetting the disk drives, initialising the printer and the parallel and serial ports, and setting up the system's default parameters.

### Configuring the System - CONFIG.SYS

Once the system file instructions have been carried out, DOS/Windows 95 looks for the system configuration file CONFIG.SYS in the root directory of drive C: (or drive A: when booting up from A:), loads it, reads it sev-

eral times and carries out its instructions. Table 2 lists basic elements of a CONFIG.SYS file. DOS/Windows 95 then looks for a file called COM-MAND.COM in root directory C: (or drive A: when booting up from A:) and loads it in memory. COMMAND.COM contains the DOS resident (internal) commands: it usually has an R (read-only) attribute.

The purpose of the CONFIG.SYS file is to configure and install hardware devices and load their control programs, which are known as device drivers. The CONFIG.SYS file has to be modified whenever a new device such as a CD-ROM drive or a sound card is added to the system. This can be carried out manually or automatically, by running the install program provided by the manufacturer of the device or running the Windows setup routine. The Windows 95 Wizard routine can detect and install devices at boot up.

A faulty command in the CONFIG.SYS file is usually indicated in the display. But with Windows 95 these messages are hidden from the user by the logo screen. Press ESC during the booting-up process and the logo will disappear so that the screen messages can be seen. Some errors may halt the boot-up process.

### System Customising with AUTOEXEC.BAT

Before the DOS prompt or the Windows icons appear on the screen, DOS (and Windows 95) looks in root directory C: (or A: when booting up from A:) for a batch file called AUTOEXEC.BAT and carries out its instructions.

The AUTOEXEC.BAT file can contain commands that determine the type of prompt, set a path or determine the keyboard character set. Table 3 lists the basic elements of an AUTOEXEC.BAT file.

A faulty command line in the AUTOEXEC.BAT file is usually indicated on the display. Some errors may halt the boot-up process.

### Bypassing CONFIG.SYS and AUTOEXEC.BAT

DOS/Windows 95 has a facility for bypassing both these files when the booting-up process is halted because of errors in either file. The two files can be bypassed by pressing F8 at the point where the BIOS begins to load MS-DOS (or Windows 95). A message to the effect that the files have been bypassed will appear.

Another facility that enables the user to step through the files is provided by pressing F5 at the point where MS-DOS starts to be loaded.

With Windows 95, pressing F8 will display a menu that provides a number of options including Normal, step-by-step, safe-mode and the previous MS-DOS version.

### Path to DOS Files

Internal or resident DOS commands that are built into the COMMAND.COM file are loaded into system RAM at the boot-up stage. External or transient com-

**Table 2: Basic elements of a CONFIG.SYS file.**

```
DEVICE=C:\MOUSE\MOUSE.SYS
DEVICE=C:\DOS\HIMEM.SYS
DEVICE=C:\DOS\EMM386.EXE NOEMS
DOS=HIGH, UMB
COUNTRY=044,,C:\DOS\COUNTRY.SYS
FILES=40
BUFFERS=20
LASTDRIVE=Z
```



**Table 3: Basic elements of an AUTOEXEC.BAT file.**

```
@ECHO OFF
PROMPT $P$G
PATH=C:\WINDOWS;C:\DOS
SET TEMP=C:\DOS
KEYB UK,,C:\DOS\KEYBOARD.SYS
```

mands remain on the disk in the form of individual files that are usually placed in a special subdirectory called DOS. Because of this, a path has to be established to ensure that external commands can be called without having to change directories.

### CONFIG.SYS Commands

The following are some of the main DOS/Windows 95 commands that are valid for CONFIG.SYS files:

**BREAK ON.** Instructs DOS to check for CTRL + C or CTRL + BREAK key combination, in which case the program will be halted.

**BREAK OFF.** DOS does not check for a key combination.

**BUFFERS.** Sets the amount of memory used as buffers for data transfer. When data is transferred between say the hard disk and another unit, it's stored in a number of buffers before being sent to its intended destination.

A small number of buffers can reduce the speed of data transfer between say the hard disk and memory. A large number will reduce the size of conventional memory however. Each buffer occupies 512 bytes of memory. A typical number of buffers is 20-40.

**FILES.** Determines the number of files that DOS can keep open at the same time.

**COUNTRY.** Sets the keyboard characters to a particular country's style. The characters' set for each country is available in a file called COUNTRY.SYS which is in a DOS subdirectory. The default is US-style characters, which are the same as used in the UK. As an example:

COUNTRY=044,,C:\DOS\COUNTRY.SYS. 044 is the code for English UK, based on the international telephone code. C:\DOS\COUNTRY.SYS is the path to the relevant file.

**DEVICE.** Sets and loads the routine, called a device driver, that controls an installed hardware device. This command installs the device driver in conventional memory. If the installed device is say a mouse, a routine that controls the mouse, typically MOUSE.SYS or IMOUSE.SYS, has to be loaded by a device statement – this states the path to the relevant file. Here are some examples:

DEVICE=C:\MOUSE\MOUSE.SYS. MOUSE.SYS is the mouse driver which is stored in subdirectory MOUSE.

DEVICE=C:\DOS\HIMEM.SYS. Enables the high-memory management routine HIMEM.SYS.

DEVICE=C:\DOS\EMM386.EXE NOEMS. Provides access to upper memory without creating expanded memory.

**DEVICEHIGH.** Has the same effect as a DEVICE command but loads the device driver in the upper memory area. For example

DEVICEHIGH=C:\MOUSE\MOUSE.SYS

**DOS.** When set high, DOS kernel (COMMAND.COM) is loaded in the Upper Memory Area (UMA). When set to UMB, upper memory blocks are created to allow TSR (Terminate and Stay Resident) programs to be loaded in upper memory.

**LASTDRIVE.** Specifies the highest drive letter. For example LASTDRIVE=K provides a maximum of eleven disk drives, A: to K:.

**NUMLOCK ON.** Sets the NUMLOCK of the numeric keypad on.

**NUMLOCK OFF.** Sets the NUMLOCK of the numeric keypad off.

**REM.** Indicates that the text that follows is descriptive and should be bypassed. It is also used to disable a command line without deleting it. For example:

REM DEVICEHIGH=C:\MOUSE\MOUSE.SYS disables the mouse driver.

The order in which these commands appear in the CONFIG.SYS file is unimportant, except that DEVICE commands, including HIMEM.SYS and EMM386.EXE NOEMS, must come before DEVICEHIGH commands.

### AUTOEXEC.BAT Files

AUTOEXEC.BAT is a batch file whose instructions DOS/Windows 95 carries out at the boot-up stage to customise the PC. The instructions are followed in the order written: they include DOS batch commands such as ECHO, PATH and PROMPT. See Table 3. The file may also contain instructions to load Terminate and Stay Resident (TSR) programs such as DOSKEY, which memorises and reproduces previous commands. Typical AUTOEXEC.BAT commands are:

**ECHO ON.** To display the command lines as they are carried out by DOS.

**ECHO OFF.** Not to display the command lines as they are carried out by DOS.

**@ECHO OFF.** Not to display any command lines including ECHO OFF itself.

**PROMPT.** To set the type of prompt. Examples:

PROMPT \$P\$G, in which \$P displays the directory path, e.g. C:\ or A:\ or C:\DOS\, and \$G displays the greater than (>) sign.

PROMPT \$D, to display the current date.

**PATH.** To specify the directories and subdirectories that should be searched by DOS when looking for a file name. DOS, when instructed to carry out a command, first searches the system memory for a resident command file. If it fails to find the file there it searches the current root directory, then any other directory specified in a PATH command. Examples:

PATH=C:\;C:\DOS means search root directory C:\ and subdirectory C:\DOS.

PATH=C:\DOS;C:\WINDOWS means search subdirectories DOS and WINDOWS. Root directory C:\ is automatically searched.

**KEYB.** To configure the keyboard for a specific language. For example:

KEYB UK,,C:\DOS\KEYBOARD.SYS specifies English UK.

The default setting is for English USA.

**SET.** Defines what is known as an environment variable. For example some programs require a temporary directory, usually called TEMP or TMP, in which temporary files are stored. Such a directory can be defined by the command SET. For example:

SET TEMP=C:\ defines TEMP directory in root directory C:\. To call this directory, the programmer writes '%TEMP%', which will be substituted with C:\.

**CD.** Changes the active directory. For example:

CD WINDOWS changes to subdirectory WINDOWS.

The prompt will then be C:\WINDOWS\>.

AUTOEXEC.BAT can also be used to launch an application program at the boot-up stage. For example, to run WINDOWS 3.X immediately after boot-up, the following lines should be included:

```
CD WINDOWS
WIN
```

The first line changes the active directory to Windows while the second line is the file name to run Windows. The first line can be omitted if the PATH command line includes a path to Windows.

Note that the CONFIG.SYS and AUTOEXEC.BAT files are constructed automatically when Windows 95 is installed.

### The System or Boot Disk

A system disk, also known as a boot or start-up disk, is a floppy disk that can be inserted in drive A: to start up the computer. It contains what is known as the system, i.e. the system files IO.SYS and MSDOS.SYS and the DOS kernel COMMAND.COM.

To create a system disk, transfer the system from drive C: to a floppy disk in drive A: (or B:). Two commands can be used to transfer the system:

```
SYS A:
FORMAT A:/s (switch /s stands for system).
```

Both will copy the system files and COMMAND.COM together with their attributes. Formatting a disk as a system disk will wipe the disk clean however, thus losing all the existing files on it.

Depending on the version of DOS, a system disk may include one or more additional system files such as DRVSPACE.BIN with SHR attributes. Furthermore, it is usual to have a number of non-resident files on the system floppy disc, such as EDIT.EXE, QBASIC.EXE, FORMAT.COM, FDISK.EXE and MSD.EXE to provide access to some useful external commands.

A Windows 95 system disk can be created at the time of installation or by going into the control panel window and selecting Add/Remove programs. By clicking on Start-up disk, a Windows 95 start-up or system disk can be created.

Start-up disks for both DOS and Windows 95 do not contain drivers for access to a CD-ROM drive, which in some cases may be essential. Certain modifications may have to be carried out to both CONFIG.SYS and AUTOEXEC.BAT to rectify this situation.

### Operating System Installation

The operating system is usually installed on the hard disk (drive C:). It comes on a number of disks (DOS) or a CD-ROM (Windows 95). All OS files and an install or setup routine are included.

With MS-DOS, install the operating system by inserting disk 1 in drive A: and running the SETUP program (by typing SETUP at the prompt). The setup program will take all the necessary steps to install the operating system, including CONFIG.SYS and AUTOEXEC.BAT file writing and creating subdirectories.

With Windows 95 the operating system is installed by inserting the Windows 95 CD into the CD-ROM drive and, from the D:> prompt, typing SETUP.

**Next month:** A look at PC memories.

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## DTT Reception

Digital terrestrial TV has now been in operation long enough for us to be able to assess reception problems and the back-up provided. The main marketing claims have been more choice and better picture quality. The former cannot be disputed. With regard to the latter, while a DTT box is theoretically capable of providing better results than the best analogue colour TV receivers, it will do so only when providing RGB outputs (not composite video) via a scart lead. It therefore depends on whether the TV set in use can accept RGB inputs.

The main advantage claimed for DTT reception is its immunity to multipath distortion, which produces ghosting and similar undesirable effects with analogue reception. For the most part this is true, but those who receive good-quality PAL analogue signals are unlikely to notice any improvement when a DTT decoder is in use. DTT sound quality is much better than analogue mono, though not Nicam, but the average set won't do justice to it. For best results the stereo audio output from a decoder should be fed to a hi-fi or 'home-cinema' audio system with quality loudspeakers.

Local EM conditions create the main reception problems. Those familiar with the 405-line system will recall its susceptibility to impulse interference caused by electrical equipment, particularly vehicle ignition systems. The disadvantage of positive modulation was not appreciated by those who designed the system. It seems that history is repeating itself.

Best RF design practice has not

# Letters

been adopted in the DTT world. To avoid mutual interference with existing services, DTT transmissions are typically 20dB below the accompanying analogue ones. This has an unfortunate consequence: local interference within a DTT multiplex can be of sufficient amplitude to corrupt the modulation. The decoder's error-correction circuitry may be unable to cope with this. Now here's the rub. The effects of impulse interference go largely unnoticed with an analogue transmission, mainly because of the use of negative modulation (the noise is driven towards black level). Any residual interference tends to appear as short-duration line flashes, which are generally not noticed by viewers. But the same level of interference has a devastating effect with a DTT channel.

The results vary from MPEG-2 mosaic blocking that typically lasts for one-two seconds to momentary total corruption, with the dreaded 'red dot' being displayed and no sound or picture. Other effects include the sound and picture becoming unsynchronised by as much as two-three seconds, and lock-up with a frozen still picture (the sound may continue normally). The remote control unit then has no effect and the box must be switched to standby and back to recover. On the audio side you can get pops and cracks that are at much higher amplitude than the programme material, with the risk – if the volume is set much above average – of loudspeaker cone damage. Many viewers report that the problem is far worse in the early evening. In almost every case a spectrum analyser check at the aerial site has revealed the cause to be vehicle ignition interference, though this has been well within regulated limits. All the DTT boxes I have examined, from various manufacturers, suffer to a greater or lesser degree from this problem.

Analogue terrestrial CTV signals degrade 'gracefully', and are far more robust than the 'all-or-nothing' digital alternative in the modern, hostile EM world. In terms of the crucially important EMC performance, the current DTT offerings are, overall, hopelessly outclassed by the existing, if ancient, analogue services.

In my experience the reaction of the service provider to complaints about poor reception has been abysmal. The trade has been provided with post-code charts, CD-ROMs etc. showing good and fringe reception areas. But, when the inevitable poor-reception complaint arises, either the aerial feeder or the box manufacturer is blamed. Here are some favourite reactions: "the box's screening is inadequate"; "you need double-screened coax"; "you live in a bungalow"; "you can't use a loft aerial"; "you can't use a communal aerial"; and "you need a mast-head preamp". Suggestions made when it's pointed out that the interference is arriving directly at the aerial site include: "tilt the aerial skywards by fifteen degrees"; "raise the height of the aerial by a further twenty feet"; "move the aerial to the back of the house"; and "you live too near a main road".

Seldom do any or all of these suggestions have any significant effect on the problem. If a stronger complaint is made, there is usually an offer of a full refund along with comments such as "the service is still being developed" or "if you were served by Crystal Palace there would be no problem".

If this experience is representative of the future of DTT broadcasting in the UK, heaven help us all.

*Dennis Glover,  
Stansted TTS, Essex.*

**Please note the following amendments to the Spares Guide published in our April issue.**

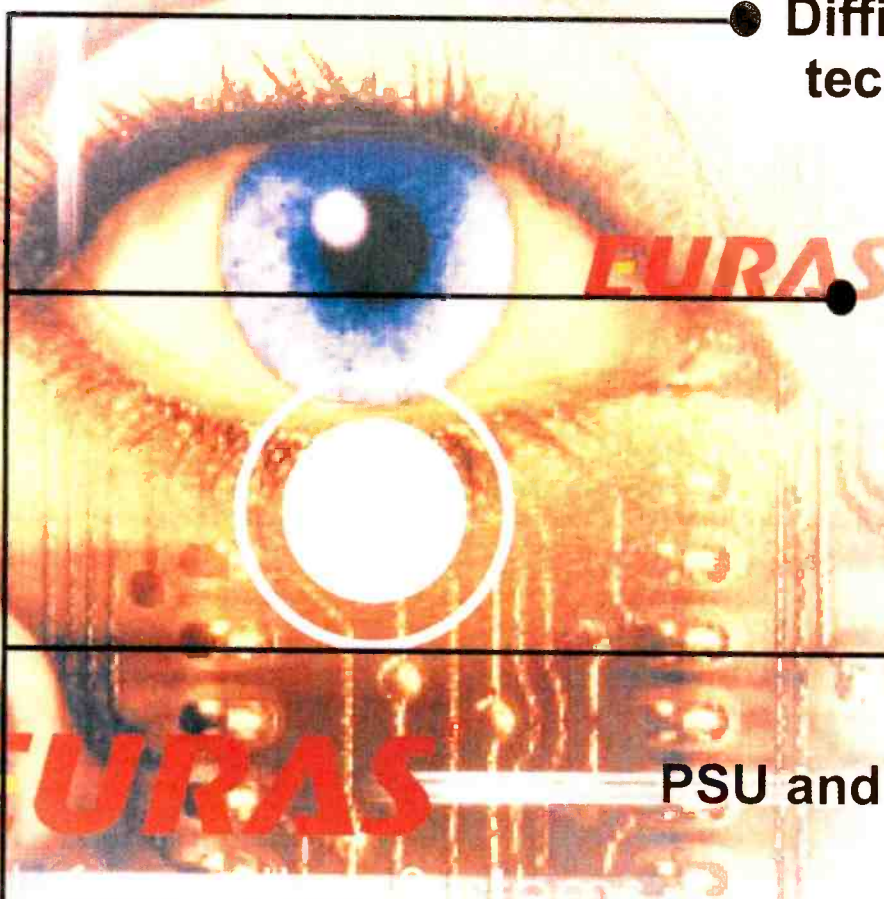
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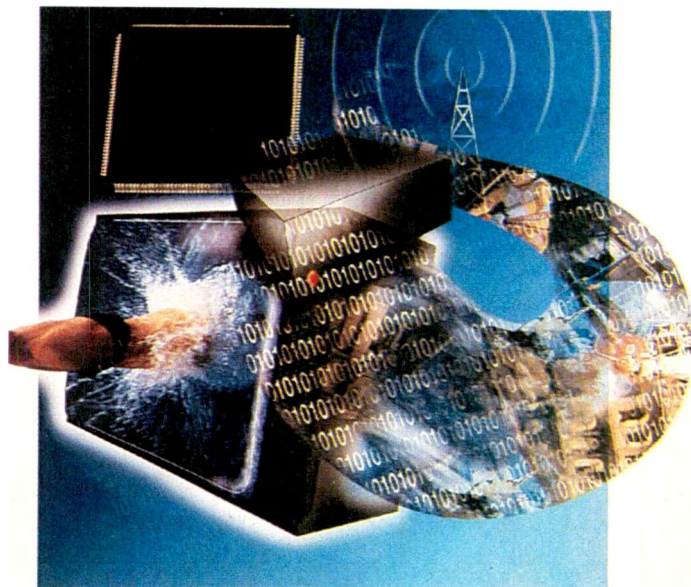
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Experience with digital TV installations, both terrestrial and satellite, is fast increasing. J. LeJeune provides a summary of some problems that have been encountered and generally-recommended best practice

# Hands-on Digital



**D**igital TV installation has already become quite a big business. A few installations have not gone well, while others have required little work apart from connecting the set-top box and, in the case of BSkyB, making the connection to the telephone network. The following notes are based on feedback from several engineers engaged in this work.

## Digital Terrestrial TV

The modulation system used for DTT is COFDM (Coded Orthogonal Frequency Division Multiplex). In the UK, it uses 1,705 carriers which are spaced at about 4.5kHz intervals across the 8MHz video channel bandwidth. Adjacent carriers have a phase difference of 90° between them (hence orthogonal). A synchronous form of demodulation is used, giving peak detection of a carrier while the adjacent carriers are at zero.

COFDM is a very rugged form of transmission. It actually takes advantage of reflected signals by using them to enhance the signal strength. Where cancellation occurs because of the phase relationships, the comprehensive error correction system built in puts matters right.

Experience to date has shown that COFDM is very tolerant of poor reception conditions, but if the signal level is below 100µV there will be loss of the programme on occasions because of signal corruption caused by noise. A safety net of 6dB should be built in. This means that signals of less than 200µV require a degree of amplification.

Those used to analogue signals would probably go for a high-gain amplifier. But a high-gain amplifier could

loose the digital signal. There's a simple reason for this. The analogue signals present are at much higher levels, some 20-26dB greater. A high-gain amplifier will raise the level of the analogue signals as well as the digital signal, to the extent that overloading could occur in the amplifier's output stages. This would cause massive interference to the digital signal and the error correction circuitry would probably be unable to cope. So the digital system would shut down, giving that familiar symptom a blue screen. Use only sufficient gain to get your 200µV, or +46dBµV. The rule is: enough is enough!

## Measurement

Measurement of a DTT signal is more complex than analogue signal measurement. Those of us who have used meters to check analogue signals over the years have become used to interpreting the meter indication in terms of signal level. But a digital signal does not have the same power spectrum as an analogue one – see Fig. 1 for a comparison.

A signal-level meter usually has a fairly narrow bandwidth. This is acceptable with an analogue signal, because the transmitted power is concentrated around the carriers – vision, sound, colour subcarrier etc. But with a DTT signal the power is spread equally across its whole bandwidth. So an analogue meter will measure only a small portion of the carrier power and give an inaccurate measurement. The serious installer needs a specialised signal-level measuring instrument – really a portable spectrum analyser, but one built to withstand the rough-and-tumble conditions it will encounter in service.



Fig. 2 shows a spectrum-analyser type signal-level meter display. The transmissions are presented on a frequency rather than a time base, their height representing the transmitted power. As you can see, the DTT signal has a low but almost flat level across the whole of its bandwidth, while the analogue signal has large peaks at the vision carrier and the sound and colour subcarriers, with very low power in the sidebands. If you intend to specialise in digital installations, go for a spectrum-analyser type of meter.

### Practical Installation

The analogue engineer shouldn't be too worried about all this. In view of the fact that COFDM is a very rugged modulation system, a 'suck-it-and-see' approach is not at all out of place. When you install a terrestrial digital set-top box, try it with the customer's existing aerial. Take a look at the analogue signals first. Is the signal strength good? Ghosting doesn't matter too much, but is the signal level sufficient to provide relatively noise-free pictures? Then connect up the digital box.

It may be that the signals are OK in winter, with leafless trees, but that the return of spring brings signal deterioration and a service call. Your experience will enable you to assess and deal with this sort of thing.

If the installation is a completely new one, remember that the analogue signals are there to guide you. The rules of good UHF installation practice still apply.

If the aerial is a wideband type, it will have been designed for greater gain at the upper end of the band. This useful feature provides compensation for the increased download loss. Use low-loss coaxial cable of good quality, with a 75Ω impedance and high screening factor.

Many installers don't fit the coaxial plugs correctly. The new crimp-on type is superior, stays put on the cable under misuse conditions, and is easier to install. Try to avoid sharp cable bends, and don't crush the cable when cleating it to the walls/boarding – this is bad practice anyway, whether the signal is an analogue or digital one.

A poorly installed aerial system will give inferior results with an analogue signal: with a digital signal it may not work at all. Digital transmissions don't fade gracefully as the signal level drops. You either have a good, clean picture or nothing.

### Digital Satellite TV

The foregoing comments apply to satellite installations as well, only more so. Satellite transmissions use QPSK (Quadrature Phase Shift Keying) modulation. It's the same system that is used for Nicam sound with terrestrial TV. There are two carriers, at the same frequency but with a 90° phase separation. By inverting the phase of one or both of the carriers, four different two-bit states (symbols) can be transmitted.

QPSK has good immunity to noise, making it ideal for satellite use, but is susceptible to reflections and impulsive interference. While these are minimal with satellite reception, they become important when the signal has to be distributed to several receivers or there's a long cable run between the LNB and the set-top box.

Where amplification of the satellite IF signal (750-2,010MHz) is required, it is again useful to have the services of a spectrum analyser for signal-level measurement. There are several types, of varying degrees of usefulness, on the market. Again, much depends on how the readings obtained are interpreted – over a peri-

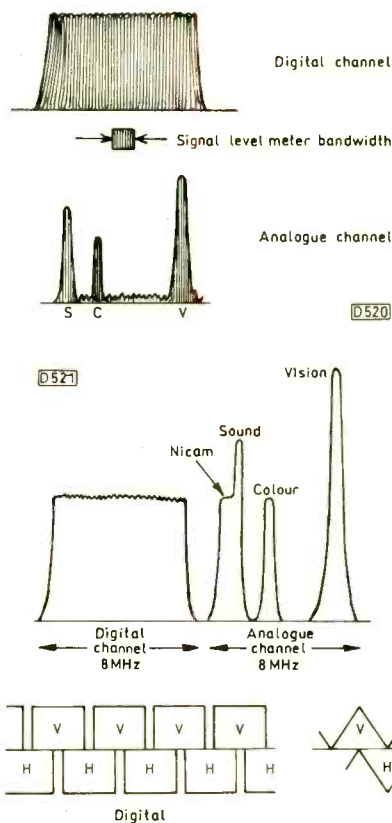


Fig. 1: Comparison of energy distribution in a DTT (a) and an analogue TV (b) channel.

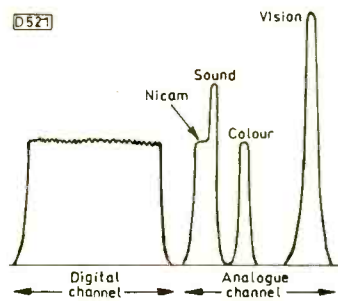


Fig. 2: Spectrum-analyser type of signal-strength meter display.

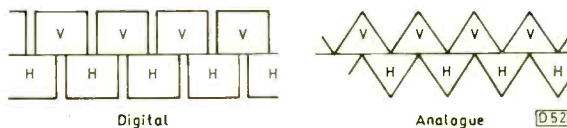


Fig. 3: Energy distribution with digital and analogue satellite TV channels.

od of time you become used to your own measuring instrument. This does not sound very scientific, but it's a practical approach to the problem.

### Dish/LNB Installation

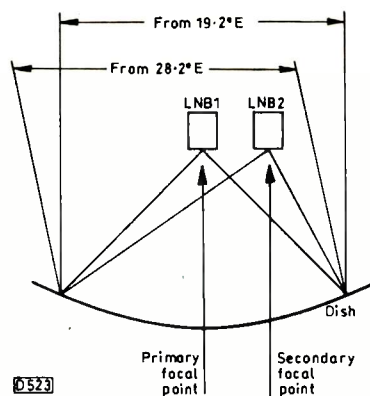
Installation of the dish and LNB for digital satellite TV reception is the same as for analogue, but one very important point is that to avoid cross-polarisation interference the LNB's skew angle must be set accurately. The reason for this is the modulation system characteristics: as with COFDM, the entire channel is filled with energy – in contrast, with the FM used for analogue transmissions the maximum energy is at the centre frequency. Fig. 3 shows the difference. Slight misalignment of the LNB skew angle will result in considerable cross-polarisation interference, which will bring about the blue-screen situation.

The satellite signals use the same IF band as analogue ones, but are in the high section. This may require a 22kHz tone to be present – the tone is permanently on with most digital satellite receivers.

The type of meter reviewed elsewhere in this issue can be used for digital satellite finding.

The quality of the cabling between the LNB and the receiver is important with QPSK. Try to do it in one length. Back-to-back F connectors have considerable insertion loss and, unless they are of superior quality, also introduce an impedance mismatch. Avoid sharp bends and cable squashing by the clips used. Crimp-on F connectors are best: they stay on the cable, and foil the best attempts of curious children to dislodge them. Use the correct tool to fit a crimp-on connector – if pliers or some other unsuitable tool is used there is likely to be cable damage and a mismatch.

**Fig. 4: Prime and secondary focal points for reception from 19.2°E and 28.2°E.**



### Two LNBs

Provided it is of the correct, Astra-recommended size, a dish used for analogue reception from 19.2°E should also provide, at a secondary focal point, an adequate digital signal from 28.2°E. But note that a secondary focal point is not as efficient, in terms of signal energy pick-up, as the prime focal point. See Fig. 4. The secondary focal point for 28.2°E is a few centimetres to the right of the prime focal point.

Various brackets are available, making the installation of a second LNB relatively simple. Select one that enables the LNB to be adjusted for azimuth, elevation and focal distance independently, so that the signal pick-up can be optimised. And use a separate cable between the second LNB and the receiver.

### Telephone Link

A telephone line connection for return path communication between the microprocessor chip in the set-top box and Sky headquarters is required with a SkyDigital installation. The job should be a simple one but never is. The TV set may be in the TV room over the garage while the telephone is at the opposite end of the house by the hall window! An LF wiring job is simply a matter of hiding the cable as best one can and satisfying the customer. ONdigital will also require a phone connection before long. Do it now, in readiness.

### Aesthetics and Council Requirements

Despite the best will in the world, there will be times when technical requirements conflict with aesthetic ones. A thorough understanding of the technical reasons for doing what you decide to do, explained with a degree of authority, will persuade most customers that you are working in their best interests.

Local councils are different: they will have a rigid set of rules, called 'guidelines' but always enforced dogmatically. It is best to say "yes" to everything demanded, then instal the equipment as you would for an important customer, again using your knowledge and authority.

At this stage not many people know much about digital reception. This gives you an advantage.

### Distribution Systems

Digital signal performance in a distribution system is again a matter, initially, of trial-and-error. Small, well-

designed and maintained systems, from a domestic four-outlet UHF job to one for a small block of flats, may need no work done on them.

This depends largely on whether any amplifiers in the network are running well within their capabilities and the cabling and accessories provide a good match. An amplifier that runs at maximum output with analogue-only signals will probably overload when digital signals are added. Cables and accessories – splitters, taps, outlet plates etc. – need to be of good quality. Cable should have a high screening factor – this applies to all network hardware. The 75Ω characteristic impedance must be observed. Any mismatches can cause problems that could shut down a digital receiver.

The main problem is likely to be reflections, which the COFDM used for terrestrial transmissions can ignore – or even use to advantage. Alongside these however there are problems caused by uneven frequency response over individual channels (slope) and phase errors. The latter can cause serious data errors with a digital transmission.

Screening is important with both analogue and digital signals. But whereas analogue signals will be subject to degradation that the viewer will probably tolerate, with a digital signal the receiver will shut down under strong interference conditions, with temporary loss of reception. Viewers will react more strongly to loss of reception than to a passing disturbance – the result is a service call.

Adding digital signals to an existing communal aerial system calls for caution. Some systems have frequency-translated channels that occupy what, in the UHF band, were spare channel spaces. Suddenly the digital channels at the local transmitter are switched on, and appear close to or on top of the translated channels. The digital channels are generally placed adjacent to analogue ones, so this may not be a problem in most areas, but there can be problems where this channel arrangement is not used. It's rare to find adjacent analogue channels in a distribution system, but installers in coastal areas may encounter this problem where it has been necessary to choose alternative channel allocations to avoid interference with services on mainland Europe.

### Viewer Advice

Digital TV is a new experience, and you may get questions from viewers about it. Many viewers find that the delay in the appearance of the picture after changing channels is annoying, and want to know why it occurs. Channel surfers are really frustrated by this. Selection of a new channel means that the receiver has to adopt a search routine to find the relevant data packets. Then a full picture has to be built up in memory, and sound synchronism established, before the display appears. This takes up to two seconds, depending on whether the new service is in the same or another multiplex and whether it's encrypted or free-to-air. Most viewers will not be aware that one channel may carry five or six TV services in a multiplex, maybe more in the future. Much depends on advances in the technology.

As with many developments before it, digital TV will soon become an everyday matter and those of us in the trade will wonder what the fuss was all about!



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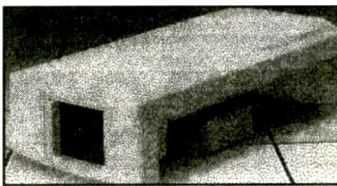
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4.5mw, 75 metre range, hand held unit runs on two AA batteries (supplied) 670nm. £29 REF DEC49J

#### HOW TO PRODUCE 35 BOTTLES OF WHISKY FROM A SACK OF POTATOES

Comprehensive 270 page book covers all aspects of spirit production from everyday materials. Includes construction details of simple stills. £12 REF MS3

#### NEW HIGH POWER MINI BUG

With a range of up to 800 metres and a 3 days use from a PP3 this is our top selling bug! Less than 1" square and a 10m voice pickup range. £28 REF LOT102

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Suitable for cctv cameras, enables the camera to be used in total darkness! £6 REF EF138

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Handheld battery powered lamp, 4 inch reflector, gives out powerful pure infrared light! Perfect for CCTV use, night sights etc. £29 REF PB1

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240X175MM, £12 REF SS51

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We have collated 140 business manuals that give you information on setting up different businesses, you peruse these at your leisure using the text editor on your PC. Also included is the certificate enabling you to reproduce (and sell) the manuals as much as you like! £14 REF EP74

#### HIGH POWER DC MOTORS, PERMANENT MAGNET

12-24v operation, probably about 1/4 horse power, body measures 100mx75mm with a 60mmx5mm output shaft with a machined flat on it. Fixing is simple using the two threaded bolts protruding from the front. £22 REF MOT4

#### INFRA RED REMOTE CONTROLS

Made for TV's but may have other uses. Pack of 100 £39 REF IREM



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#### ELECTRONIC SPEED CONTROLLER KIT

For the above motor is £19 REF MAG17. Save £5 if you buy them both together, 1 motor plus speed controller rrp is £41, offer price £36 REF MOT5A

#### SONY STEREO TV CHASSIS

Assemblies comprising complete TVPCB excluding tube and scan coils. Nizam stereo, mains input. Appear to be unused but sold 'as seen'. Would probably be good for spares or as a nizam stereo TV sound receiver and amplifier. For KV29F1U and KV25F1U(BE3D) PCB no's 1-659-827-12 1-659-826-14 1-711-800-11 £20 REF STV1

RCB UNITS Inline IEC lead with fitted RC breaker. Installed in seconds. Pack of 3 £9.98 REF LOT5A

#### RADIO CONTROLLED CARS etc

No remotes but good strippers for servos' motors and receivers. Sold as is, no returns, mixed types. £3 each REF RCC2

#### VOICE CHANGERS

Hold one of these units over your phone mouth piece and you can adjust your voice using the controls on the unit! Battery operated £15 REF CCC3

#### LOW COST CORDLESS MIC

500' range, 90-105mhz, 115g, 193x26x39mm, 9v PP3 battery required. £17 REF MAG15P1

#### AUTO SUNCHARGER

155x300mm solar panel with diode and 3 metre lead fitted with a cigar plug. 12v 2watt. £12.99 REF AUG10P3

#### SOLAR POWER LAB SPECIAL

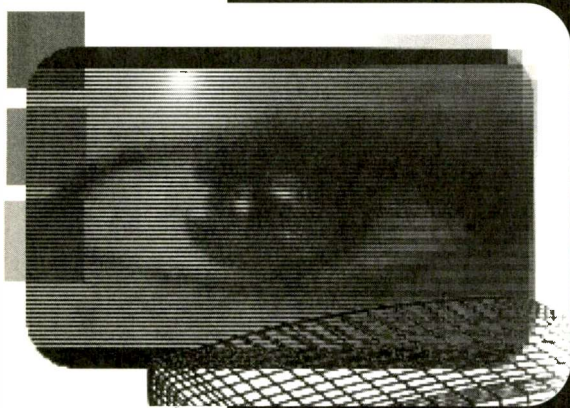
2x6"x6" 6v 130mA cells, 4 LED's, wire, buzzer, switch + 1 relay or motor. £7.99 REF SA27

#### SOLAR NICAD CHARGERS

4 x AA size £9.99 REF 6P476, 2 x C size £9.99 REF 6P477

#### 5.25" FLOPPY DISKS

Pack of 500 disks £25 REF FDJ



**Reports from**  
**Philip Blundell, AMIEelec**  
**Michael Dranfield**  
**Coplin J. Guy**  
**Kevin J. Green, TMIE**  
**Terry Lamoon**  
**Graham Colebourn**  
**David A. Chaplin and**  
**Pete Gurney, LCGI**

### **Grundig ST61-460 (CUC4635 chassis)**

If there is no Nicam sound, mono FM sound working normally, scope the waveforms at pins 3, 4 and 33 of the CF70123 chip IC2550. If there are waveforms at pins 3 and 4 but the one at pin 33 is low, disconnect pin 15 of the AMU2484 chip. This chip can develop low-resistance to chassis at pin 15. If you are lucky, disconnecting pin 15 will restore the signal at pin 33 of IC2550 and replacement of the AMU2484 chip will clear the fault. If you are unlucky both ICs may have failed. In this case you will probably find that an exchange Nicam board is cheaper than IC replacement. **P.B.**

### **Philips 21PT166B (AA5 AB chassis)**

The set was dead with the Wickman fuse 1571 open-circuit. This fuse can blow if the overvoltage thyristor 7481 has been triggered. In case there was an overvoltage condition, I fitted a new fuse and ran the set up slowly using a variac, monitoring the 183V HT supply as I did so. The HT was low, the EHT was low and the power supply was tripping. Yes! The LOPT had failed. The HT was correct when a new LOPT had been fitted. Maybe the HT had risen when the LOPT had failed? To be

# TV

## Fault Finding

on the safe side I gave the set a long soak test.

If fuse 1571 has blown because thyristor 7481 has been triggered, or if the fuse blows for no apparent reason, Philips recommends that the thyristor (part no. 4822 130 20293) and the 6.8k $\Omega$  surface-mounted resistor 3482 (part no. 4822 051 20682) are replaced. **P.B.**

### **Toshiba 32MW7DB (C7SS chassis)**

I recently had to repair a 32MW7 with the oversized on-screen display/slow channel change problem described in Toshiba Service Briefs August 1998 (page 694). Service kit TSN01467 is now supplied for both the 28MW7DB and the 32MW7DB. It consists of a new microcontroller chip (QA01) and a Dolby module (board AC3). QA01 has new software while the Dolby board has been modified to reduce background hiss from the rear speakers.

To fit the new Dolby board, unsolder the four screening can earthing tags, unclip the screening can cover and unplug the jumper connector to the IF module. The Dolby module can then be unplugged and the replacement fitted. Reconnect the jumper and resolder the earthing tags. There is no point in switching the set on at this stage: there will be no sound until the new microcontroller chip has been installed. Guess how I found this out!

Desolder the microcontroller chip and fit the new one. The tuning and geometry settings will be the same. Remember to connect the degaussing coils before you power the set, otherwise you will have the fright of your life when a strong burning smell fills the workshop as R811 overheats. This resistor is connected in parallel with the degaussing coils and, with the coils

disconnected, there is insufficient current flow to warm up the positioner. As a result R811 gets rather hot! **P.B.**

### **Grundig ST63-660/8 (CUC5360 chassis)**

If the tuner unit (29504-101.22) is intermittent, remove it and examine the area around the crystal with a magnifying glass. You could well find that the crystal is dry-jointed. **P.B.**

### **Sharp 37AM-23H (5BSA chassis)**

The problem with this portable was tuning drift. It could be brought on by flexing the panel. Suspecting damaged print, I made ohmic checks on the tracks that connect the tuner to the tuning voltage generator and the AFC section of the IF department, but the tracks were OK. Cold checks then revealed that the resistance between the tuning voltage pin and chassis changed as the panel was flexed. The 100nF surface-mounted capacitor C1013 was cracked and leaky. **P.B.**

### **Hitachi G8Q Chassis**

There was a blank, unmodulated raster and no channel LED display. If any button was pressed, odd dashes would light up. It was not microcontroller failure this time: the chip's 5V supply was missing. There was no input to the 5V regulator because D934 in the chopper power supply was short-circuit. The 2 $\Omega$  series safety resistor R933 was also faulty.

On test once the first fault had been repaired a second one was present. This time there was a bright white screen with flyback lines. The 200V video output stage supply was missing because another 2 $\Omega$  safety resistor, R720, had failed. **M.Dr.**



**Matsui TVR161**

If you get one of these TV-video combi units with the chopper FET Q500 (2SK2056) short-circuit, check resistors R504 (330k $\Omega$ ) and R506 (820k $\Omega$ ). One or both of them will be open-circuit. Don't use ordinary carbon types. The correct type is an 0.75W metal film resistor rated at 350V. These are readily available from Farnell Electronic Components in Leeds.

The 2- $\Omega$ , 7W mains input surge limiter resistor may also be faulty. **M.Dr.**

**Hitachi CPT1646R (NP84CQ chassis)**

The customer asked us to adjust the vertical hold – the picture was rolling. But the cause of the trouble was excessive HT, indicated by the large, stand-off, wirewound resistor near the aerial socket being cold. This resistor is connected in parallel with the series regulator transistor TR902 to bypass about two-thirds of the total current. TR902 was at full conduction because R908 in the error-sensing network had risen in value from 22k $\Omega$  to 28k $\Omega$ . **M.Dr.**

**Amstrad CTV2110 (new model)**

There was no sync. I was working with a very poor photocopy of the manual, so the cause took a long time to find. R395 was the culprit – at least I think this is the correct circuit reference number. It is an 82k $\Omega$  resistor which is connected to pin 30 of the AN5601K jungle chip. Its value had risen to the M $\Omega$  region. **M.Dr.**

**Sterivision Portable**

These 8in. battery-only sets, made by NEC, were sold by CPC some years ago. If the set is dead, check whether Q114 (2SD401) is short-circuit. If so you will have to replace the 12V zener diode ZD101 in its base circuit as well. Should the set be dead with the internal 4A fuse blown, replace ZD101.

If the set switches back to standby, and cycles on/off when the on/off button is held down, replace Q113 (2SD882). **M.Dr.**

**NEI 2591FTXN**

There was no EW correction with this Nicam set. The cause of the problem was associated with pin 8 of the TDA8145 EW chip. Pulses from the line output stage should be present here. They come via two series-connected 150k $\Omega$  resistors, one of which was open-circuit. As

a precaution I replaced them both. **M.Dr.**

**Matsui 1455**

The cause of intermittent field collapse was traced to R306 (2.7 $\Omega$ ), which was going open-circuit intermittently. **C.J.G.**

**Ferguson C49F (TX90E chassis)**

There was a most confusing symptom. Initially it looked like AGC trouble, as snow was displayed with no aerial connection then a noisy picture appeared as the aerial socket was approached. When the signal strength increased, the picture broke up and the raster blanked out.

I removed the IF module and replaced all the electrolytics in it. This made no difference. So I removed the module again and replaced the IC. Still no difference. In desperation I replaced the complete module. Again no difference. What, external to the IF module, could cause such a symptom? Don't ask me how, but the cause turned out to be RH04 (27k $\Omega$ ) which is in the 33V tuning supply feed. It had gone high in value, though the supply still read about 33V. There was noise present on the supply however – it increased as the received signal strength increased. Phew! **C.J.G.**

**Beko 16328NX**

Poor field linearity was the complaint with this set. I found that R717 had risen in value from 1M $\Omega$  to 28M $\Omega$ ! **C.J.G.**

**Mitsubishi CT2532TX (Euro 4 chassis)**

This set produced a rolling picture whose width was excessive. The cause of these symptoms was excessive HT – at 180V. The faulty component turned out to be C908 (10 $\mu$ F, 100V) which is the reservoir capacitor for the -41V supply to the chopper chip IC901. There had been no tripping or shutdown. **C.J.G.**

**Hitachi C2544TN**

I've recently had two cases of tripping on and off at one second intervals with these sets. In one case the cause was C924 (470 $\mu$ F, 16V), the reservoir capacitor for the 5V supply. In the other case R609 (1 $\Omega$ ) in the 27V supply to the field output chip was open-circuit. **C.J.G.**

**Mitsubishi CT21M5BT (EE4 chassis)**

The power supply would try to start

up, with the red LED lighting up. It would then back off. If the power supply was run with a dummy load in place of the feed to the line output stage it was OK. The cause of the trouble was the TEA5101B RGB output chip IC660 on the CRT's base panel – it had gone short-circuit. **K.J.G.**

**Mitsubishi CT28AV1BD (EE3 chassis)**

This set's grey scale would change of its own accord. When I checked the set in the service mode I found that the 'CRT bias request bit' would not set correctly to 00 with the G2 control. I replaced the MC44031 colour decoder/timebase generator chip IC201, which has been the cause of the trouble on previous occasions. The 'request bit' could then be set, but after one day of soak testing the grey scale was still no good. The fault was cured by replacing the TEA5101 RGB output chip IC660 and the 1N4148 diodes D655/6/7 on the CRT's base panel. **K.J.G.**

**Matsui 1091X/Bush CTV100**

This little 10in. portable wouldn't come out of standby. I found that the 19V supply to the line output transistor Q552 was low at 5V. The cause was D552 (ERD29-06) which was open-circuit. It's in the feed to pin 8 of the line output transformer. **T.L.**

**Hitachi C1411T**

This set suffered from remote control problems and faulty tuning. On investigation it auto-tuned all right but, when it had finished, only one channel was displayed and the set was in the skip mode, showing channels 1, 3, 5, 7 etc. The remote control did function, but when you tried to select teletext it wouldn't change over and locked up in that mode. All voltages around the main microcontroller chip were OK and the oscillator was working.

I decided to check with Hitachi before ordering a replacement chip, just in case, and was told that the text IC might be the cause – it has been known to lock up the data lines. So this and a 27MHz crystal were ordered. The IC made no difference, but the crystal did. Lucky I ordered it! **T.L.**

**Matsui 1407**

There was low, muffled sound. When I went to check the voltages in the audio circuit I noticed severe overheating around Q351 and

Q352. The sound was better when these transistors had been replaced, but was still distorted. A new loud-speaker put that right, and once it had been installed the transistors ran cool. T.L.

#### **GoldStar CIT2181**

This set would come out of standby and the power supply was functioning, but the HT was only 65V and there was tripping. I checked the line output transistor and transformer, which appeared to be OK, then noticed C807S which looked very stressed. It turned out to be leaky, a replacement restoring normal operation. T.L.

#### **Sony KVX21TU**

There was no picture. If the set was put in the tuning mode you could get a station, but the tuning would not stop as it should. The fault is quite a common one. It's always worth checking for dry-joints at T101 and T102 on the tuner PCB: this set was no exception. I cleaned the connections thoroughly then resoldered them. After that the tuning locked to stations and good pictures were produced. T.L.

#### **Matsui 2095T**

There was intermittent red drop out. A squirt of freezer on the MPSA42 red output transistor T901 on the CRT's base panel would restore correct colour. Once a replacement had been fitted there was a good grey scale. T.L.

#### **Nokia FX6332 (Euro Mono 2 chassis)**

This set was dead apart from a faint squeak that came from the power supply. Checks on the S2000A line output transistor 5T10 showed that it was very leaky. The cause of this was a cracked joint at 5C38, a small polyester capacitor in the network that feeds HT to the line output transformer. The values of the components in this network depend on the model – 5C38 ranges from 10nF in this one up to 33nF. G.C.

#### **Samsung CI210R**

This 10in. set produced a blank white raster with flyback lines and just visible green on-screen displays. The tube's cathode voltages were all very low, because the 115V HT supply to the RGB output transistors was low. This supply is obtained from the line output transformer: its reservoir capacitor C512 (22µF, 160V) had dried up. The 115V supply is also used to feed

the tuning voltage stabiliser D101. G.C.

#### **Sony KVM1420U (BE2A chassis)**

The picture would cut out intermittently, leaving a blank screen. The owner said that waggling the aerial socket would restore the picture. This chassis doesn't have the separate IF module used in previous models, but the cause of the fault was still cracked solder joints. The crucial one was at pin 16 of the TDA8304 chip IC502, but other pins also required resoldering. G.C.

#### **Ferguson ICC5 Chassis**

This set went into the standby mode every few minutes. It would sometimes come back on immediately, always returning on channel one. The cause of the trouble was a dry-joint at the collector of the chopper transistor TP24. D.A.C.

#### **NEI 2031TX**

This set would sometimes go to standby, after which it would be almost impossible to get it to switch on again. The stock faults with these sets, i.e. the thermistor in the power supply, faulty resistors and certain dry-joints, were all tried without success. As everything else had failed I decided to resolder every joint in the power supply. This cured the fault. D.A.C.

#### **Ferguson TX85 chassis**

Most of the time the picture was severely serrated, but sometimes there was a perfect display. So I looked for dry-joints. The culprit was found at one of the jumper connections between the small daughter board in the line output section and the main PCB, at the main PCB end. D.A.C.

#### **Philips CP110 Chassis**

The display said F1 and there was field collapse. The cause of the trouble was a dry-joint at the 12V regulator IC7675. D.A.C.

#### **Philips KT3 Chassis**

The customer said that the picture would sometimes jump in and out at the sides, and on a couple of occasions the set had died altogether. No amount of persuasion would instigate the fault in the workshop. I checked for dry-joints but couldn't find any. Then, while poking about with a plastic stick, I found that one end of R1561 had never been pushed through the board properly. It had finally parted from its precarious solder joint. R1561 is in series

with the base of the line output transistor Tr1562. The mains on/off switch was a bit 'iffy', so I replaced that as well. D.A.C.

#### **Ferguson 59P7A (ICC5 chassis)**

This set was stuck in standby because the S2000A3 line output transistor TL31 was short-circuit. The associated tuning capacitor CL48 (10.5nF) showed signs of overheating, so this was also replaced. It had probably been the cause of the transistor failure. In my experience power transistors very rarely fail unless an external cause is present, so I am always relieved when I find a second faulty item, connection etc. D.A.C.

#### **Orion 14ARX**

This set refused to power up, remaining stuck in standby. The STR50103 power supply chip and the start-up resistors appeared to be OK, so I carried out some checks around the microcontroller chip IC101 and found that its supply was low at only 3.2V. The supply comes from the 5V regulator IC105, whose input voltage was extremely unstable. It's derived from the mains supply via a resistive dropper/diode arrangement, with a further dropper resistor to the regulator. The associated reservoir capacitor C530 (3.3µF, 250V), which is next to the mains switch, was found to be open-circuit. There should be approximately 130V at this capacitor. P.G.

#### **Sharp DV3751H**

The complaints with this portable were intermittent failure to start, sometimes dead, sometimes lack of width. There was a common cause for this varied set of symptoms. The 5-6Ω, 5W resistor R601 in the HT feed to the line output stage varied in value (from correct to several ohms) and occasionally went open-circuit. P.G.

#### **Goodmans Compact 100**

The owner of this 9in. colour portable said there was sometimes a hum-bar on the picture. I placed the set on the soak bench and left it to run. After about an hour quite a bad hum-bar appeared. The cause was obvious when the back had been removed: one of the 1N5402 bridge rectifier diodes was open-circuit – its body had parted company with the leads some time ago. I replaced all four diodes and am still wondering how the set worked with a three-diode bridge! P.G.



# 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	31p	BU126	65p	BUV48AF	325p	MJ4502	300p	4N35	50p	LINEAR ICs	AN6340	600p	BA335	55p	BA7004	200p	
BC108	8p	BD435	30p	BU128	125p	BUV48C	250p	MJ10012	300p			AN203	210p	BA338	80p	BA7007	200p		
BC109	8p	BD436	30p	BU133	125p	BUV50	425p	MJ11015	250p			AN210	165p	BA340	75p	BA7021	180p		
BC109C	10p	BD437	28p	BU137	150p	BUV61	1000p	MJ11016	250p	RECTIFIER DIODES		AN211	150p	BA343	60p	BA7022	350p		
BC140	20p	BD438	30p	BU180	100p	BUV70	100p	MJ11032	300p	BY127	8p	AN2140	170p	BA346	60p	BA7025L	100p		
BC142	20p	BD439	40p	BU184	100p	BUV90	175p	MJ11033	300p	BY128	8p	AN217F	95p	BA401	60p	BA7107	475p		
BC143	20p	BD440	40p	BU204	65p	BUV93	375p	MJ15003	250p	BY129	8p	AN2228	280p	BA402	60p	BA7125	200p		
BC147	8p	BD441	40p	BU205	70p	BUW11A	200p	MJ15004	300p	BY164	40p	AN252	150p	BA511	145p	BA7604N	100p		
BC149	8p	BD533	50p	BU206	100p	BUW11AF	225p	MJ15015	250p	BY179	35p	AN259	250p	BA516	150p	BA7751L5	150p		
BC159	8p	BD534	38p	BU207	150p	BUW12A	150p	MJ15022	400p	BY184	32p	AN262	140p	BA518	150p	BA7752	250p		
BC171	10p	BD535	38p	BU208	75p	BUW12F	250p	MJ15023	400p	BY206	11p	AN271	240p	BA521	100p	BA7755	150p		
BC172	10p	BD537	40p	BU208AT	200p	BUW13A	200p	MJ15024	400p	BY207	20p	AN274	240p	BA524	240p	BA7755AS	150p		
BC177	14p	BD538	40p	BU208B	200p	BUW32A	500p	MJ15025	700p	BY227	19p	AN277B	400p	BA526	180p	BA8504	350p		
BC178	14p	BD643	50p	BU208D	130p	BUW48	550p	MJE340	25p	BY228	28p	AN278	60p	BA527	95p	BA15218	60p		
BC179	14p	BD645	50p	BU209	90p	BUW49	550p	MJE350	30p	BY298	15p	AN301	330p	BA532	100p	CA3140E	38p		
BC182	7p	BD647	50p	BU225	120p	BUW50	450p	MJE520	80p	BY329-1200	150p	AN302	650p	BA534	220p	CN362A	50p		
BC182L	7p	BD649	50p	BU226	120p	BUW81A	150p	MJE2955T	65p	BY448	20p	AN304	360p	BA536	100p	CN362A	60p		
BC183	7p	BD675	90p	BU312	90p	BUW84	75p	MJE3055T	65p	BYT11	25p	AN315	210p	BA537	120p	CN362A	80p		
BC183L	7p	BD676	40p	BU325	55p	BUW85	75p	MJE13004	100p	BYT13-1000	25p	AN316	350p	BA538	120p	CN362A	80p		
BC184	7p	BD677	38p	BU326A	55p	BUX10	180p	MJE13005	100p	BYT13-1000	25p	AN317	375p	BA539	120p	CN362A	80p		
BC184L	7p	BD678	40p	BU326B	55p	BUX11	200p	MJE13007	100p	BYW96E	36p	AN318	375p	BA540	120p	CN362A	80p		
BC212	7p	BD679	40p	BU406D	85p	BUX12	150p	MJE13009	100p	BYX10	15p	AN319	375p	BA541	120p	CN362A	80p		
BC212L	7p	BD680	40p	BU407	55p	BUX20	350p	MJE15028	200p	BYX55/600	25p	AN320	375p	BA542	120p	CN362A	80p		
BC213	7p	BD681	45p	BU407D	75p	BUX21	250p	MJE15029	200p	IN4001	3p	AN321	375p	BA543	120p	CN362A	80p		
BC213L	7p	BD682	45p	BU408	75p	BUX22	350p	MJE15030	250p	IN4002	3p	AN321.1K	375p	BA544	120p	CN362A	80p		
BC214	7p	BD705	50p	BU408D	75p	BUX23	900p	MJE15031	250p	IN4003	3p	AN321.5K	375p	BA545	120p	CN362A	80p		
BC214L	7p	BD707	50p	BU409	85p	BUX37	220p	MJE18004	125p	IN4004	3p	AN321.1K	375p	BA546	120p	CN362A	80p		
BC237	7p	BD709	50p	BU412	175p	BUX39	450p	MJE18004	125p	IN4005	3p	AN321.5K	375p	BA547	120p	CN362A	80p		
BC238	7p	BD711	50p	BU413	175p	BUX40	210p	MJE18204	125p	IN4006	3p	AN322	375p	BA548	120p	CN362A	80p		
BC239	7p	BD736	50p	BU414B	250p	BUX41	200p	OC29	350p	IN4007	3p	AN323	375p	BA549	120p	CN362A	80p		
BC239L	7p	BD738	50p	BU415A	170p	BUX42	200p	OC35	350p	IN4008	3p	AN323.1K	375p	BA550	120p	CN362A	80p		
BC300	20p	BD828	50p	BU426A	70p	BUX47A	220p	OC35	350p	IN4009	3p	AN323.5K	375p	BA551	120p	CN362A	80p		
BC302	20p	BD839	50p	BU433	120p	BUX48A	150p	OC35	350p	IN4010	3p	AN324	375p	BA552	120p	CN362A	80p		
BC303	20p	BD897	50p	BU500	100p	BUX55	800p	S2000A3	175p	IN4011	3p	AN325	375p	BA553	120p	CN362A	80p		
BC304	25p	BD899	50p	BU500D	125p	BUX60	180p	S2000A4	190p	IN4012	3p	AN326	375p	BA554	120p	CN362A	80p		
BC304L	25p	BD977	50p	BU505	90p	BUX81	160p	S2055A	175p	IN4013	3p	AN327	375p	BA555	120p	CN362A	80p		
BC328	7p	BDX33	60p	BU505D	90p	BUX84	50p	S2555AF	175p	IN4014	3p	AN328	375p	BA556	120p	CN362A	80p		
BC337	7p	BDX37	100p	BU505DF	90p	BUX85	50p	S2555A	175p	IN4015	3p	AN329	375p	BA557	120p	CN362A	80p		
BC338	7p	BDX44	100p	BU506	100p	BUX88	50p	TIP29	15p	IN4016	3p	AN330	375p	BA558	120p	CN362A	80p		
BC441	28p	BDX47	60p	BU506D	70p	BUX87	50p	TIP29A	22p	IN4017	3p	AN331	375p	BA559	120p	CN362A	80p		
BC446	8p	BDX64C	75p	BU506DF	100p	BUX98A	350p	TIP29C	25p	IN4018	3p	AN332	375p	BA560	120p	CN362A	80p		
BC516	18p	BDX62C	150p	BU508A	60p	BUZ71	75p	TIP29E	40p	IN4019	3p	AN333	375p	BA561	120p	CN362A	80p		
BC516L	22p	BDX63C	175p	BU508AF	60p	BUZ71AF	100p	TIP30	25p	IN4020	3p	AN334	375p	BA562	120p	CN362A	80p		
BC537	25p	BDX64C	175p	BU508APH	60p	BUZ72A	100p	TIP30A	25p	IN4021	3p	AN335	375p	BA563	120p	CN362A	80p		
BC546	8p	BDX65	80p	BU508B	75p	BUZ72AF	100p	TIP31A	22p	IN4022	3p	AN336	375p	BA564	120p	CN362A	80p		
BC547	8p	BDX65C	175p	BU508DF	85p	BUZ73A	150p	TIP31C	27p	IN4023	3p	AN337	375p	BA565	120p	CN362A	80p		
BC548	8p	BDX67C	275p	BU508DR	130p	BUZ73AF	60p	TIP32	24p	IN4024	3p	AN338	375p	BA566	120p	CN362A	80p		
BC549	8p	BDX71	70p	BU508V	110p	BUZ76A	110p	TIP32A	21p	IN4025	3p	AN339	375p	BA567	120p	CN362A	80p		
BC550	8p	BDX77	175p	BU508VF	100p	BUZ80	135p	TIP32C	28p	IN4026	3p	AN340	375p	BA568	120p	CN362A	80p		
BC556	8p	BDX87C	175p	BU526	75p	BUZ80AF	200p	TIP33	28p	IN4027	3p	AN341	375p	BA569	120p	CN362A	80p		
BC557	8p	BDX89C	150p	BU536	100p	BUZ83	200p	TIP33C	60p	IN4028	3p	AN342	375p	BA570	120p	CN362A	80p		
BC558	8p	BDW24	50p	BU546	125p	BUZ90A	180p	TIP34	65p	IN4029	3p	AN343	375p	BA571	120p	CN362A	80p		
BC559	8p	BDW93	50p	BU603	125p	BUZ91A	260p	TIP34C	60p	IN4030	3p	AN344	375p	BA572	120p	CN362A	80p		
BC560	8p	BDW94	50p	BU606D	225p	BY448	20p	TIP35C	65p	IN4031	3p	AN345	375p	BA573	120p	CN362A	80p		
BC563	20p	BDY29	225p	BU608D	125p	BYT11	25p	TIP36	65p	IN4032	3p	AN346	375p	BA574	120p	CN362A	80p		
BC564	20p	BDY56	225p	BU628	225p	IRF120	25p	TIP36A	65p	IN4033	3p	AN347	375p	BA575	120p	CN362A	80p		
BC564L	20p	BDY58	200p	BU705	175p	IRF130	130p	TIP41C	22p	IN4034	3p	AN348	375p	BA576	120p	CN362A	80p		
BCY33	200p	BDY90	125p	BU706DF	150p	IRF140	475p	TIP42A	22p	IN4035	3p	AN349	375p	BA577	120p	CN362A	80p		
BCY34	200p	BDY92	100p	BU706F	150p	IRF230	550p	TIP42C	22p	IN4036	3p	AN350	375p	BA578	120p	CN362A	80p		
BCY70	16p	BF137	35p	BU724A	100p	IRF240	425p	TIP42E	40p	IN4037	3p	AN351	375p	BA579	120p	CN362A	80p		
BCY71	16p	BF187	30p	BU801	70p	IRF250	375p	TIP42F	22p	IN4038	3p	AN352	375p	BA580	120p	CN362A	80p		
BCY72	16p	BF181	30p	BU806	70p	IRF330	600p	TIP50	60p	IN4039	3p	AN353	375p	BA581	120p	CN362A	80p		
BD115	30p	BF183	20p	BU807	60p	IRF340	325p	TIP51	60p	IN4040	3p	AN354	375p	BA582	120p	CN362A	80p		
BD124P	50p	BF195	7p	BU807F	75p	IRF350	750p	TIP52	80p	IN4041	3p	AN355	375p	BA583	120p	CN362A	80p		
BD131	25p	BF199	8p	BU808DF	210p	IRF450	650p	TIP54	85p	IN4042	3p	AN356	375p	BA584	120p	CN362A	80p		
BD132	25p	BF200	18p	BU810	10p	IRF510	110p	TIP102	70p	IN4043	3p	AN357	375p	BA585	120p	CN362A	80p		
BD133	25p	BF205	18p	BU812	10p	IRF520	110p	TIP105	65p	IN4044	3p	AN358	375p	BA586	120p	CN362A	80p		
BD135	20p	BF240	16p	BU826	120p	IRF530	120p	TIP106	65p	IN4045	3p	AN359	375p	BA587	120p	CN362A	80p		
BD136	20p	BF245	25p	BU826A	160p	IRF540	120p	TIP107	65p	IN4046	3p	AN360	375p	BA588	120p	CN362A	80p		
BD137	20p	BF254	15p	BU902	110p	IRF610	120p	TIP110	65p	IN4047	3p	AN361	375p	BA589	120p	CN362A	80p		
BD138	20p	BF255	12p	BU903	110p	IRF611	110p	TIP111	65p	IN4048	3p	AN362	375p	BA590	120p	CN362A	80p		
BD139	20p	BF256	12p	BU910	110p	IRF620	160p	TIP112	35p	IN4049	3p	AN363	375p	BA591	120p	CN362A	80p		
BD140	20p	BF257	18p	BU912	110p	IRF620	160p	TIP112H	35p	IN4050	3p	AN364	375p	BA592	120p	CN362A	80p		



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

# LINEAR ICs

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
HA13001	850p	LA2800	350p	LA7096	200p	LF353	48p	MC3302	50p	SAB3029	525p	STK3102 II	530p	STK5478	380p	STR16006	500p	TA7281	200p
HA13002	200p	LA3120	200p	LA7113	275p	LF355	60p	MC3401	45p	SAB3035	275p	STK3106	2500p	STK5479	300p	STR17006	500p	TA7282	180p
HA13006	400p	LA3150	200p	LA7116	275p	LF357	70p	MC3423P	100p	SAB3036	725p	STK3122 III	725p	STK5481	470p	STR20005	450p	TA7210	200p
HA13007	400p	LA3160	120p	LA7123	1300p	LF398	300p	MC3488AP	250p	SAB3037	700p	STK3152 II	900p	STK5482	285p	STR20012	450p	TA7213	200p
HA13108	280p	LA3161	40p	LA7210	60p	LH2426S	600p	MC34063AP	600p	SAB3042	825p	STK3156	500p	STK5483	440p	STR20015	450p	TA7283	400p
HA13117	175p	LA3210	65p	LA7212	150p	LM301	26p	MN1220T	300p	SAB3064	130p	STK4017	400p	STK5484	450p	STR30110	350p	TA7284P	200p
HA13118	140p	LA3226	60p	LA7214	150p	LM311	35p	MN1226	450p	SAB3209	225p	STK4019	480p	STK5487	525p	STR30115	275p	TA7288	220p
HA13119	140p	LA3246	75p	LA7220	125p	LM319	165p	MN1228	450p	SAB3210	250p	STK4021	380p	STK5488	480p	STR30120	400p	TA7291P	200p
HA13127	350p	LA3300	140p	LA7222	115p	LM324	30p	MN1276	1300p	SAB6456	125p	STK4024 II	550p	STK5490	450p	STR30123	450p	TA7292P	325p
HA13128	400p	LA3301	110p	LA7224	150p	LM335Z	150p	MN1280	150p	SAB8049	225p	STK4025	480p	STK5632	450p	STR30125	550p	TA7294	450p
HA13130	450p	LA3361	100p	LA7225	250p	LM339	35p	MN3004	600p	SAB8051AP	700p	STK4026	480p	STK5720	400p	STR30130	250p	TA7295	200p
HA13135	500p	LA3365	70p	LA7292	275p	LM348	50p	MN3005	2000p	SDA2003	450p	STK4028	550p	STK5725	450p	STR40090	350p	TA7302P	75p
HA13139	600p	LA3370	70p	LA7294	200p	LM358	45p	MN3011	4000p	SDA2004	325p	STK4032 II	1050p	STK5730	450p	STR40115	600p	TA7303	70p
HA13150A	1150p	LA3373	70p	LA7295	160p	LM380	80p	MN3101	110p	SDA2005	700p	STK4034 X	925p	STK6316	300p	STR41090	330p	TA7307	100p
KA13151	875p	LA3375	300p	LA7297	120p	LM381	150p	MN3102	110p	SDA2007	300p	STK4036	470p	STK6324B	500p	STR43111	950p	TA7310	100p
HA13403	400p	LA3376	80p	LA7305A	80p	LM382	130p	MN3207	375p	SDA2008	400p	STK4038	680p	STK6327	1200p	STR44115	475p	TA7312	120p
HA13406W	400p	LA3380	300p	LA7308	70p	LM386	60p	MN3208	950p	SDA2112	450p	STK4040 II	650p	STK6327	1200p	STR44115	475p	TA7313	70p
HA13408	350p	LA3390	250p	LA7311	200p	LM387	100p	MN6030B	350p	SDA2120	200p	STK4042 II	800p	STK6431	850p	STR50020	550p	TA7313	120p
HA13412	600p	LA3400	250p	LA7320	120p	LM389N	105p	MN6163A	700p	SDA2131	225p	STK4044	950p	STK6607	400p	STR50092	550p	TA7314	175p
HA13426	500p	LA3401	90p	LA7323	325p	LM393	50p	MTA001M	600p	SDA2208	450p	STK4046	950p	STK6722	725p	STR50103A	260p	TA7315	200p
HA13432	400p	LA3410	150p	LA7330	350p	LM431	50p	NE555	20p	SDA4212	775p	STK4048	1280p	STK6732	1000p	STR50113	500p	TA7317P	120p
HA13441	450p	LA3412	150p	LA7331	250p	LM710	40p	NE558	40p	SDA5241	725p	STK4050 II	1600p	STK6822	900p	STR50115	500p	TA7320P	200p
HA17524	250p	LA3600	60p	LA7332	225p	LM723	40p	NE559	80p	SDA5243-2	850p	STK4060	510p	STK6822	900p	STR50115	500p	TA7322	130p
KA2102	100p	LA3605	100p	LA7340	300p	LM741DIL	18p	NE565	110p	SDA5343	1450p	STK4066	510p	STK6822	1000p	STR51041	500p	TA7323	75p
KA2130	150p	LA3607	125p	LA7316	150p	LM741MET	45p	NE567	115p	SDA5640	200p	STK4101	500p	STK6822	275p	STR51041	500p	TA7324	150p
KA2131	110p	LA4030	180p	LA7391	550p	LM747	55p	NE571	290p	SDA5642	450p	STK4111	500p	STK6822	490p	STR54041	320p	TA7325	90p
KA2206	150p	LA4031	140p	LA7520	200p	LM1017	200p	NE592	85p	SGS444	500p	STK4112	500p	STK6898B	490p	STR55041	450p	TA7326	200p
KA2209	400p	LA4032	150p	LA7530	200p	LM1035N	350p	NE5932P	85p	SGS445	500p	STK4121	480p	STK6898B	600p	STR56041	550p	TA7328	110p
KA2210	230p	LA4051	160p	LA7531	200p	LM1040N	650p	NE5932P	85p	SLA0031	450p	STK4122	580p	STK6898B	600p	STR56041	550p	TA7328	110p
KA2212	65p	LA4052	160p	LA7545	160p	LM1203	225p	SA1004	650p	SLA7020M	450p	STK4122	580p	STK6898B	600p	STR56041	550p	TA7330P	80p
KA2213	130p	LA4101	80p	LA7550	275p	LM1203AN	225p	SA1005	325p	STA301A	200p	STK4132 II	600p	STK6898B	600p	STR59041	300p	TA7331P	80p
KA2214	130p	LA4102	100p	LA7555	150p	LM1875T	330p	SA1006	300p	STA314M	180p	STK4133 II	750p	STK7225	500p	STR60103	400p	TA7332	100p
KA2244	75p	LA4110	120p	LA7620	500p	LM1881N	375p	SA1008	450p	STA401A	220p	STK4141 II	420p	STK7226	600p	STR61145	350p	TA7335	85p
KA2244	75p	LA4120	120p	LA7680	675p	LM1886	250p	SA1010	400p	STA403A	270p	STK4142	530p	STK7226	600p	STR61145	350p	TA7336	180p
KA2261	100p	LA4128	105p	LA7681	650p	LM1888	250p	SA1012A	250p	STA405A	280p	STK4147 II	1450p	STK7253	450p	STRD1206	500p	TA7337P	175p
KA2263	100p	LA4140	60p	LA7710	200p	LM1894N	200p	SA1014	250p	STK4056	250p	STK4181	680p	STK7308	350p	STRD1406	600p	TA7339P	175p
KA2264	100p	LA4142	65p	LA7800	90p	LM1895N	275p	SA1026	400p	STA432A	220p	STK4182	650p	STK7309	400p	STRD1706	380p	TA7341	250p
KA2284	75p	LA4145	65p	LA7801	100p	LM2901N	35p	SA1027	400p	STA434A	270p	STK4181	650p	STK7310	470p	STRD1806	380p	TA7342	70p
KA2309	175p	LA4160	100p	LA7802	300p	LM2902N	35p	SA1029	150p	STA435A	270p	STK4182	550p	STK7348	400p	STRD1816	350p	TA7343	120p
KA2401	150p	LA4182	110p	LA7806	260p	LM2903N	40p	SA1042	325p	STA441C	220p	STK4184 II	1175p	STK7356	425p	STRD1906	550p	TA7347P	120p
KA2412	225p	LA4183	150p	LA7808	250p	LM3900	170p	SA1043P	675p	ST4451C	280p	STK4171	900p	STK7358	425p	STRD3035	300p	TA7348P	120p
KA2912	150p	LA4186	150p	LA7820	200p	LM3908	100p	SA1044	1000p	STK456C	280p	STK4172 II	680p	STK7402	560p	STRD4420	550p	TA7349P	175p
KA2913A	175p	LA4188	180p	LA7823	200p	LM3911N	200p	SA1056	300p	ST4A11	210p	STK4181	680p	STK7402	560p	STRD4420	550p	TA7349P	175p
KA2914A	200p	LA4190	300p	LA7824	130p	LM3914	160p	SA1057	375p	STA910M	280p	STK4182	750p	STK7406	650p	STRD4512	450p	TA7354P	60p
KA22472	100p	LA4192	140p	LA7830	90p	LM3915	160p	SA1058	225p	STK0025	420p	STK4191	700p	STK7408	675p	STRD5441	475p	TA7357	340p
KIA6213S	60p	LA4200	130p	LA7831	85p	LM3916	270p	SA1060	375p	STK0029	1000p	STK4192	700p	STK7410	1500p	STRD5541	475p	TA7358	85p
KIA6210AH	250p	LA4201	120p	LA7832	130p	LM3936	320p	SA1061	250p	STK0039	600p	STK4211 II	1000p	STK7418	1250p	STRD6008	575p	TA7359P	90p
KIA6283HK	50p	LA4260	150p	LA7833	150p	LM3936	320p	SA1062	250p	STK0040	520p	STK4211 V	800p	STK7554	600p	STRD6008E	450p	TA7361	120p
KIA6289K	210p	LA4261	150p	LA7837	150p	LM3936	320p	SA1063	250p	STK0040	520p	STK4211 V	800p	STK7554	600p	STRD6008E	450p	TA7361	120p
KIA6299K	210p	LA4265	125p	LA7838	200p	LM3936	320p	SA1064	250p	STK0040	520p	STK4211 V	800p	STK7554	600p	STRD6008E	450p	TA7361	120p
KIA7227CP	200p	LA4270	300p	LA7850	225p	LM13700	125p	SA1064	250p	STK0050	440p	STK4231 II	1050p	STK7561	650p	STRD6018	450p	TA7362	175p
KIA7313	45p	LA4282	350p	LA7851	200p	MA918B1	800p	SA1070	550p	STK0059	620p	STK4241 V	1250p	STK7563	800p	STRD6601	650p	TA7363P	35p
L149V	30p	LA4282	140p	LA7851	150p	M49481	700p	SA1075	325p	STK0070	810p	STK4272	500p	STK7576	1500p	STRM6546	900p	TA7373F	150p
L200	200p	LA4422	200p	LA7930	350p	M5265F	200p	SA1088	175p	STK0080	1000p	STK4273	550p	STK7703	1000p	STRM6549	900p	TA7374	175p
L272	200p	LA4430	130p	LA7940	200p	M50117P	500p	SA1101	700p	STK015	440p	STK4311	650p	STK7805	1600p	STRS5741	800p	TA7376P	100p
L272M	110p	LA4440	200p	LA7953	300p	M50119P	525p	SA1124	200p	STK016	760p	STK4332	365p	STK8260	1800p	STRS6307	600p	TA7378P	60p
L290B	225p	LA4445	200p	LA9200	300p	M50422P	750p	SA1130	550p	STK025	650p	STK4352	500p	STK8280	1200p	STRS308	600p	TA7401	250p
L291B	300p	LA4446	170p	LB205	170p	M50461	350p	SA1250	280p	STK050	1600p	STK4362	450p	STK73405 II	550p	STRS6309	600p	TA7402P	200p
L292	200p	LA4460	170p	LB210	170p	M50784	300p	SA1251	380p	STK077	520p	STK4372	450p	STK73410 I	350p	STRS6707	1000p	TA7403	325p
L293B	325p	LA4462	225p	LB258	100p	M50788	300p	SA1271	250p	STK080	180p	STK4392	500p	STK7340 II	500p	STRS6708	575p	TA7404	150p
L293C	225p	LA4466	225p	LB268	70p	M50790	600p	SA1274	280p	STK080	180p	STK4392	5						



# LINEARICs/JAPANESE TRANSISTORS

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
TA8164P	100p	TA1180A	120p	TA2760	400p	TA4661	225p	TA8391	675p	UPC1004C	130p	2SA771	90p	2SA1177	25p	2SB561	30p	2SC738	15p
TA8184P	350p	TA1185A	190p	TA2780	600p	TA4670	475p	TA8395	360p	UPC1009	950p	2SA773	50p	2SA1179	20p	2SB562	90p	2SC739	150p
TA8189P	130p	TA1185B	80p	TA2797	275p	TA4680	350p	TA8405	175p	UPC1010	200p	2SA775	35p	2SA1182	20p	2SB564	15p	2SC741	170p
TA8200AH	320p	TA1209B	200p	TA2815	150p	TA4685	75p	TA8415	650p	UPC1020	200p	2SA778	100p	2SA1184	120p	2SB566	90p	2SC742	150p
TA8201AK	300p	TA1220	50p	TA2822M	80p	TA4700A	750p	TA8416	625p	UPC1023	60p	2SA781	150p	2SA1185	200p	2SB568	50p	2SC743	85p
TA8205	220p	TA1235	300p	TA2824	85p	TA4714C	350p	TA8417	550p	UPC1024H	2	2SA786	25p	2SA1186	500p	2SB569	30p	2SC749	20p
TA8207K	175p	TA1236	240p	TA2840	200p	TA4716C	450p	TA8421	300p	UPC1025	75p	2SA794	50p	2SA1198	40p	2SB570	500p	2SC752	380p
TA8210	260p	TA1251	150p	TA3047	100p	TA4718A	250p	TA8425	500p	UPC1026	95p	2SA796	30p	2SA1200	25p	2SB571	25p	2SC753	25p
TA8211AH	200p	TA1270	150p	TA3048	130p	TA4725	750p	TA8432	300p	UPC1029	90p	2SA811	15p	2SA1202	25p	2SB572	60p	2SC754	25p
TA8214K	280p	TA1327	200p	TA3050	200p	TA4800	300p	TA8433	600p	UPC1031H	150p	2SA814	60p	2SA1204	225p	2SB573	40p	2SC755	15p
TA8215	300p	TA1405	50p	TA3083	200p	TA4810	500p	TA8440	300p	UPC1032	60p	2SA816	70p	2SA1206	60p	2SB574	40p	2SC756	20p
TA8216H	300p	TA1410	220p	TA3190	200p	TA4814A	300p	TA8442	200p	UPC1035C	110p	2SA817	20p	2SA1207	25p	2SB575	85p	2SC757	900p
TA8217P	120p	TA1412	35p	TA3301B	120p	TA4850	475p	TA8443	350p	UPC1043C	125p	2SA825	20p	2SA1208	70p	2SB576	12p	2SC758	100p
TA8220AH	500p	TA1506	275p	TA3310	160p	TA4851	325p	TA8444	200p	UPC1159H	70p	2SA836	20p	2SA1210	120p	2SB577	14p	2SC759	175p
TA8221AH	600p	TA1508	175p	TA3410	150p	TA4852	325p	TA8445	175p	UPC1161	110p	2SA837	200p	2SA1211	120p	2SB578	45p	2SC760	30p
TA8225H	475p	TA1510	170p	TA3420	200p	TA4853	200p	TA8452	200p	UPC1167	125p	2SA839	110p	2SA1215	600p	2SB579	35p	2SC761	15p
TA8225L	475p	TA1512	140p	TA3501	300p	TA4856	275p	TA8453	350p	UPC1170	150p	2SA841	20p	2SA1216	550p	2SB580	100p	2SC762	300p
TA8227	250p	TA1514A	325p	TA3502	360p	TA4881	200p	TA8461	950p	UPC1173	200p	2SA844	20p	2SA1217	100p	2SB581	85p	2SC763	15p
TA8229K	200p	TA1515A	200p	TA3504	300p	TA4935	300p	TA8469	225p	UPC1178C	120p	2SA847	25p	2SA1220	75p	2SB582	90p	2SC764	10p
TA8400P	200p	TA1518	350p	TA3505	275p	TA4940	200p	TA8540	250p	UPC1178H	250p	2SA854	25p	2SA1222	50p	2SB583	200p	2SC765	40p
TA8410K	200p	TA1517	150p	TA3507	280p	TA4942	200p	TA8541	200p	UPC1180C	200p	2SA861	45p	2SA1226	50p	2SB584	200p	2SC766	40p
TA8410P	200p	TA1519	250p	TA3507	250p	TA4944	175p	TA8542	300p	UPC185H	400p	2SA872	25p	2SA1227	25p	2SB585	200p	2SC767	225p
TA8432	200p	TA1519A	200p	TA3510	200p	TA4950	100p	TA8543	200p	UPC186	80p	2SA872A	50p	2SA1227	250p	2SB586	20p	2SC768	40p
TA8605N	350p	TA1520	275p	TA3520	250p	TA5030A	100p	TA8544	200p	UPC187	150p	2SA879	30p	2SA1232	180p	2SB587	60p	2SC769	20p
TA8606N	350p	TA1521	210p	TA3530	250p	TA5140A	200p	TA8545	300p	UPC188H	350p	2SA884	100p	2SA1237	25p	2SB588	20p	2SC770	20p
TA8607P	320p	TA1522	110p	TA3540	200p	TA5330T	300p	TA8546	200p	UPC189	200p	2SA888	45p	2SA1239	30p	2SB589	35p	2SC771	20p
TA8611AN	250p	TA1524	200p	TA3531	200p	TA5331T	150p	TA8547	150p	UPC191	140p	2SA886	45p	2SA1239	30p	2SB590	20p	2SC772	20p
TA8615N	250p	TA1526	200p	TA3532	200p	TA5332T	150p	TA8548	150p	UPC198H	200p	2SA887	15p	2SA1240	45p	2SB591	20p	2SC773	20p
TA8622N	350p	TA1534	2000p	TA3561	300p	TA5500	400p	TA8808T	350p	UPC1210	150p	2SA893	15p	2SA1242	40p	2SB592	22p	2SC774	225p
TA8631	500p	TA1540	420p	TA3561A	300p	TA5600	450p	TA8809T	350p	UPC1215V	125p	2SA896	25p	2SA1244	120p	2SB593	55p	2SC775	75p
TA8632N	550p	TA1541	500p	TA3562	260p	TA5660P	250p	TA8905	300p	UPC1222	130p	2SA899	40p	2SA1245	55p	2SB594	60p	2SC776	10p
TA8644N	425p	TA1542	250p	TA3562TF	300p	TA5700	200p	TA9020	200p	UPC1223	130p	2SA899	40p	2SA1246	80p	2SB595	100p	2SC777	10p
TA8644A	275p	TA1543	200p	TA3563	200p	TA5701	200p	TA9020C	250p	UPC1227V	225p	2SA904	20p	2SA1248	35p	2SB596	80p	2SC778	10p
TA8653N	1500p	TA1552Q	350p	TA3564	325p	TA5708	275p	TA9043	130p	UPC1227HA	45p	2SA907	650p	2SA1249	100p	2SB597	30p	2SC779	250p
TA8653AN	900p	TA1553AQ	325p	TA3565	220p	TA5709	375p	TA9500	750p	UPC1230	200p	2SA909	500p	2SA1252	20p	2SB598	70p	2SC780	20p
TA8659N	700p	TA1555Q	375p	TA3566	280p	TA5800	850p	TA9503	550p	UPC1237HA	70p	2SA912	70p	2SA1253	30p	2SB599	25p	2SC781	280p
TA8661N	450p	TA1557Q	300p	TA3567	350p	TA5820	370p	TA9513	225p	UPC1238	120p	2SA913	100p	2SA1259	55p	2SB600	25p	2SC782	130p
TA8701AN	275p	TA1558Q	300p	TA3569	300p	TA5832	125p	TA9517	225p	UPC1241H	120p	2SA914	100p	2SA1259	55p	2SB601	25p	2SC783	10p
TA8718N	550p	TA1560Q	675p	TA3571	200p	TA5850	175p	TA9520	200p	UPC1242H	150p	2SA915	30p	2SA1259	70p	2SB602	110p	2SC784	175p
TA8720	400p	TA1561	300p	TA3580	200p	TA5930	225p	TA9521	150p	UPC1245V	130p	2SA916	30p	2SA1261	150p	2SB603	35p	2SC785	65p
TA8739P	450p	TA1572	175p	TA3586	750p	TA6100Q	150p	TA9533T	80p	UPC1270H	250p	2SA921	40p	2SA1262	110p	2SB604	130p	2SC786	300p
TA8772N	450p	TA1574	125p	TA3590	250p	TA6101Q	120p	TA9535	300p	UPC1274V	250p	2SA922A	25p	2SA1263	280p	2SB605	40p	2SC787	225p
TA8780	25p	TA1576	170p	TA3591	360p	TA6111Q	225p	TA9536	300p	UPC1277	240p	2SA933	30p	2SA1264	200p	2SB606	15p	2SC788	20p
TBA120S	40p	TA1578A	210p	TA3592A	200p	TA6200	75p	TA9537	60p	UPC1280	200p	2SA933	30p	2SA1265	200p	2SB607	15p	2SC789	250p
TBA396	70p	TA1580	75p	TA6600-2	200p	TA6201	100p	TA9538	200p	UPC1281	200p	2SA933	30p	2SA1266	200p	2SB608	15p	2SC790	20p
TBA520	120p	TA1589	275p	TA6602	225p	TA6610-2	1100p	TA9539	100p	UPC1287A	320p	2SA935	40p	2SA1283	50p	2SB609	160p	2SC791	180p
TBA530	100p	TA1591	275p	TA6611-2	900p	TA7000	170p	TA9540	110p	UPC1288V	320p	2SA937	20p	2SA1284	60p	2SB610	160p	2SC792	180p
TBA540	90p	TA1596	200p	TA6612-2	900p	TA7010P	210p	TA9541	110p	UPC1298	320p	2SA939	140p	2SA1286	60p	2SB611	60p	2SC793	20p
TBA560	90p	TA1598	180p	TA6613	200p	TA7020T	120p	TA9542	110p	UPC1313H	40p	2SA940	50p	2SA1289	50p	2SB612	60p	2SC794	20p
TBA800	40p	TA1600	200p	TA6614	200p	TA7020T	120p	TA9543	110p	UPC1313H	40p	2SA942	50p	2SA1290	50p	2SB613	60p	2SC795	20p
TBA810AS	40p	TA1602A	200p	TA6615	200p	TA7021T	200p	TA9544	110p	UPC1330H	80p	2SA945	70p	2SA1293	110p	2SB614	60p	2SC796	20p
TBA820	55p	TA1670A	200p	TA6616-TX10800	100p	TA7050	100p	TA9545	110p	UPC1335V	120p	2SA951	60p	2SA1294	450p	2SB615	75p	2SC797	110p
TBA820M	35p	TA1675	200p	TA6617	85p	TA7052	120p	TA9546	110p	UPC1350	115p	2SA952	30p	2SA1295	500p	2SB616	200p	2SC798	600p
TBA920	100p	TA1701	500p	TA6618	85p	TA7053	200p	TA9547	110p	UPC1352C	450p	2SA953	60p	2SA1296	200p	2SB617	200p	2SC799	750p
TBA950	100p	TA1771	500p	TA6619	85p	TA7056	200p	TA9548	110p	UPC1365	225p	2SA954	30p	2SA1297	150p	2SB618	200p	2SC800	180p
TBA990	60p	TA1870A	200p	TA6620	75p	TA7057Q	225p	TA9549	110p	UPC1366	225p	2SA955	185p	2SA1300	110p	2SB619	200p	2SC801	150p
TC5020	80p	TA1904	80p	TA6621	100p	TA7072	100p	TA9550	110p	UPC1367	190p	2SA956	60p	2SA1306	110p	2SB620	110p	2SC802	33p
TC5051AP	80p	TA1904	80p	TA6622	100p	TA7077	175p	TA9551	110p	UPC1363C	190p	2SA956	60p	2SA1307	100p	2SB621	110p	2SC803	210p
TC5082P	170p	TA1905	80p	TA6623	100p	TA7211	100p	TA9552	110p	UPC1364C	190p	2SA956	60p	2SA1309	50p	2SB622	25p	2SC804	35p
TC5090A	230p	TA1908A	80p	TA6624	100p	TA7220	65p	TA9553	110p	UPC1365	250p	2SA956	60p	2SA1315	50p	2SB623	25p	2SC805	25p
TC9125BP	410p	TA1910	180p	TA6625	100p	TA7222	100p	TA9554	110p	UPC1366	250p	2SA956	60p	2SA1315	50p	2SB624	25p	2SC806	25p
TC9130P	150p	TA1940	180p	TA6626	100p	TA7230A	100p	TA9555	110p	UPC1367	250p	2SA956	60p	2SA1317	50p	2SB625	25p	2SC807	25p
TC9134	150p	TA1941	180p	TA															



# JAPANESE TRANSISTORS

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price
2SC1675	90p	2SC2281	700p	2SC2719	25p	2SC3263	280p	2SC3798	220p	2SD257	195p	2SD880	40p	2SD1327	150p	2SD1763A	60p	2SK312	750p
2SC1678	80p	2SC2282	90p	2SC2721	120p	2SC3264	390p	2SC3807	120p	2SD287	250p	2SD882	25p	2SD1328	60p	2SD1764	70p	2SK315	70p
2SC1683	100p	2SC2270	60p	2SC2724	15p	2SC3269	50p	2SC3808	70p	2SD291	250p	2SD889	35p	2SD1330	50p	2SD1765	70p	2SK320	120p
2SC1684	30p	2SC2271	25p	2SC2738	200p	2SC3270	50p	2SC3811	70p	2SD313	25p	2SD892A	75p	2SD1347	70p	2SD1769	110p	2SK323	130p
2SC1695	30p	2SC2274	15p	2SC2749	350p	2SC3271	75p	2SC3831	250p	2SD315	75p	2SD894	35p	2SD1348	65p	2SD1773	100p	2SK332	175p
2SC1729	900p	2SC2275	50p	2SC2750	300p	2SC3272	280p	2SC3832	135p	2SD325	30p	2SD895	100p	2SD1350	150p	2SD1776	70p	2SK359	40p
2SC1730	100p	2SC2278	70p	2SC2751	270p	2SC3273	30p	2SC3833	250p	2SD330	65p	2SD896	200p	2SD1376	60p	2SD1783	70p	2SK363	50p
2SC1735	70p	2SC2283	700p	2SC2752	75p	2SC3280	200p	2SC3834	100p	2SD348	300p	2SD898B	225p	2SD1378	60p	2SD1785	160p	2SK364	40p
2SC1740	100p	2SC2290	1800p	2SC2767	300p	2SC3281	600p	2SC3851	80p	2SD350	320p	2SD900	400p	2SD1379	100p	2SD1789	210p	2SK367	40p
2SC1741	35p	2SC2291	40p	2SC2769	400p	2SC3284	600p	2SC3853	220p	2SD358	40p	2SD905	450p	2SD1380	100p	2SD1792	120p	2SK374	40p
2SC1755	90p	2SC2298	35p	2SC2773	700p	2SC3293	85p	2SC3855	220p	2SD358	40p	2SD916	130p	2SD1382	60p	2SD1802	75p	2SK369	30p
2SC1756	35p	2SC2307	300p	2SC2774	500p	2SC3298	50p	2SC3857	500p	2SD359	50p	2SD917	300p	2SD1384	50p	2SD1806	75p	2SK373	40p
2SC1758	30p	2SC2308	10p	2SC2785	40p	2SC3299	120p	2SC3858	550p	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	100p	2SC2314	70p	2SC2787	10p	2SC3303	100p	2SC3868	100p	2SD371	20p	2SD946	120p	2SD1392	85p	2SD1825	60p	2SK389	115p
2SC1781	20p	2SC2316	150p	2SC2791	500p	2SC3306	130p	2SC3870	200p	2SD380	650p	2SD947	100p	2SD1395	80p	2SD1827	120p	2SK400	700p
2SC1789	100p	2SC2320	10p	2SC2792	220p	2SC3307	600p	2SC388A	25p	2SD381	50p	2SD950	300p	2SD1396	120p	2SD1843	70p	2SK405	450p
2SC1809	40p	2SC2324	120p	2SC2793	700p	2SC3309	150p	2SC3883	210p	2SD382	75p	2SD951	200p	2SD1397	100p	2SD1846	350p	2SK414	550p
2SC1810	250p	2SC2328A	60p	2SC2808	40p	2SC3310	125p	2SC3884A	200p	2SD386	70p	2SD957A	60p	2SD1398	120p	2SD1847	275p	2SK415	500p
2SC1815	10p	2SC2310	25p	2SC2810	360p	2SC3316	280p	2SC3885	250p	2SD388	150p	2SD958	50p	2SD1399	300p	2SD1849	280p	2SK423	75p
2SC1819	70p	2SC2315	175p	2SC2812	40p	2SC3317	350p	2SC3885A	290p	2SD389	80p	2SD965	35p	2SD1400	280p	2SD1850	325p	2SK427	50p
2SC1826	60p	2SC2329	480p	2SC2814	40p	2SC3326	50p	2SC3886A	275p	2SD400	14p	2SD970	170p	2SD1402	120p	2SD1853	40p	2SK430	200p
2SC1827	60p	2SC2230	300p	2SC2824	75p	2SC3327	60p	2SC3890	150p	2SD401	50p	2SD972	40p	2SD1403	225p	2SD1856	40p	2SK427	50p
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	2SK511	450p
2SC1834	50p	2SC2334	80p	2SC2827	130p	2SC3331	25p	2SC3895	325p	2SD415	55p	2SD982	90p	2SD1407	60p	2SD1863	35p	2SK513	325p
2SC1841	12p	2SC2335	55p	2SC2832	300p	2SC3333	120p	2SC3896	40p	2SD424	350p	2SD985	120p	2SD1408	125p	2SD1864	85p	2SK526	160p
2SC1844	50p	2SC2336A	125p	2SC2834	280p	2SC3345	100p	2SC3897	400p	2SD426	150p	2SD986	120p	2SD1409	170p	2SD1877	175p	2SK531	350p
2SC1845	15p	2SC2344	150p	2SC2837	250p	2SC3346	130p	2SC3907	250p	2SD427	350p	2SD988	70p	2SD1411	85p	2SD1878	160p	2SK534	700p
2SC1846	35p	2SC2347	35p	2SC2839	40p	2SC3352	200p	2SC3927	250p	2SD438	35p	2SD1010	40p	2SD1412	75p	2SD1879	275p	2SK537	900p
2SC1847	45p	2SC2353	120p	2SC2853	70p	2SC3353	280p	2SC3940	40p	2SD467	15p	2SD1012	40p	2SD1413	60p	2SD1880	380p	2SK538	300p
2SC1855	85p	2SC2360	120p	2SC2873	60p	2SC3355	50p	2SC3943	75p	2SD468	15p	2SD1020	40p	2SD1415	190p	2SD1881	350p	2SK539	1100p
2SC1856	25p	2SC2361	150p	2SC2877	120p	2SC3356	120p	2SC3944	80p	2SD471	10p	2SD1021	120p	2SD1417	75p	2SD1884	300p	2SK544	30p
2SC1865	700p	2SC2362	50p	2SC2878	20p	2SC3358	50p	2SC3950	120p	2SD476	100p	2SD1022	250p	2SD1425	260p	2SD1886	300p	2SK542	250p
2SC1870	700p	2SC2365	280p	2SC2879	3200p	2SC3376	300p	2SC3951	50p	2SD525	850p	2SD1024	850p	2SD1426	135p	2SD1887	225p	2SK553	225p
2SC1871	425p	2SC2369	100p	2SC2882	60p	2SC3377	50p	2SC3955	60p	2SD526	70p	2SD1027	850p	2SD1427	160p	2SD1894	300p	2SK555	320p
2SC1875	25p	2SC2371	25p	2SC2883	60p	2SC3378	120p	2SC3956	100p	2SD545	18p	2SD1030	75p	2SD1428	180p	2SD1895	225p	2SK556	500p
2SC1881	70p	2SC2373	210p	2SC2888	200p	2SC3379	1200p	2SC3972	250p	2SD549	120p	2SD1031	70p	2SD1430	280p	2SD1910	175p	2SK556	500p
2SC1890	15p	2SC2383	50p	2SC2890	50p	2SC3381	130p	2SC3973	210p	2SD551	30p	2SD1036	600p	2SD1431	200p	2SD1911	300p	2SK557	400p
2SC1895	500p	2SC2389	45p	2SC2909	60p	2SC3383	80p	2SC3975	210p	2SD554	225p	2SD1046	200p	2SD1432	400p	2SD1913	50p	2SK559	800p
2SC1904	125p	2SC2407	110p	2SC2910	25p	2SC3393	80p	2SC3987	160p	2SD555	50p	2SD1047	180p	2SD1433	300p	2SD1929	50p	2SK560	500p
2SC1906	15p	2SC2408	120p	2SC2911	80p	2SC3397	20p	2SC3996	600p	2SD556	225p	2SD1051	130p	2SD1438	60p	2SD1930	50p	2SK566	475p
2SC1907	20p	2SC2412K	50p	2SC2912	120p	2SC3399	50p	2SC3997	1250p	2SD558	200p	2SD1055	60p	2SD1439	165p	2SD1933	40p	2SK606	70p
2SC1909	250p	2SC2440	200p	2SC2921	650p	2SC3400	35p	2SC3998	800p	2SD560	50p	2SD1060	130p	2SD1441	220p	2SD1939	60p	2SK612	80p
2SC1913	90p	2SC2458	10p	2SC2922	480p	2SC3401	50p	2SC4006	100p	2SD571	20p	2SD1062	150p	2SD1442	80p	2SD1941	350p	2SK684	950p
2SC1914	30p	2SC2459	50p	2SC2923	75p	2SC3402	40p	2SC4020	150p	2SD575	530p	2SD1063	200p	2SD1445	200p	2SD1944	50p	2SK685	1150p
2SC1921	15p	2SC2466	55p	2SC2928	550p	2SC3405	130p	2SC4023	325p	2SD592	25p	2SD1064	250p	2SD1446	300p	2SD1958	80p	2SK699	100p
2SC1922	175p	2SC2486	275p	2SC2929	280p	2SC3409	400p	2SC4029	350p	2SD596	35p	2SD1065	160p	2SD1450	60p	2SD1959	210p	2SK719	300p
2SC1923	10p	2SC2492	50p	2SC2934	75p	2SC3416	30p	2SC4043	45p	2SD600	30p	2SD1069	150p	2SD1451	200p	2SD1978	50p	2SK725	500p
2SC1929	180p	2SC2470	85p	2SC2937	250p	2SC3417	90p	2SC4046	40p	2SD601	40p	2SD1073	350p	2SD1452	275p	2SD1984	60p	2SK726	425p
2SC1940	110p	2SC2482	20p	2SC2939	400p	2SC3419	120p	2SC4056	200p	2SD602	60p	2SD1088	150p	2SD1453	140p	2SD1981	50p	2SK727	475p
2SC1941	57p	2SC2483	20p	2SC2944	300p	2SC3420	80p	2SC4059	400p	2SD612	70p	2SD1094	375p	2SD1455	250p	2SD1984	200p	2SK726	425p
2SC1942	350p	2SC2483	120p	2SC2958	50p	2SC3421	45p	2SC4064	140p	2SD613	50p	2SD1110	225p	2SD1457	165p	2SD1986	45p	2SK727	475p
2SC1944	350p	2SC2484	185p	2SC2962	80p	2SC3422	75p	2SC4106	150p	2SD617	300p	2SD1111	20p	2SD1458	50p	2SD2006	75p	2SK739	400p
2SC1945	350p	2SC2485	400p	2SC2979	180p	2SC3423	65p	2SC4107	175p	2SD636	70p	2SD1113	225p	2SD1459	60p	2SD2010	250p	2SK759	300p
2SC1946	1500p	2SC2491	200p	2SC2987	280p	2SC3425	85p	2SC4123	230p	2SD637	15p	2SD1128	60p	2SD1468	40p	2SD2011	60p	2SK759	300p
2SC1947	450p	2SC2498	50p	2SC2988	150p	2SC3446	150p	2SC4124	200p	2SD637	15p	2SD1133	65p	2SD1487	225p	2SD2012	50p	2SK769	500p
2SC1953	45p	2SC2500	25p	2SC2995	60p	2SC3447	130p	2SC4125	275p	2SD638	15p	2SD1135	75p	2SD1484	150p	2SD2018	65p	2SK786	200p
2SC1957	70p	2SC2502	140p	2SC2999	50p	2SC3456	200p	2SC4137	40p	2SD639	20p	2SD1138	40p	2SD1487	300p	2SD2033	80p	2SK787	800p
2SC1959	10p	2SC2503	600p	2SC3001	1400p	2SC3457	125p	2SC4138	200p	2SD640	350p	2SD1140	40p	2SD1487	300p	2SD2033	80p	2SK791	225p
2SC1962	175p	2SC2512	20p	2SC3019	320p	2SC3459	180p	2SC4157	400p	2SD655	18p	2SD1142	350p	2SD1497-02	350p	2SD2062	250p	2SK792	225p
2SC1967	1300p	2SC2517	120p	2SC3020															



# REPLACEMENT VIDEO HEADS

Model	Price	Model	Price	Model	Price	Model	Price	Model	Price
<b>AKAI</b>		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	HRD250, HRD255, HRD258	1800p	NVFS1	4200p	VHR120, 130, 14, 141, 143G, 145P, 151, 15, 16, 17, 22, 23, 24, 27, 27A, VHR310, 330, 4100, 4105, 4200, 430, 4300, 4400, 4500, 5080, 5100, VHR5200, 5600, 6850, 7100, 7200, 7250, 7300, 8070, 8100, 8101, 8200, VHR7800, 7810, 8005P, 88015P, VHRD4400, 4410, 4500, 4600, VHR	3100p
VPT100, VSP900, VSP950	900p	VHSHB1, VHSCH1	2100p	HRD310, HRD315, HRD318	2300p	N.E.C.	850p	VHR2600, 2700, 2800, 2900, 3000, 3100, 3200, 3300, 3400, 3500, 3600, 3700, 3800, 3900, 4000, 4100, 4200, 4300, 4400, 4500, 4600, 4700, 4800, 4900, 5000, 5100, 5200, 5300, 5400, 5500, 5600, 5700, 5800, 5900, 6000, 6100, 6200, 6300, 6400, 6500, 6600, 6700, 6800, 6900, 7000, 7100, 7200, 7300, 7400, 7500, 7600, 7700, 7800, 7900, 8000, 8100, 8200, 8300, 8400, 8500, 8600, 8700, 8800, 8900, 9000, 9100, 9200, 9300, 9400, 9500, 9600, 9700, 9800, 9900, 10000	4500p
VSP200, VSP700, VS9800	900p	VHSEB1, VHSDB1	1600p	HRD370, HRD375, HRD378	1600p	N9096, DX1000, 1600, PX1200	850p	VHR4610, 6700, 4800	4100p
VS1	900p	VHSEY1, VHSFY2	1400p	HRD430, HRD435, HRD438	1800p	PVC600, 740, 744, 754, 763E, 764, PV2300, 2400, 760, 794, 770, 774	1650p	TL52000	4250p
VS2	900p	VHSHF1, VHSFG2	1300p	HRD490, HRD495, HRD498	1600p	N830, N831, N830, N831, N832, N833, N834, N835, N836	550p	VHR3500E	2150p
VS3	900p	VHSHG1, VHSFG4, VHSFG6,3	1300p	HRD550, HRD555, HRD558	1600p	82611AH1 (FOR MODEL DX3000)	2400p	VHR16, 235, 335E, 4150, 4160, 4350, 7250, 7260, 8250	1500p
VS10	1350p	VHSTJ1, VHSJTJ, VHSJTJ3, VHSWJ3, VHSVJ4	1300p	HRD610, HRD615, HRD618	1600p	DX85, 6290, N9610, NS7000	1800p	VT3000	1400p
VS11	900p	VHSHV1, VHSWH1, VHSXH1, VHSVH2	700p	HRD670, HRD675, HRD678	1600p	N895	3400p	<b>SHARP</b>	
VS33,35, 37, 38, 38EOG MKII, 53, 55, 66, 765, 766, 767, 768, 865, 867, VSP30, 33, 4, 400, 410, 420, 430, 440, 441, 450, 455, 480, 490, 497, VS351, 54, 55, VXS450, VXS470	1600p	VHSWJ, VHSXJ3	700p	HRD730, HRD735, HRD738	1600p	N8052, N9530, DX2000	1700p	VC390, VC393, VC496	2750p
VS512, VS515, VS516	2250p	<b>GRUNDIG</b>		HRD790, HRD795, HRD798	1600p	VCP1	1700p	VC488	4200p
VS462, 465, 467, 467EOG2, VSF12, 15EK, 15EOH, 300, 301, 310, VSF320, 330, 340, 350, VSG30, 33, 34, 35	2300p	V410, V415, 435, 450, 456, 460, 500, 505, 510, 520, 521, 530, 546	1600p	HRD850, HRD855, HRD858	1600p	PVC2300, 2400, 740, 744, 760, 764	1400p	VC479	1800p
VS470, 475, VSF10, 11, 180, 190	1000p	BARCELONA, MVSS400, 440, 500, 600, SE510, 610, 610, 611, 9100	1600p	HRD910, HRD915, HRD918	1600p	DS6000	3500p	VC789, VC790	2900p
VSF200, 210, 220, 221, 222, 230, 240, 260, 261, 262, 265, 270, 275, 280, VSF290, 510, 550, VSG20, 204, 205, 206, VSG21, 211, 212, 215	2400p	TVR4500, 4510, 5510, VS400, 440, 441, 500, 505, 510, 518, 600, 610, 611, 9100	1400p	HRD970, HRD975, HRD978	1600p	D5000	3500p	VC220, 220, 300, 381, 383, 384, 385, 386, 387, 388, 471, 477, 481, 482, VC483, 486, 3300, 6381, 9100, 9300, 9400, 9500, 9600, 9700	850p
VSF300, 330, 340, 350, VSG30, 33, 34, 35	2300p	VVS5180, VS6190, 700, 900, 901, 902, 9091, GV200, 201, 2092, SE210, 5110	1400p	HRD1030, HRD1035, HRD1038	1600p	VH900	3500p	VC108, 208, 382, 402, 405, 408, 500, 550, 571, 573, 581, 582, 583, VCSW20E, 600, 651, 674, 681, 684, 6V3, 750, 780, 781, 683, 684, 402, VCS500, 571, 573, 580, 584, 600, 682, 693, 700, 712, 780ME, 782, 7822, VC783, 8481, 8581, VCA10, 100, 102, 103, 1031, 103, 104, 105, 106, VCA111, 113, 116, 131, 140, 202, 203, 211, 234, 244, 254, 255, 30, 35, VCA40, VCB311N, 320, VCD801, 802, VCM73, VCT12, 310, 410, VCT510, 72, VCT1314, VCT1313	1500p
VS11, VS12	2300p	MADRID, SE5140, VS540, VS5480	3000p	HRD1090, HRD1095, HRD1098	1600p	VH1000 (ALL MODELS)	1100p	VC200, 220, 300, 381, 383, 384, 385, 386, 387, 388, 471, 477, 481, 482, VC483, 486, 3300, 6381, 9100, 9300, 9400, 9500, 9600, 9700	850p
VS6, VS8, VS9	2400p	MVS550, 620, VSS50, 620, 630, 640, 790, 930, 940	2400p	HRD1150, HRD1155, HRD1158	1600p	VH1, VH2A	700p	VC200, 220, 300, 381, 383, 384, 385, 386, 387, 388, 471, 477, 481, 482, VC483, 486, 3300, 6381, 9100, 9300, 9400, 9500, 9600, 9700	850p
VSX9	2250p	VS120, VS125, VS130, VS135, VS140, VS145, VS150, VS155, VS160, VS165, VS170, VS175, VS180, VS185, VS190, VS195, VS200, VS205, VS210, VS215, VS220, VS225, VS230, VS235, VS240, VS245, VS250, VS255, VS260, VS265, VS270, VS275, VS280, VS285, VS290, VS295, VS300, VS305, VS310, VS315, VS320, VS325, VS330, VS335, VS340, VS345, VS350, VS355, VS360, VS365, VS370, VS375, VS380, VS385, VS390, VS395, VS400, VS405, VS410, VS415, VS420, VS425, VS430, VS435, VS440, VS445, VS450, VS455, VS460, VS465, VS470, VS475, VS480, VS485, VS490, VS495, VS500, VS505, VS510, VS515, VS520, VS525, VS530, VS535, VS540, VS545, VS550, VS555, VS560, VS565, VS570, VS575, VS580, VS585, VS590, VS595, VS600, VS605, VS610, VS615, VS620, VS625, VS630, VS635, VS640, VS645, VS650, VS655, VS660, VS665, VS670, VS675, VS680, VS685, VS690, VS695, VS700, VS705, VS710, VS715, VS720, VS725, VS730, VS735, VS740, VS745, VS750, VS755, VS760, VS765, VS770, VS775, VS780, VS785, VS790, VS795, VS800, VS805, VS810, VS815, VS820, VS825, VS830, VS835, VS840, VS845, VS850, VS855, VS860, VS865, VS870, VS875, VS880, VS885, VS890, VS895, VS900, VS905, VS910, VS915, VS920, VS925, VS930, VS935, VS940, VS945, VS950, VS955, VS960, VS965, VS970, VS975, VS980, VS985, VS990, VS995, V1000, V1005, V1010, V1015, V1020, V1025, V1030, V1035, V1040, V1045, V1050, V1055, V1060, V1065, V1070, V1075, V1080, V1085, V1090, V1095, V1100, V1105, V1110, V1115, V1120, V1125, V1130, V1135, V1140, V1145, V1150, V1155, V1160, V1165, V1170, V1175, V1180, V1185, V1190, V1195, V1200, V1205, V1210, V1215, V1220, V1225, V1230, V1235, V1240, V1245, V1250, V1255, V1260, V1265, V1270, V1275, V1280, V1285, V1290, V1295, V1300, V1305, V1310, V1315, V1320, V1325, V1330, V1335, V1340, V1345, V1350, V1355, V1360, V1365, V1370, V1375, V1380, V1385, V1390, V1395, V1400, V1405, V1410, V1415, V1420, V1425, V1430, V1435, V1440, V1445, V1450, V1455, V1460, V1465, V1470, V1475, V1480, V1485, V1490, V1495, V1500, V1505, V1510, V1515, V1520, V1525, V1530, V1535, V1540, V1545, V1550, V1555, V1560, V1565, V1570, V1575, V1580, V1585, V1590, V1595, V1600, V1605, V1610, V1615, V1620, V1625, V1630, V1635, V1640, V1645, V1650, V1655, V1660, V1665, V1670, V1675, V1680, V1685, V1690, V1695, V1700, V1705, V1710, V1715, V1720, V1725, V1730, V1735, V1740, V1745, V1750, V1755, V1760, V1765, V1770, V1775, V1780, V1785, V1790, V1795, V1800, V1805, V1810, V1815, V1820, V1825, V1830, V1835, V1840, V1845, V1850, V1855, V1860, V1865, V1870, V1875, V1880, V1885, V1890, V1895, V1900, V1905, V1910, V1915, V1920, V1925, V1930, V1935, V1940, V1945, V1950, V1955, V1960, V1965, V1970, V1975, V1980, V1985, V1990, V1995, V2000, V2005, V2010, V2015, V2020, V2025, V2030, V2035, V2040, V2045, V2050, V2055, V2060, V2065, V2070, V2075, V2080, V2085, V2090, V2095, V2100, V2105, V2110, V2115, V2120, V2125, V2130, V2135, V2140, V2145, V2150, V2155, V2160, V2165, V2170, V2175, V2180, V2185, V2190, V2195, V2200, V2205, V2210, V2215, V2220, V2225, V2230, V2235, V2240, V2245, V2250, V2255, V2260, V2265, V2270, V2275, V2280, V2285, V2290, V2295, V2300, V2305, V2310, V2315, V2320, V2325, V2330, V2335, V2340, V2345, V2350, V2355, V2360, V2365, V2370, V2375, V2380, V2385, V2390, V2395, V2400, V2405, V2410, V2415, V2420, V2425, V2430, V2435, V2440, V2445, V2450, V2455, V2460, V2465, V2470, V2475, V2480, V2485, V2490, V2495, V2500, V2505, V2510, V2515, V2520, V2525, V2530, V2535, V2540, V2545, V2550, V2555, V2560, V2565, V2570, V2575, V2580, V2585, V2590, V2595, V2600, V2605, V2610, V2615, V2620, V2625, V2630, V2635, V2640, V2645, V2650, V2655, V2660, V2665, V2670, V2675, V2680, V2685, V2690, V2695, V2700, V2705, V2710, V2715, V2720, V2725, V2730, V2735, V2740, V2745, V2750, V2755, V2760, V2765, V2770, V2775, V2780, V2785, V2790, V2795, V2800, V2805, V2810, V2815, V2820, V2825, V2830, V2835, V2840, V2845, V2850, V2855, V2860, V2865, V2870, V2875, V2880, V2885, V2890, V2895, V2900, V2905, V2910, V2915, V2920, V2925, V2930, V2935, V2940, V2945, V2950, V2955, V2960, V2965, V2970, V2975, V2980, V2985, V2990, V2995, V3000, V3005, V3010, V3015, V3020, V3025, V3030, V3035, V3040, V3045, V3050, V3055, V3060, V3065, V3070, V3075, V3080, V3085, V3090, V3095, V3100, V3105, V3110, V3115, V3120, V3125, V3130, V3135, V3140, V3145, V3150, V3155, V3160, V3165, V3170, V3175, V3180, V3185, V3190, V3195, V3200, V3205, V3210, V3215, V3220, V3225, V3230, V3235, V3240, V3245, V3250, V3255, V3260, V3265, V3270, V3275, V3280, V3285, V3290, V3295, V3300, V3305, V3310, V3315, V3320, V3325, V3330, V3335, V3340, V3345, V3350, V3355, V3360, V3365, V3370, V3375, V3380, V3385, V3390, V3395, V3400, V3405, V3410, V3415, V3420, V3425, V3430, V3435, V3440, V3445, V3450, V3455, V3460, V3465, V3470, V3475, V3480, V3485, V3490, V3495, V3500, V3505, V3510, V3515, V3520, V3525, V3530, V3535, V3540, V3545, V3550, V3555, V3560, V3565, V3570, V3575, V3580, V3585, V3590, V3595, V3600, V3605, V3610, V3615, V3620, V3625, V3630, V3635, V3640, V3645, V3650, V3655, V3660, V3665, V3670, V3675, V3680, V3685, V3690, V3695, V3700, V3705, V3710, V3715, V3720, V3725, V3730, V3735, V3740, V3745, V3750, V3755, V3760, V3765, V3770, V3775, V3780, V3785, V3790, V3795, V3800, V3805, V3810, V3815, V3820, V3825, V3830, V3835, V3840, V3845, V3850, V3855, V3860, V3865, V3870, V3875, V3880, V3885, V3890, V3895, V3900, V3905, V3910, V3915, V3920, V3925, V3930, V3935, V3940, V3945, V3950, V3955, V3960, V3965, V3970, V3975, V3980, V3985, V3990, V3995, V4000, V4005, V4010, V4015, V4020, V4025, V4030, V4035, V4040, V4045, V4050, V4055, V4060, V4065, V4070, V4075, V4080, V4085, V4090, V4095, V4100, V4105, V4110, V4115, V4120, V4125, V4130, V4135, V4140, V4145, V4150, V4155, V4160, V4165, V4170, V4175, V4180, V4185, V4190, V4195, V4200, V4205, V4210, V4215, V4220, V4225, V4230, V4235, V4240, V4245, V4250, V4255, V4260, V4265, V4270, V4275, V4280, V4285, V4290, V4295, V4300, V4305, V4310, V4315, V4320, V4325, V4330, V4335, V4340, V4345, V4350, V4355, V4360, V4365, V4370, V4375, V4380, V4385, V4390, V4395, V4400, V4405, V4410, V4415, V4420, V4425, V4430, V4435, V4440, V4445, V4450, V4455, V4460, V4465, V4470, V4475, V4480, V4485, V4490, V4495, V4500, V4505, V4510, V4515, V4520, V4525, V4530, V4535, V4540, V4545, V4550, V4555, V4560, V4565, V4570, V4575, V4580, V4585, V4590, V4595, V4600, V4605, V4610, V4615, V4620, V4625, V4630, V4635, V4640, V4645, V4650, V4655, V4660, V4665, V4670, V4675, V4680, V4685, V4690, V4695, V4700, V4705, V4710, V4715, V4720, V4725, V4730, V4735, V4740, V4745, V4750, V4755, V4760, V4765, V4770, V4775, V4780, V4785, V4790, V4795, V4800, V4805, V4810, V4815, V4820, V4825, V4830, V4835, V4840, V4845, V4850, V4855, V4860, V4865, V4870, V4875, V4880, V4885, V4890, V4895, V4900, V4905, V4910, V4915, V4920, V4925, V4930, V4935, V4940, V4945, V4950, V4955, V4960, V4965, V4970, V4975, V4980, V4985, V4990, V4995, V5000, V5005, V5010, V5015, V5020, V5025, V5030, V5035, V5040, V5045, V5050, V5055, V5060, V5065, V5070, V5075, V5080, V5085, V5090, V5095, V5100, V5105, V5110, V5115, V5120, V5125, V5130, V5135, V5140, V5145, V5150, V5155, V5160, V5165, V5170, V5175, V5180, V5185, V5190, V5195, V5200, V5205, V5210, V5215, V5220, V5225, V5230, V5235, V5240, V5245, V5250, V5255, V5260, V5265, V5270, V5275, V5280, V5285, V5290, V5295, V5300, V5305, V5310, V5315, V5320, V5325, V5330, V5335, V5340, V5345, V5350, V5355, V5360, V5365, V5370, V5375, V5380, V5385, V5390, V5395, V5400, V5405, V5410, V5415, V5420, V5425, V5430, V5435, V5440, V5445, V5450, V5455, V5460, V5465, V5470, V5475, V5480, V5485, V5490, V5495, V5500, V5505, V5510, V5515, V5520, V5525, V5530, V5535, V5540, V5545, V5550, V5555, V5560, V5565, V5570, V5575, V5580, V5585, V5590, V5595, V5600, V5605, V5610, V5615, V5620, V5625, V5630, V5635, V5640, V5645, V5650, V5655, V5660, V5665, V5670, V5675, V5680, V5685, V5690, V5695, V5700, V5705, V5710, V5715, V5720, V5725, V5730, V5735, V5740, V5745, V5750, V5755, V5760, V5765, V5770, V5775, V5780, V5785, V5790, V5795, V5800, V5805, V5810, V5815, V5820, V5825, V5830, V5835, V5840, V5845, V5850, V5855, V5860, V5865, V5870, V5875, V5880, V5885, V5890, V5895, V5900, V5905, V5910, V5915, V5920, V5925, V5930, V5935, V5940, V5945, V5950, V5955, V5960, V5965, V5970, V5975, V5980, V5985, V5990, V5995, V6000, V6005, V6010, V6015, V6020, V6025, V6030, V6035, V6040, V6045, V6050, V6055, V6060, V6065, V6070, V6075, V6080, V6085, V6090, V6095, V6100, V6105, V6110, V6115, V6120, V6125, V6130, V6135, V6140, V6145, V6150, V6155, V6160, V6165, V6170, V6175, V6180, V6185, V6190, V6195, V6200, V6205, V6210, V6215, V6220, V6225, V6230, V6235, V6240, V6245, V6250, V6255, V6260, V6265, V6270, V6275, V6280, V6285, V6290, V6295, V6300, V6305, V6310, V6315, V6320, V6325, V6330, V6335, V6340, V6345, V6350, V6355, V6360, V6365, V6370, V6375, V6380, V6385, V6390, V6395, V6400, V6405, V6410, V6415, V6420, V6425, V6430, V6435, V6440, V6445, V6450, V6455, V6							









# VIDEO SERVICE KITS

<b>AMSTRAD</b> VCR700 <b>Contents</b> BELT SET, PINCH ROLLER, REEL IDLER, VIDEO LAMP Order Code: SK41	<b>HITACHI</b> VT11/VT33 <b>Contents</b> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK08	NV600/NV688 <b>Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND Order Code: SK25	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER TYRE, FF/REW IDLER TYRE Order Code: SK26	£5.50	£5.00	£12.00	£6.00
<b>FERGUSON &amp; JVC</b> 3V42/43 HRD455/HRD725 <b>Contents</b> BELT SET, PINCH ROLLER, CLUTCH MECHANISM, TENSION BAND Order Code: SK37	VT11/VT33 <b>Contents</b> BELT SET, T/U/P REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, FF/REW IDLER, CLUTCH PLATE, TENSION BAND Order Code: SK45	NV730/NV770 <b>Contents</b> SLOT IN BELT, LOADING BELT, PINCH ROLLER, IDLER UNIT, TENSION BAND Order Code: SK19	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, SLOT IN BELT, LOADING BELT, PINCH ROLLER, IDLER TYRE Order Code: SK20	£9.00	£13.00	£5.50	£3.00
3V58/59/64/65 HRD170/180/210/230/300/320/370/400/430/530/700/750 HRS5000 <b>Contents</b> BELT SET, PINCH ROLLER, IDLER ARM, TENSION BAND Order Code: SK44	VT52/61/62/63/64/65/85/86/640 <b>Contents</b> BELT SET, PINCH ROLLER, FF/REW ARM, CLUTCH PLATE, TENSION BAND Order Code: SK49	NV370/NV380/480/630/780/830/850/AG2100PK/AG2200PK <b>Contents</b> BELT SET, PINCH ROLLER, IDLER, TENSION BAND Order Code: SK21	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK22	£7.00	£14.00	£5.00	£2.75
3V29/3V30 HR7200/7300/7350 <b>Contents</b> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK05	VT400/405/410/13/14/15/18/420/25/26/28/430/31/35/46/450/498/510/520/25/26/30/35/36/540/545/46/48/570/575/576/580/85/88 <b>Contents</b> TIMING BELT, PINCH ROLLER, FF/REW ARM, CLUTCH BASE, TENSION BAND Order Code: SK52	NV777/NV788 <b>Contents</b> BELT SET, PINCH ROLLER, IDLER UNIT, TENSION BAND Order Code: SK17	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK18	£5.00	£9.75	£6.00	£4.00
3V35/36, 38/39/49 HRD110/111/120/225 <b>Contents</b> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK04	VT100/110/111/113/115/118/120/125/128/130/135/138/145/150/175/220/225/250/255/258/260/VTL30 <b>Contents</b> BELT SET, PINCH ROLLER, FF/REW ARM, CLUTCH PLATE, TENSION BAND Order Code: SK51	SHARP VC381 <b>Contents</b> BELT SET, PINCH ROLLER, REEL IDLER, TENSION BAND, VIDEO LAMP Order Code: SK47	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, REEL IDLER TYRE Order Code: SK48	£5.00	£14.00	£8.00	£3.25
3V31/3V42 HR7600/7610/7650/7655 <b>Contents</b> BELT SET, T/U REEL TABLE TYRE, PINCH ROLLER, REEL IDLER, T/U CLUTCH, T/U IDLER, TENSION BAND, VIDEO LAMP Order Code: SK33	<b>PANASONIC</b> NV2000/NV2010NV7000/NV7200/NV7800 <b>Contents</b> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK03	VC500/VC571/VC581/VC582/VC583/VC584/VC5F3 <b>Contents</b> BELT SET, PINCH ROLLER, REEL IDLER, TENSION BAND Order Code: SK60	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, REEL IDLER Order Code: SK61	£5.00	£5.00	£9.50	£5.00
3V35/36/38/39/49 HRD110/111/120/121/225 <b>Contents</b> BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, T/U CLUTCH, T/U IDLER TYRE, REEL IDLER TYRE Order Code: SK35	NV300/NV330/NV333/NV340/NV366 <b>Contents</b> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRE Order Code: SK01	VC781/VC7810/VC7822/VC785/VC786/VC793/VC800/VC100/VC102/VC104/VC104/VC104/VC104 <b>Contents</b> BELT SET, PINCH ROLLER, REEL DRIVE UNIT, TENSION BAND Order Code: SK64	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, REEL DRIVE UNIT TYRE Order Code: SK65	£5.50	£5.00	£13.50	£3.75
3V29/3V30 HRD7200/7300/7350 <b>Contents</b> BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, T/U CLUTCH, T/U IDLER TYRE, REEL IDLER TYRE Order Code: SK35	NV2000/NV2010 <b>Contents</b> BELT SET, PINCH ROLLER, FF IDLER, PLAY IDLER, TENSION BAND, VIDEO LAMP Order Code: SK13	VC681/VC682/VC684/VC685/VC693/VC699/VC6F3/VC700 <b>Contents</b> BELT SET, PINCH ROLLER, REEL DRIVE UNIT, TENSION BAND Order Code: SK62	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, REEL DRIVE UNIT TYRE Order Code: SK63	£5.50	£3.25	£13.50	£5.00
3V29/3V30 HRD7200/7300/7350 <b>Contents</b> 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	NV7000/NV7200/NV7800 <b>Contents</b> BELT SET, PINCH ROLLER, IDLER UNIT, PLAY IDLER, TENSION BAND Order Code: SK11	NV300/NV330/NV333/NV340/NV366 <b>Contents</b> BELT SET, PINCH ROLLER, IDLER UNIT, PLAY IDLER, TENSION BAND Order Code: SK15	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, IDLER TYRE, CLUTCH TYRE Order Code: SK12	£5.00	£3.25	£8.50	£3.25
3V44/45/48/53/54/55/57 HRP50/HRD140/150/158/160 HRD250/257/565/566/755 <b>Contents</b> BELT SET, PINCH ROLLER, CLUTCH MECHANISM, TENSION BAND Order Code: SK39	NVG7/NVG9/NVG10/NVG11/NVG12/NVG14/NVG15/NVG16/NVG18/NVG30/NVG120/NVG300/NVG400/NVH65 (PXA/ACI/AG1810 (PAK)) <b>Contents</b> LOADING BELT, CAPSTAN BELT, PINCH ROLLER, IDLER TENSION BAND Order Code: SK27	NV332 <b>Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND, FF/REW TYRE Order Code: SK29	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER TYRE, FF/REW IDLER TYRE Order Code: SK30	£9.50	£7.00	£6.00	£3.00
<b>FISHER</b> FVHP905/906/907/908/910/911/916/918 <b>Contents</b> BELT SET, PINCH ROLLER, IDLER, GEAR IDLER UNIT, TENSION BAND Order Code: SK57	NV230/250/260/280/430/450/460/470/650/810/890/AG1200PK/AG1500PK <b>Contents</b> BELT SET, PINCH ROLLER, IDLER, TENSION BAND Order Code: SK23	NV332 <b>Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND, FF/REW TYRE Order Code: SK29	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER TYRE, FF/REW IDLER TYRE Order Code: SK30	£5.00	£12.00	£12.00	£5.10
FVHP615/618/620/622/710/711/715/716/720/721/722/725/730/830/840 <b>Contents</b> BELT SET, PINCH ROLLER, IDLER, GEAR IDLER UNIT, TENSION BAND Order Code: SK68	NV230/250/260/280/430/450/460/470/650/810/890/AG1200PK/AG1500PK <b>Contents</b> BELT SET, PINCH ROLLER, IDLER, TENSION BAND Order Code: SK23	NV332 <b>Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND, FF/REW TYRE Order Code: SK29	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER TYRE, FF/REW IDLER TYRE Order Code: SK30	£3.00	£7.00	£6.00	£3.25
3V31/3V42 HR7600/7610/7650/7655 <b>Contents</b> BELT SET, T/U REEL TABLE TYRE, PINCH ROLLER, REEL IDLER, T/U CLUTCH, T/U IDLER, TENSION BAND, VIDEO LAMP Order Code: SK33	NVG7/NVG9/NVG10/NVG11/NVG12/NVG14/NVG15/NVG16/NVG18/NVG30/NVG120/NVG300/NVG400/NVH65 (PXA/ACI/AG1810 (PAK)) <b>Contents</b> LOADING BELT, CAPSTAN BELT, PINCH ROLLER, IDLER TENSION BAND Order Code: SK27	NV332 <b>Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND, FF/REW TYRE Order Code: SK29	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER TYRE, FF/REW IDLER TYRE Order Code: SK30	£5.00	£12.00	£12.00	£5.10
3V35/36/38/39/49 HRD110/111/120/121/225 <b>Contents</b> BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, T/U CLUTCH, T/U IDLER TYRE, REEL IDLER TYRE Order Code: SK35	NV230/250/260/280/430/450/460/470/650/810/890/AG1200PK/AG1500PK <b>Contents</b> BELT SET, PINCH ROLLER, IDLER, TENSION BAND Order Code: SK23	NV332 <b>Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND, FF/REW TYRE Order Code: SK29	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER TYRE, FF/REW IDLER TYRE Order Code: SK30	£5.00	£7.00	£6.00	£3.25
3V44/45/48/53/54/55/57 HRP50/HRD140/150/158/160 HRD250/257/565/566/755 <b>Contents</b> BELT SET, PINCH ROLLER, CLUTCH MECHANISM, TENSION BAND Order Code: SK39	NVG7/NVG9/NVG10/NVG11/NVG12/NVG14/NVG15/NVG16/NVG18/NVG30/NVG120/NVG300/NVG400/NVH65 (PXA/ACI/AG1810 (PAK)) <b>Contents</b> LOADING BELT, CAPSTAN BELT, PINCH ROLLER, IDLER TENSION BAND Order Code: SK27	NV332 <b>Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND, FF/REW TYRE Order Code: SK29	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER TYRE, FF/REW IDLER TYRE Order Code: SK30	£9.50	£7.00	£6.00	£3.00
<b>FISHER</b> FVHP905/906/907/908/910/911/916/918 <b>Contents</b> BELT SET, PINCH ROLLER, IDLER, GEAR IDLER UNIT, TENSION BAND Order Code: SK57	NV230/250/260/280/430/450/460/470/650/810/890/AG1200PK/AG1500PK <b>Contents</b> BELT SET, PINCH ROLLER, IDLER, TENSION BAND Order Code: SK23	NV332 <b>Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND, FF/REW TYRE Order Code: SK29	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER TYRE, FF/REW IDLER TYRE Order Code: SK30	£5.00	£12.00	£12.00	£5.10
FVHP615/618/620/622/710/711/715/716/720/721/722/725/730/830/840 <b>Contents</b> BELT SET, PINCH ROLLER, IDLER, GEAR IDLER UNIT, TENSION BAND Order Code: SK68	NV230/250/260/280/430/450/460/470/650/810/890/AG1200PK/AG1500PK <b>Contents</b> BELT SET, PINCH ROLLER, IDLER, TENSION BAND Order Code: SK23	NV332 <b>Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND, FF/REW TYRE Order Code: SK29	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER TYRE, FF/REW IDLER TYRE Order Code: SK30	£3.00	£7.00	£6.00	£3.25
3V31/3V42 HR7600/7610/7650/7655 <b>Contents</b> BELT SET, T/U REEL TABLE TYRE, PINCH ROLLER, REEL IDLER, T/U CLUTCH, T/U IDLER, TENSION BAND, VIDEO LAMP Order Code: SK33	NVG7/NVG9/NVG10/NVG11/NVG12/NVG14/NVG15/NVG16/NVG18/NVG30/NVG120/NVG300/NVG400/NVH65 (PXA/ACI/AG1810 (PAK)) <b>Contents</b> LOADING BELT, CAPSTAN BELT, PINCH ROLLER, IDLER TENSION BAND Order Code: SK27	NV332 <b>Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND, FF/REW TYRE Order Code: SK29	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER TYRE, FF/REW IDLER TYRE Order Code: SK30	£5.00	£12.00	£12.00	£5.10
3V35/36/38/39/49 HRD110/111/120/121/225 <b>Contents</b> BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, T/U CLUTCH, T/U IDLER TYRE, REEL IDLER TYRE Order Code: SK35	NV230/250/260/280/430/450/460/470/650/810/890/AG1200PK/AG1500PK <b>Contents</b> BELT SET, PINCH ROLLER, IDLER, TENSION BAND Order Code: SK23	NV332 <b>Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND, FF/REW TYRE Order Code: SK29	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER TYRE, FF/REW IDLER TYRE Order Code: SK30	£5.00	£7.00	£6.00	£3.25
3V44/45/48/53/54/55/57 HRP50/HRD140/150/158/160 HRD250/257/565/566/755 <b>Contents</b> BELT SET, PINCH ROLLER, CLUTCH MECHANISM, TENSION BAND Order Code: SK39	NVG7/NVG9/NVG10/NVG11/NVG12/NVG14/NVG15/NVG16/NVG18/NVG30/NVG120/NVG300/NVG400/NVH65 (PXA/ACI/AG1810 (PAK)) <b>Contents</b> LOADING BELT, CAPSTAN BELT, PINCH ROLLER, IDLER TENSION BAND Order Code: SK27	NV332 <b>Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND, FF/REW TYRE Order Code: SK29	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER TYRE, FF/REW IDLER TYRE Order Code: SK30	£9.50	£7.00	£6.00	£3.00
<b>FISHER</b> FVHP905/906/907/908/910/911/916/918 <b>Contents</b> BELT SET, PINCH ROLLER, IDLER, GEAR IDLER UNIT, TENSION BAND Order Code: SK57	NV230/250/260/280/430/450/460/470/650/810/890/AG1200PK/AG1500PK <b>Contents</b> BELT SET, PINCH ROLLER, IDLER, TENSION BAND Order Code: SK23	NV332 <b>Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND, FF/REW TYRE Order Code: SK29	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER TYRE, FF/REW IDLER TYRE Order Code: SK30	£5.00	£12.00	£12.00	£5.10
FVHP615/618/620/622/710/711/715/716/720/721/722/725/730/830/840 <b>Contents</b> BELT SET, PINCH ROLLER, IDLER, GEAR IDLER UNIT, TENSION BAND Order Code: SK68	NV230/250/260/280/430/450/460/470/650/810/890/AG1200PK/AG1500PK <b>Contents</b> BELT SET, PINCH ROLLER, IDLER, TENSION BAND Order Code: SK23	NV332 <b>Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND, FF/REW TYRE Order Code: SK29	<b>Economy Kit Contents</b> BELT SET, PINCH ROLLER, PLAY IDLER TYRE, FF/REW IDLER TYRE Order Code: SK30	£3.00	£7.00	£6.00	£3.25

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- \* AKAI
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# 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	HRD515, 520, 527, 540, 550, 580, 600, 610, 620, 660, 670, HRD830, 840, 850, 860, 4050, 6600, FV37H, HRD540, 580, 830, 860, 910, 960, HRD970, HRD X20,	CH19	4300p	VCA103, 103GV, 106, 106GV, 254GV, VCS211, 244, 5055, 605, VCB230, VCD806G, 810G, VCT212, 310, 410G, 610	CH23	2500p	
GRANADA	VHSDP1, VHSYJ2	CH05	1100p			CH20	2200p	410G, 610	CH24	2500p	
GOLDSTAR	GHV1290P, I291P, I295P, 3400, 73401, GSE1295P, GSE1891P, 20001Q, 20051Q, VCP4200, 4300, 4301, 4305, VCP4306, 4311, 4315, 4316, 4320, 4321, 4325	CH25	2000p	FERGUSON	FV57H, VR3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948, VR3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948	CH27	2400p	VR2970	CH02	2800p	
	GHV51, I221, I232, I240, I241, I242, I244, I246, I248, GHV8000, 8200	CH26	2900p	I.T.T.	VR3605, VR3905	CH01	2800p	THOMSON	V320, 321, 323, 326, 4200, 4300	CH01	2800p
FERGUSON & J.V.C.	3V38, 3V39, 8943, 8944, 8951, 3V35, 3V36, 3V49, HRD 110, 111, 120, 121, 225	CH01	2800p			CH02	2800p	V342, 343, 352, 353, 360, 364, 368, 4210, 4230, 4260, 4400, V5500, 6000, 8540	CH02	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	NATIONAL PANASONIC	NV730	CH06	4300p	TOSHIBA	V55, V57	CH01	2800p
	8948, 8950, FV10B, 12L, 13H, 14T, 20B, 21R, 22L, 26, 395, HRD230, 430, 530	CH03	2800p	N.E.C.	N830EG, N831EG, N831EG, N832, N833EG, N895	CH01	2800p	V65, V66	CH02	2800p	
	3V58, 3V59, 3V64, 3V65, FV11R, 8950, 8951, HRD170, HRD180, HRD370	CH04	2800p	PHILIPS	CASSETTE LIFT ASSEMBLY (69120366) DV186, 190, 286, 471, 562, 761, VR6180, 6182, 6185, 6285, VR6290, 6291, 6293, 6362, 6367, 6393, 6467, 6468, 6470, VR6561, 6670, 6760, 6761, 6870, 6970	CH05	1100p				
					VR6443, VR6448, 49S56	CH22	2900p				
						CH23	2500p				
						CH24	2500p				
						CH22	2900p				

## AMSTRAD MOD KIT

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

PRICE : £2.25 + VAT each

\*\*\*\*\*



## MODE SWITCH

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

## 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 (Surenson)	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

CURRENT RATING	TIME LAG (20mm)		QUICK BLOW (20mm)	
	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 Euroslot

**ORDER CODE: TOOL11**

**PRICE: 220p**

## SPRING HOOK

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

**ORDER CODE: TOOL20**

**PRICE: 265p**

# FAULT FINDING / COMPARISON BOOKS

Satellite Fault Finding Guide Issue 1.  
Listing about 1,000 faults for over a range of 24 different brands.

Order Code: BOOK05.

**Price £8.50 - No VAT.**

## TELEVISION Edition 7

This new A5 size guide lists more than 9600 faults and to approx. 474 pages in size.

Price: 1650p only - no VAT (+ £2 Postage)

Order Code: BOOK02

## SEMICONDUCTOR COMPARISONS 1999

With over 650 pages listing more than 34,200

Semiconductors with suitable alternatives complete with descriptions and base information.

Price: 1900p only - No VAT (+ £2 Postage).

Order Code: BOOK04

## Video Recorders Edition 5 1997

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

**Price £15.00 - No VAT. Order Code: BOOK01**

## Satellite Repair Manual Edition 5

346 pages of receiver faults plus notes and general information such as many useful button sequences for resetting parental lock codes, resetting installation choice to factory defaults.

Price £16.00 - No VAT plus Postage £1  
Order Code: BOOK03

## SEMICONDUCTOR COMPARISONS 1999

The new 1998 Jaeger Semiconductor comparison with 1100 pages packed with information on over 95,000 semiconductors in much greater detail plus marketing data on SMD devices and a separate generic table of all the type designations.

Price: £47.00 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	SP18	580p
FOAM CLEANER	400ML	SP05	180p
ANTI-STATIC	200ML	SP06	180p
AEROKLEANE	200ML	SP07	200p
AERO DUSTER	200ML	SP08	340p
AERO DUSTER	400ML	SP17	580p
PLASTIC SEAL	200ML	SP09	250p
GLASS CLEANER	200ML	SP10	160p
COLDKLENE	200ML	SP13	220p
EXCEL POLISH 80	200ML	SP18	160p
ADHESIVE 120	500ML	SP19	250p
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

All the above items are manufactured by Servisol  
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## SOLDERING ACCESSORIES

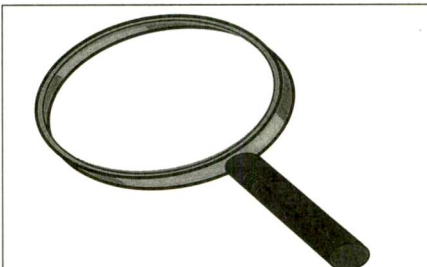
DESCRIPTION	CODE	PRICE
<b>ANTEX SOLDERING IRONS</b>		
25 WATT 240 VAC (XS25W 240V)	S101	900p
15 WATT 240 VAC (XS15W 240V)	S102	900p
25 WATT SPARE ELEMENT	S103	450p
15 WATT SPARE ELEMENT	S104	450p
<b>SOLDERING STAND &amp; SPONGES</b>		
SOLDERING STAND (MADE BY ANTEX)	S108	350p
SPARE SPONGE	S109	55p
<b>SOLDER</b>		
18 SWG 500 GRAMMES	S110	500p
20 SWG 500 GRAMMES	S111	650p
22 SWG 500 GRAMMES	S112	700p
<b>DESOLDERING AIDS</b>		
SOLDER MOP STANDARD GAUGE 1.2MM X 1.5M	S107	100p
SOLDER MOP 1.2MM X 10M	S113	420p
DESOLDERING PUMP	S105	320p
SPARE NOZZLE	S106	60p

## I.C. PROTECTORS

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

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

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# REPLACEMENT LINE OUTPUT TRANSFORMERS

Part No.	Code	Price	HITACHI	LOT44	1050p	4515 01 19	LOT169	1500p	TLF 14520 F	LOT40	1500p	094-01020/0.7	LOT59	1400p	1-439-303-31	LOT94	1300p
AKAI			2424593	LOT79	1600p	4515 01 24	LOT137	1600p	TLF 14521 F	LOT39	1850p	094-01027/0.6	LOT59	1400p	1-439-303-32	LOT94	1300p
45150344	LOT56	1650p	2423210	LOT169	1500p	4515 01 26	LOT136	1600p	TLF 14567 F	LOT39	1850p	094-01027/0.0	LOT186	1825p	1-439-311-00	LOT95	1550p
101-214017-03	LOT72	1300p	2423261	LOT80	1800p	4515 03 01	LOT169	1500p	TLF 14568 F	LOT40	1500p	094-01038/0.7	LOT245	1900p	1-439-311-11	LOT95	1550p
101-220005-03A	LOT72	1600p	2423261	LOT80	1800p	4515 03 02	LOT180	1500p	TLF 14584 F	LOT41	1700p	094-01052/0.8	LOT186	1825p	1-439-311-13	LOT95	1550p
D 050/37	LOT27	1450p	2423265	LOT80	1800p	4515 03 04	LOT169	1500p	TLF 14586 F	LOT42	1700p	094-01057/1.1	LOT285	1450p	1-439-311-31	LOT95	1550p
D 053/37	LOT207	1550p	2423276	LOT169	1500p	4515 03 05	LOT180	1500p	TLF 14586 F	LOT256	2000p	810.018.0620	LOT189	1850p	1-439-311-32	LOT95	1550p
D 056/37	LOT56	1650p	2423281	LOT37	1200p	4515 03 06	LOT168	1500p	TLF 70012 F	LOT78	1500p	610.018.6637	LOT215	1800p	1-439-331-22	LOT96	1550p
D 059/37	LOT200	1400p	2423282	LOT37	1200p	4515 03 08	LOT178	1500p	TLF 70012 A	LOT78	1500p	SHARP			1-439-331-41	LOT98	1550p
D 069/37	LOT56	1650p	2423282	LOT37	1200p	4515 03 08	LOT178	1500p	TLF 70018	LOT274	1550p	RTRNF 1220 CEZZ	LOT39	1850p	1-439-332-00	LOT99	1600p
FCM 2015 AL	LOT78	1500p	2423311	LOT171	1600p	4515 03 10	LOT168	1500p	TLF 70018 F	LOT274	1550p	RTRNF 1783 BMZZ	LOT202	1600p	1-439-332-11	LOT99	1600p
FERGUSON			2423312	LOT171	1600p	4515 03 13	LOT30	1250p	TLF 70161	LOT274	1550p	RTRNF 1783 CEZZ	LOT202	1600p	1-439-332-22	LOT99	1600p
00 D-3-508-001	LOT38	1250p	2423304	LOT171	1600p	4515 03 14	LOT174	1400p	TLF 70162	LOT278	1300p	RTRNF 1786 BMZZ	LOT211	1850p	1-439-332-21	LOT99	1600p
00 D-3-508-002	LOT38	1250p	2423321	LOT168	1500p	4515 03 15	LOT22	1250p	TLF 70162	LOT72	1600p	RTRNF 1786 CEZZ	LOT211	1850p	1-439-332-42	LOT100	1450p
00 D-3-508-003	LOT276	1400p	2423321	LOT172	1350p	4515 03 18	LOT192	1250p	TLF 70162A	LOT72	1600p	RTRNF 2000 BMZZ	LOT214	1600p	1-439-332-52	LOT100	1500p
00 D-3-515-001 PL1	LOT276	1400p	2423329	LOT246	1600p	4515 03 19	LOT30	1250p	TLF 70162B	LOT72	1600p	RTRNF 2002 CEZZ	LOT307	1450p	1-439-333-00	LOT100	1500p
00 D-4-208-001	LOT79	1600p	2423301	LOT188	1900p	4515 03 20	LOT190	1650p	TLF 70162G	LOT72	1600p	RTRNF 2002 BMZZ	LOT307	1450p	1-439-333-11	LOT100	1500p
00 D-4-208-002	LOT79	1600p	2423341	LOT191	1600p	4515 03 22	LOT196	1550p	TLF 77001 B	LOT274	1550p	RTRNF 2003 BMZZ	LOT308	1350p	1-439-333-12	LOT100	1500p
00 D-4-208-003	LOT79	1600p	2423342	LOT181	1350p	4515 03 24	LOT194	1450p	PHILIPS			RTRNF 2004 BMZZ	LOT307	1450p	1-439-333-11	LOT100	1500p
00 D-4-235-002	LOT240	1250p	2423441	LOT82	1250p	4515 03 25	LOT22	1250p	4822 140 10142	LOT142	1800p	RTRNF 2005 BMZZ	LOT308	1350p	1-439-333-12	LOT100	1500p
00 D-4-235-002 HTI	LOT81	1350p	2423442	LOT82	1250p	4515 03 26	LOT198	1550p	4822 140 10145	LOT134	1450p	RTRNF 2006 BMZZ	LOT308	1350p	1-439-333-11	LOT100	1500p
00 D-4-235-0201G	LOT81	1350p	2423442	LOT82	1250p	4515 03 26	LOT198	1550p	4822 140 10146	LOT112	1700p	RTRNF 2007 BMZZ	LOT307	1450p	1-439-333-12	LOT100	1500p
00 D-4-280-004 HTI	LOT38	1250p	2423445	LOT234	1600p	4515 03 28	LOT27	1450p	4822 140 10151	LOT102	1700p	RTRNF 2023 BMZZ	LOT310	1500p	1-439-333-12	LOT100	1500p
00 H-0-701-2400	LOT182	1450p	2423455	LOT85	1600p	4515 03 29	LOT193	1550p	4822 140 10161	LOT103	1250p	SONY			1-439-333-11	LOT100	1500p
06 D-3-083-001	LOT82	1250p	2423521	LOT22	1250p	4515 03 30	LOT179	1650p	4822 140 10171	LOT104	1500p	3753100	LOT275	1500p	1-439-333-12	LOT100	1500p
06 D-3-083-002	LOT82	1250p	2423521	LOT22	1250p	4515 03 31	LOT207	1550p	4822 140 10176	LOT114	1150p	1-439-243-00	LOT91	1600p	1-439-333-11	LOT100	1500p
06 D-3-084-001	LOT23	1400p	2423521	LOT01	1300p	4515 03 34	LOT56	1650p	4822 140 10194	LOT105	1500p	1-439-243-01	LOT91	1600p	1-439-333-12	LOT100	1500p
06 D-3-087-001	LOT23	1400p	2423522	LOT01	1300p	4515 03 35	LOT193	1550p	4822 140 10198	LOT116	1600p	1-439-243-12	LOT91	1600p	1-439-333-11	LOT100	1500p
06 D-3-088-001	LOT84	1450p	2423522	LOT250	1350p	4515 03 38	LOT27	1450p	4822 140 10201	LOT104	1500p	1-439-243-31	LOT229	1700p	1-439-333-12	LOT100	1500p
06 D-3-093-001	LOT204	1600p	2423522	LOT23	1400p	4515 03 40	LOT200	1400p	4822 140 10206	LOT108	1550p	1-439-243-32	LOT229	1700p	1-439-333-11	LOT100	1500p
06 D-3-095-001	LOT87	1000p	2423522	LOT84	1450p	4515 03 41	LOT56	1650p	4822 140 10246	LOT111	1500p	1-439-244-00	LOT48	1600p	1-439-333-12	LOT100	1500p
06 D-3-095-002	LOT87	1000p	2423522	LOT23	1400p	4515 03 44	LOT56	1650p	4822 140 10247	LOT105	1500p	1-439-244-01	LOT48	1600p	1-439-333-11	LOT100	1500p
06 D-3-095-003	LOT87	1000p	2423522	LOT23	1400p	4515 03 44	LOT56	1650p	4822 140 10254	LOT107	1450p	1-439-244-11	LOT48	1600p	1-439-333-12	LOT100	1500p
06 D-3-333-512-001	LOT204	1600p	2423522	LOT200	1400p	4515 03 46	LOT201	1550p	4822 140 10263	LOT117	1550p	1-439-244-31	LOT48	1600p	1-439-333-11	LOT100	1500p
FETX 100 90 DEG	LOT04	1500p	2423522	LOT33	1000p	4515 03 50	LOT27	1450p	4822 140 10269	LOT210	1350p	1-439-256-00	LOT45	1650p	1-439-333-12	LOT100	1500p
FETX 90 WHITE	LOT06	1650p	2423522	LOT33	1000p	4515 03 51	LOT27	1450p	4822 140 10271	LOT208	1650p	1-439-256-21	LOT45	1650p	1-439-333-11	LOT100	1500p
FETX 100 100 DEG	LOT34	1500p	2423522	LOT44	1050p	4515 03 75	LOT56	1650p	4822 140 10274	LOT123	1450p	1-439-256-22	LOT45	1650p	1-439-333-12	LOT100	1500p
GRUNDIG			2424274	LOT44	1050p	4515 16 01	LOT22	1250p	4822 140 10274	LOT123	1450p	1-439-256-31	LOT45	1650p	1-439-333-11	LOT100	1500p
29201.008.01	LOT153	1750p	2424453	LOT86	1600p				4822 140 10282	LOT122	1300p	1-439-256-32	LOT45	1650p	1-439-333-12	LOT100	1500p
29201.014.01	LOT140	1500p	2424455	LOT234	1600p	731003	LOT51	1550p	4822 140 10283	LOT104	1500p	1-439-276-21	LOT230	1700p	1-439-333-11	LOT100	1500p
29201.015.01	LOT149	1400p	2424455	LOT44	1050p	276-16399	LOT49	1500p	4822 140 10294	LOT125	2150p	1-439-280-00	LOT46	1300p	1-439-333-12	LOT100	1500p
29201.017.01	LOT60	1250p	2424593	LOT296	950p	334 B 07803	LOT50	1450p	4822 140 10306	LOT110	1200p	1-439-280-13	LOT46	1300p	1-439-333-11	LOT100	1500p
29201.018.01	LOT163	1300p	2424593	LOT296	950p	334 B 07803	LOT50	1450p	4822 140 10325	LOT132	1500p	1-439-280-13	LOT46	1300p	1-439-333-12	LOT100	1500p
29201.018.02	LOT61	1700p	2424593	LOT296	950p	334 B 07803	LOT50	1450p	4822 140 10326	LOT122	1300p	1-439-286-00	LOT46	1300p	1-439-333-11	LOT100	1500p
29201.019.01	LOT62	1250p	2424593	LOT296	950p	334 B 07803	LOT50	1450p	4822 140 10328	LOT124	1450p	1-439-286-11	LOT46	1300p	1-439-333-12	LOT100	1500p
29201.019.02	LOT62	1250p	2424593	LOT296	950p	334 B 07803	LOT50	1450p	4822 140 10349	LOT106	1250p	1-439-286-12	LOT46	1300p	1-439-333-11	LOT100	1500p
29201.022.01	LOT63	1700p	2424593	LOT296	950p	334 B 07803	LOT50	1450p	4822 140 10353	LOT284	1400p	1-439-286-12	LOT46	1300p	1-439-333-12	LOT100	1500p
29201.022.02	LOT66	1600p	2424593	LOT296	950p	334 B 07803	LOT50	1450p	4822 140 10356	LOT284	1400p	1-439-286-11	LOT46	1300p	1-439-333-11	LOT100	1500p
29201.022.03	LOT65	1350p	2424593	LOT296	950p	334 B 07803	LOT50	1450p	4822 140 10367	LOT286	1400p	1-439-288-00	LOT228	1750p	1-439-333-12	LOT100	1500p
29201.022.04	LOT65	1350p	2424593	LOT296	950p	334 B 07803	LOT50	1450p	4822 140 10369	LOT109	1200p	1-439-288-12	LOT228	1750p	1-439-333-11	LOT100	1500p
29201.024.01	LOT65	1500p	2424593	LOT296	950p	334 B 07803	LOT50	1450p	4822 140 10381	LOT128	1300p	1-439-289-00	LOT47	1400p	1-439-333-12	LOT100	1500p
29201.024.02	LOT164	1400p	2424593	LOT296	950p	334 B 07803	LOT50	1450p	4822 140 10384	LOT127	1550p	1-439-289-21	LOT47	1400p	1-439-333-11	LOT100	1500p
HINARI			2423892G	LOT23	1400p	MSH-1FBW08	LOT78	1500p	4822 140 10395	LOT116	1600p	1-439-289-32	LOT47	1400p	1-439-333-12	LOT100	1500p
154 138 K	LOT24	1500p	I.T.T.	LOT84	1450p	NIKKAI			4822 140 10406	LOT73	1150p	1-439-294-00	LOT93	1450p	1-439-333-11	LOT100	1500p
51 13914 1	LOT24	1500p	4515 01 08	LOT113													



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0.5A	FUSE84	30p
0.63A	FUSE85	30p
0.8A	FUSE86	30p
1A	FUSE87	30p
1.25A	FUSE88	30p
1.6A	FUSE89	30p
2A	FUSE90	30p
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820 pF	3000v	CAP05	150p	3300 pF	2000v	CAP12	145p
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10 µF	16v	CAP17	110p	4.7 µF	50v	CAP25	110p
22 µF	16v	CAP18	110p	10 µF	50v	CAP26	130p
47 µF	16v	CAP19	130p	22 µF	50v	CAP27	180p
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- \* AC VOLTAGE: 200mV/2V/20V/200V/700V
- \* DC CURRENT A: 200µA/20mA/200mA/2A/20A
- \* AC CURRENT A: 200µA/20mA/200mA/2A/20A
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ORDER CODE: CM3900A  
PRICE: 2900p



### CM3230 DIGITAL CAPACITANCE METER

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- \* MAXIMUM READING 1999
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- \* TEMPERATURE MEASUREMENT
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- \* AUTO POWER OFF (APPROX 15 min)
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- \* ALL RANGES OVERLOAD PROTECTED
- \* SUPPLIED WITH TEST PROBES
- \* DC VOLTAGE: 200mV/2V/20V/200V/1000V ACCURACY \* 0.5%
- \* AC VOLTAGE: 200mV/2V/20V/200V/700V
- \* DC CURRENT A: 2mA/20mA/200mA/20A
- \* AC CURRENT A: 200mA/20A
- \* RESISTANCE Ω: 200Ω/2kΩ/200kΩ/2MΩ/20MΩ
- \* CAPACITANCE: 2nF/20nF/200nF/2\*F/20\*F

ORDER CODE: CM3920  
PRICE: 4100p

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



# HELP WANTED

**The help wanted column is intended to assist readers who require a part, circuit etc. that's not generally available. Requests are published at the discretion of the editor. Send them to the editorial department - do not write to or phone the advertisement department about this feature.**

**Wanted:** Service manuals for the Ferguson 3V32 VCR, Ferguson 3722 TV receiver, Grundig TV Series S820, CUC120 etc. and the Toshiba V55B VCR. Ron White, 29 Nunnery Street, Castle Heddingham, Essex C09 3ND. 01787 463 091.

**Wanted:** Remote control handset for the Dual DMQ-14B1. Bob Felix, Cumnor Road, Boards Hill, Oxford OX1 5JW. 01865 739 008.

**Wanted:** Power unit for the Rigonda Bolshoi stereo multiplex (the transformer is short-circuit). Would consider complete radiogram in working order. This unit was manufactured for use in Russia. John Forsyth, Craighour, North Beach Road, Balmedie, Aberdeen AB23 8WU. 01358 742 340.

**For disposal:** Philips N1500, N1700 and V2020 VCRs. Leslie Cooke, 68A Haven Road, Canford Cliffs, Poole, Dorset BH13 7LY. 01202 700 441.

**Wanted:** Complete tuner or tuner on main board no. BT318703769 (chassis no. TU101) for the Solavox colour TV Model CML14RC; also a complete door flap unit for the Saisho VR3300X VCR; and a black tuning door flap for the Pye colour TV Model 37KT2040/25R. C.M. Graves, Orchard Cottage, High Street, Spaxton, Bridgwater, Somerset TA5 1BW. 01278 671 225.

**For disposal:** Two Avo 8 multimeters, two oscilloscopes, colour-bar generator, signal generator, EHT meter and various other items of test equipment. No reasonable offer refused for the lot. B. Hopkins, 5 Clare Crescent, Towcester, Northants NN12 6QQ. 01327 358 987.

**Wanted:** Circuit diagram and PCB layout diagram for the remote control receiver used in the Philips colour TV Model 672 (G11 chassis). Good photostat OK. C.R. Tomlinson, 24 Kelmscott Gardens, Leeds LS15 8HLK.

**For disposal:** Large quantity of VCRs (about 40) vintage 1982-1996, mostly complete. Free to good home. Also some TV sets. Store room must be

cleared! Collection will be necessary - please take the lot. A Transit sized van would be required. Bear in mind ferry fares. Julian Davidson, Rosemount, Whiting Bay, Isle of Arran KA27 8PR.

**Wanted:** Timer/counter control IC type HD38750A79, or working timer PCB, for the Hitachi VCR Model VT11E. G. Plaxton, 6 Pasture Court, Sherburn-in-Elmet, Leeds, Yorkshire LS25 6LL. 01977 681 745.

**Wanted:** Circuit diagrams for the Philips mono TV/radio type 9T6 2000/05A NR-K945-784 and the Grundig TRE340 entertainment centre. D. Griggs, 5 Collingwood Avenue, Muswell Hill, London N10 3EH. 0181 374 9070.

**Wanted:** Teletext panel for the Sony Model KV-M2131U or servicing information for this panel. Phone Clive Thomas on 01302 844 788 or 07899 777 184 (mobile). Alternatively e-mail [clivethomas@cwcom.net](mailto:clivethomas@cwcom.net)

**Wanted:** Student in Zimbabwe requires manuals, magazines or anything to help with electronic studies for C&G radio and television course at local college. Because of economic problems it is difficult for students here to get foreign currency. Kuda Jonasi, House no// 5760, Mharapara Drive, Mucheke C, Masyingo, Zimbabwe, Central Africa.

**Wanted:** Tube base panel and focus control for the Philips Model 27CE2390 (2A chassis). Tom Grady, 18 Marlowe Drive, Mablethorpe, Lincs LN12 1BW.

**Wanted/for disposal:** Require scrap Akai VSF200EK VCR and Toshiba V312B VCR for spares. Also circuit diagram and servicing information for these machines and for the Philips VR6462/6463 VCRs. Have for disposal an IBM 5154 ECD monitor, a Philips BM7513 monitor and an Apricot Xen-s base unit (DOS 6.22/Windows 3.11 installed) complete with keyboard and new serial mouse. Also various PC 3.5in. floppy disc drives, most with head misalignment

faults, for spares/repair. Offers? John McClean, 66 Castle Park, Limavady, Co. Londonderry, N. Ireland BT49 0SB. 01504 763 045.

**Wanted:** Circuit diagrams for the Hikona Models 1437 and RM2000. Photocopies OK. Ivan J. Bradley, 139 Somerfield Road, Bloxwich, Walsall, W. Midlands WS3 2EN.

**Wanted:** Service manual for the Supermatch 17T Macintosh monitor - to buy, borrow or alternatively details of a possible supplier. I believe that this monitor is a badged version of the Radius STD9735. Also, does anyone have a text board and harness for the Tatung 145 series chassis. Alistair Dunsmore, 21 East Croft, Ratho, Midlothian EH28 8PD. 0131 333 2610.

**Wanted/for disposal:** Require service manuals (not photocopies) for the Ferguson 3V29, Sharp VC780HM and Sanyo VTC5000 VCRs; also an original stand for the Ferguson Model 59H5 CTV and a remote control unit for the Fidelity ZX3000 CTV (four buttons). Have for disposal lots of panels, parts and service manuals for 1970/80s CTV and 1960/70s mono TV sets; several unused regunned CRTs and used colour/mono CRTs; Ultra 22in. CTV (Thorn 8800 chassis), Grundig 6010TDGB 26in. CTV, Bush 22in. Model CTV1122 (Rank A823AV chassis), Ferguson 22in. 3763 CTV (9600 chassis), several monochrome portables and some Goodmans/HMV audio units from the early 1970s. Small donation appreciated! David Hazell, 3 Wrde Hill, Highworth, Swindon, Wilts SN6 7BX. 01793 765 390.

**Wanted/for disposal:** Require circuits/service information for the Taxan MV789LR and Zenith ZCM1495X monitors - loan or copies. Also Sony SLV315 VCR instructions. Have for disposal radio, TV, Hi-Fi and tape recorder magazines from the Fifties onwards plus books, equipment and test gear. Ken Domminney, 7 Chestnut Close, Eastbourne BN22 0SZ. 01323 500 174.

## Servicing

Alan Dent provides an in-depth fault-finding guide for these sets, which were widely sold under a number of brand names

# the Indiana 100/200 Chassis

**T**he Indiana 100 and 200 chassis were used in a number of models released during 1990-92. They are the same in most respects: the main difference lies in the TCR (tuning control) panel. The sets appeared in a number of brand ranges. Models fitted with the 100 chassis include the following:

**Alba** CTV704T, CTV711, CTV712, CTV741, CTV742 and CTV744.

**Bush** 2151, 2151TX, 2520TX, 2521TX, 2541 and 2541TX.

**NEI** 1451, 1451TX, 1461, 1461TX, 1551TX, 2031, 2031TX, 2131 and 2131TX.

**Nikkai** TLG2155 and TLG2156.

**Perdio** P1480, P2004, P2005, P2101 and P2102.

Those fitted with the 200 chassis include these:

**NEI** 1481, 1481TX, 2041, 2041TX, 2047, 2047TX, 2051, 2051TX, 2147, 2147TX, 2151 and 2151TX.

**Nikkai** TLG1447TX, TLG2000, TLG2149, TLG2151TX and TLG51TX.

The design of the chassis is straightforward. The following notes are based on considerable experience with these chassis. We'll start with the power supply.

### Power Supply Fault Finding

The switch-mode power supply circuit is shown in Fig. 1. It's operational whether the set is in the standby mode or not. T801, the chopper transformer, is a foil-wound type.

The best approach is check at pin 9 of IC800 first. If the voltage is low at about 8.5V, apply the scope's probe to pin 7 to monitor the drive pulses applied to the chopper transistor Q800. Various fault possibilities are listed below.

The HT current is 490mA at maximum beam current, 250mA at average beam current. The 26V supply pro-

vides 650mA at full volume, 210mA at minimum volume. The 12V supply provides about 360mA.

**Set will not start up (no pulses at pin 7 of IC800):** Check whether F800, R801, R802, R803, R808, R815, R816 or C814 is open-circuit or C819 or D804 is short-circuit. IC800 or Q800 could be faulty. Note that R802 is a thermistor which should read 4.7k $\Omega$  when cold.

**Set will not start up (one pulse every 300msec at pin 7 of IC800):** Check whether R812, R814, C810, L801, D804, Q800 or winding 1-5 of T801 is open-circuit.

**Uncontrollable HT:** R810, R811 or D807 could be open-circuit.

**Slow start-up:** C810 is leaky.

**No outputs though there are 20msec bursts of pulses at pin 7 of IC800:** C809 is probably open-circuit.

**Q800 is short-circuit:** In this case check whether R801 or the bridge rectifier diodes D800-803 are open-circuit or R809 has gone high-resistance. R809 must be replaced with a VR37 high-voltage type supplied by Maplin Electronics (NEI Spares Division).

**Tripping at 1Hz (chirping sound):** The line output transistor Q600 or D809 could be short-circuit. Check for shorts on the secondary side of T801.

**No or low output (T801 squealing and Q800 hot):** T801's insulation could have failed. Check the line output transformer T601 for short-circuit windings (blister on body).

**F800 blasted:** Q800 shorted to heatsink or L802 touching R806.

**No 12V supply:** R844 could be open-circuit. Alternatively if pin 1 of IC803 is at 0V, Q809 could be short-circuit or there could be a fault on the microcontroller panel. As a check, disconnect plug K804 to see if the supply is restored.



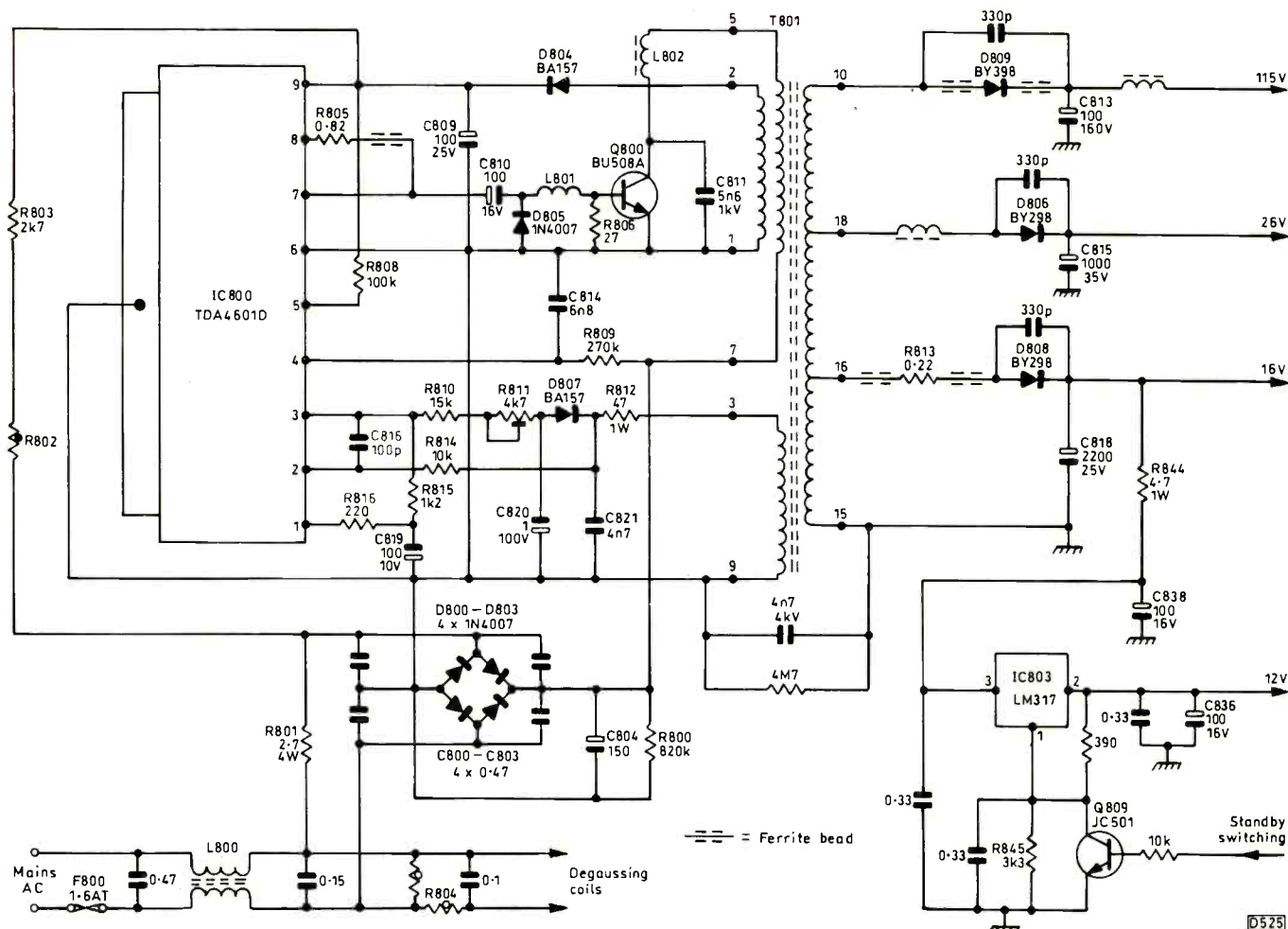


Fig. 1: The chopper power supply circuit used in the Indiana 100 and 200 chassis. There are 5V regulators on the microcontroller panel and, where fitted, the teletext panel. They are both fed from the 16V rail.

**Set appears to go to standby:** This could be because of a microcontroller section fault, see later, or an intermittent power supply failure. Both have the same effect. Monitor the power supply by using a bulb as a dummy load, in place of the line output stage, to see what happens.

T801 can have an intermittent winding-to-pin connection. Oxidation can reduce the current and cause connection failure. The power supply will then stop momentarily. When it restarts, the set will remain in standby until an instruction is received, either from the handset or switch contacts.

L801 can fail, removing the drive to Q800. Failure can be intermittent, the result being similar to the T801 problem mentioned above.

**Other standby faults:** See microcontroller section later.

**Travelling hum bar at right-hand side of the screen, visible from the bottom of the screen to about half way up:** The mains filter coil L800 may be of incorrect value or have a faulty core.

### The Line Timebase

The line driver and output stages are conventional. T601, the line output transformer, generates the EHT, focus, first anode, CRT heater and RGB output stage HT supplies. The line generator is in the IF/timebase generator chip IC100 (see IF section). Here are some fault possibilities:

**No line drive:** Check that IC100 is producing an 0.7V peak-to-peak output at pin 26. The driver stage receives its supply via R607 (5.6k $\Omega$ ) which could be open-circuit. This resistor is rated at 3W, though in early models a 2W carbon-film resistor was used. It must be replaced with the type supplied by NEI spares (Maplin).

**No EHT:** Check that the HT supply to the line output stage is at 115V. There should be a 90V peak-to-peak drive waveform at the collector of the line driver transistor Q601. The line output transformer T601 could have shorted turns – examine the outer casing for blisters.

**Low/high EHT:** Check that the HT supply is at 115V. Check the value of the flyback tuning capacitor C605, especially if the CRT has been replaced (the value depends on tube type, see later).

**Low EHT:** Check the continuity of the scan coils and connectors.

**Raster wide/narrow:** Check that the HT is at 115V. Check T601 for shorted turns (examine the case for blisters).

If the CRT has been replaced, check whether it needs a loss coil and if so that this is correctly adjusted. Check the CRT data to see whether the value of C605 needs to be changed. The scan-coupling capacitor C604, whose value also depends on the CRT, affects the linearity of

the scanning, not the picture width.

If the line part of the super sandcastle pulse is incorrect, check C606, R603, R613 (values vary with different versions of the chassis) and D604 (ZPD10V).

Basic output stage scan coupling and flyback tuning capacitor values are as follows:

Tube size	C604	C605
14in.	470nF	7.5nF
15in.	330nF	5.6nF
20in.	470nF	7.5nF
21in.	330nF	6.8nF

C605 is rated at 1.5kV

### The Field Timebase

A TDA3653 chip, IC400, is used in the field output stage. The field drive waveform is generated in IC100. There is AC and DC feedback between the two chips. IC400's 26V supply comes from the chopper circuit.

**Reduced height (no picture unless the first anode control is turned up, no tuning function):** The 33V stabiliser D001 (ZTX33) has failed because of a CRT flashover. This is more common in 20in. sets fitted with an Orion 22mm neck CRT. In addition to the tuning voltage supply, D001 provides a reference for the field generator in IC100. To protect D001, change C001 from 1nF to 100nF. In the 200 chassis, add a 100nF capacitor across pins 36 and 41 of the microcontroller chip IC300.

**Field collapse:** See the section on IC100 for field generator faults. Disc ceramics C400 and C401 (4.7nF) can develop leakage, R402 (3.9k $\Omega$ ) and R403 (10k $\Omega$ ) can go high in value or open-circuit, C402 (470pF) can go short-circuit, R401 (4.7 $\Omega$ , 1W) and R412 (1.8 $\Omega$ , 0.5W) can go open-circuit. IC400 can fail, though this is unusual. Check at connector K400 for broken tracks or pads, also the tracks and pads around IC400. Breaks can be caused by physical stress. Check whether R411 (22k $\Omega$ ) is open-circuit or C406 (100nF) is short-circuit.

**Poor linearity (lack of height):** C408 (2.2 $\mu$ F, 35V), C407 (1,500 $\mu$ F, 35V), C403 (100 $\mu$ F, 40V) or D400 (BAX12A) could be leaky; R407 (5.6k $\Omega$ ) or R408 (10k $\Omega$ ) could be high-resistance or R409 (4.7k $\Omega$ , linearity preset) faulty.

**Picture shifted (cannot recentre):** R405 (10k $\Omega$ , shift preset) or R413 (1k $\Omega$ ) could be high-resistance or C407 (1,500 $\mu$ F, 35V) leaky.

**Hum bar on field scan:** Cause will be in the power supply. Check whether D806 (BY298) is leaky or C815 (1,000 $\mu$ F, 35V) open-circuit.

**Line pairing and vertical jitter:** The CRT's Aquadag earth connection is probably open-circuit.

### The Jungle Circuit

The 'jungle' chip IC100 incorporates the IF circuitry and the timebase generators. Either a TDA4505 or a TDA8305 may be fitted in this position. They are in effect the same, but are not interchangeable because the connections to pins 11 and 19 are interchanged. The chip also carries out sync separation, AGC processing and AFC and generates the super sandcastle pulses.

**Noisy picture and/or video smearing:** The SAW filter

Z100 could be faulty, C105 open-circuit, C106 short-circuit or C144 (if fitted) short-circuit. The video detector coil L102 could be misaligned. Care is required with this – several false tuning points may be obtained.

**Blank raster:** Check the following. L102 open-circuit; Q101 (JC501) short-circuit; C120 or C107 short-circuit; muting voltage at pin 3 of K100 at 12V; no output at pin 17 of IC100; or video lost in path towards Q103 and the colour decoder.

**Picture overloaded:** The AGC cross-over point is set by R105/R107 with C101 for decoupling. If a different type of tuner is fitted these components should be changed to suit. See manual.

**Tuning drift:** The AFC is set at 6V (TP4) by R012/R013 with an input at 39.5MHz and L102 correctly set. If drift occurs the cause is usually elsewhere.

**No audio output:** Pins 11-15 are connected to the audio IF section. For no output check C109, C111, C123 and Z101, also the control voltage (should vary between 0-2.5V) from IC300 and the associated filter.

**Low audio output:** Check the alignment of L101, whether Z101 is the correct type (SFE6.0MB), and the control voltage from IC300 (see above).

**Vision buzz:** Check R111, Z101 and the alignment of L102.

**No sync:** Possibilities are C118 (470nF) or R129 (1.8k $\Omega$ ) open-circuit or C113 (150pF) short-circuit.

**Poor sync, picture has excessive gain:** C113 (150pF) leaky.

**No line drive output at pin 26:** Check components connected to pins 23, 24, 27 and 28.

**Line frequency incorrect:** C114 (22nF) or C116 (2.7nF) could be leaky, R122 (82k $\Omega$ ) or R125 (30k $\Omega$ ) could be high-resistance. If necessary check R119 (1.5k $\Omega$ ) and C115 (10 $\mu$ F, 16V).

**Line phasing/picture shift incorrect:** C112 (100nF) or C126 (560pF) could be leaky, R114 (47k $\Omega$ ) high-resistance or R117 (2.7M $\Omega$ ) open-circuit.

**No field drive output at pin 3:** Check whether C100 (220nF), C102 (1nF) or D001 (ZTK33) is short-circuit or R104 (1M $\Omega$ ), R001 (15k $\Omega$ , 2W) or R002 (150k $\Omega$ ) is open-circuit.

**Field frequency incorrect:** Check whether C100 (220nF) is leaky or R104 (1M $\Omega$ ) high-resistance.

**Super sandcastle pulses:** If there is a problem with these the IC is unlikely to be the cause. Check the pulse sources in the line and field output stages.

### Audio Output

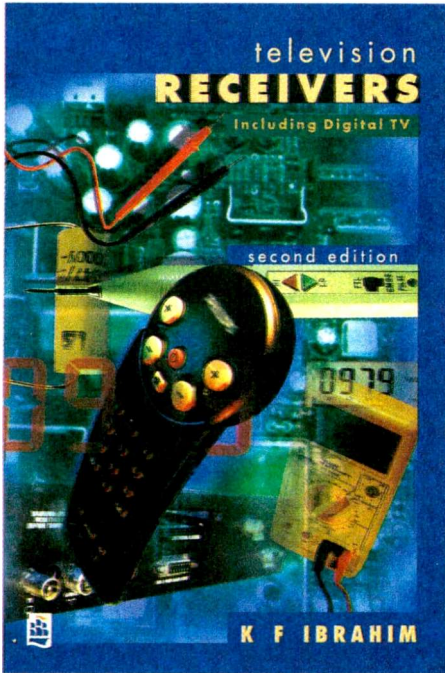
IC200, type TDA2611A, provides the loudspeaker drive. It's powered at 26V from the chopper circuit. The current consumption is 440mA at full volume.

**No output:** Check R200 (4.7 $\Omega$ , 1W) and IC200, whether there's an input from the IF section at pin 7, whether the loudspeaker is open-circuit and the print

*continued on page 502*



## Book Review



**Television Receivers, second edition**, by K.F. Ibrahim. Published by Addison Wesley Longman at £16.99. 394 pages 6-75 x 9-25in. ISBN 0-582-35631-8

This must certainly be the most up-to-date book on the subject. It has been extensively revised for the new edition to

take into account the advent of digital TV and the extensive use of digital control and processing technology in modern TV receivers. Over a third of the book is devoted to these developments.

The book has been written with the needs of students in mind, and is an ideal textbook for those taking the BTEC levels 2, 3 and 4 and City & Guilds courses. It is also suitable for those who want to refresh their knowledge, as a handy reference source should you want to check up on a particular topic, and for keeping up-to-date with the technology.

TV technology is now a vast subject, having grown in complexity as more and more has been added. The additions started with colour, then teletext and Nicam sound transmissions. Microcontroller technology started to be used to supervise the operation of TV sets, while in some chassis digital signal processing was adopted. More recently satellite TV has come along, first with analogue transmissions then digital. It is, amazingly, all here in Mr Ibrahim's book. The theory is clearly explained, with virtually no reference to mathematics, and is backed

throughout by practical circuit examples. The numerous circuit, waveform and block diagrams assist in making matters clear. It couldn't have been done better.

The book is particularly valuable for its treatment of digital TV. The mysteries of MPEG, the discrete cosine transform, error correction, COFDM transmission and so on are all explained, with nothing glossed over. Digital satellite TV receivers are fully covered, but DTT channel decoding will have to wait till next time. This is not a vital omission: the basic MPEG processing is common to all types of digital reception. The concluding chapter covers the basics of digital TV receiver/decoder testing.

There are sections on the scart socket and its interfacing, and on Dolby sound systems. Nothing of importance has been omitted. I have no hesitation in recommending this book, which is excellent value. It can be obtained from bookshops or, plus £2.50 postage and packing, from Addison Wesley Longman, Fourth Avenue, Harlow, Essex CM19 5AA (01279 623 928, fax 01279 414 130). J.A.R.



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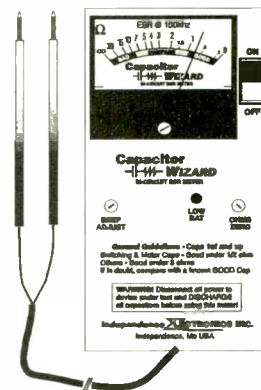
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## Test Report

The digital age means that new test and measurement equipment will be required. This meter has been designed specifically for digital satellite signal location and optimisation. Eugene Trundle has been trying it out.

Note that the meter is also called the **Satfinder**



# The Digisat Meter

The advent of digital satellite TV broadcasting has brought with it the need for an accurate, inexpensive dish-alignment aid. The types of signal-strength meter that have served us for dish alignment with analogue transmissions are, for various reasons, ill-suited for use with digital transmissions from 28.2°E – though some may work after a fashion, with perhaps the aid of a 22kHz generator to switch the LNB to the correct band. However that might be, the Digisat meter reviewed here has been designed to meet the specific requirements of alignment with a digital signal.

### Description

The Digisat meter is a bone-shaped yellow/orange box (see photograph) with an F connector at the top and an LCD dot-matrix display plus two push-buttons at the front. At one side there's a telephone-type socket for future updates via a phone line: at the other side there's a 5mm power socket to enable the internal 12V Ni-Cad battery pack to be recharged from the mains power pack that comes with the meter. For further details refer to the accompanying specification box.

### Use

Operation of the meter is very simple: the design takes into account the fact that the meter may be used by relatively unskilled operators. You switch the meter on by pressing both keys together – this minimises the risk of accidental battery discharge. The display then appears with a status indicator, in this case ASTRA 28 Finder, version 03.00.02, followed by a readout of the percent-

age battery charge state. After this the meter auto-switches to the search mode for Astra 28.2.

Satellite identification is carried out by what is referred to as USID – Unique Satellite Information Data – which currently checks two on-board transponders for frequency, BER (Bit Error Ratio), polarisation, symbol rate and FEC (Forward Error Correction). When these parameters have been confirmed, you get a 'found' indication followed by a readout of signal strength in two forms simultaneously, a bar-graph and a numerical count. These can be used to optimise the dish alignment.

At a touch on the lower control key the display reads "hor picture quality". You optimise this by adjusting the LNB skew to get the polarisation setting spot-on – there's again a bar-graph and a numerical indication, the higher the reading the better. A second press on the lower key brings up "ver picture quality" in the display, enabling the vertical polarisation to be optimised in the same way.

Finally, a two-second press on the upper key switches the instrument off. To conserve battery power it shuts off automatically after three minutes' idleness.

### On Test

We used the Digisat meter on all our digital satellite jobs, involving both universal LNBs and those supplied with digital receivers and dishes, for just over two weeks. Obviously the dish has to be within a couple of degrees of the correct position, both vertically and horizontally, for the meter to latch on to the broadcast data and start to respond. The reading fluctuates until the



"Astra 28-2 Found" caption appears. Pointing can then be finely adjusted for the highest signal-strength reading.

This provides reasonably accurate alignment, but I was disappointed to find that the indicator's resolution in this mode is not very high: the readout figure, which is arbitrary, i.e. not a quantitative voltage or decibel level, jumps eight units at a time, corresponding to one block in the bar-graph display. So, as the signal strength increases progressively, you get "64" and eight blocks, then "72" and nine blocks, followed by "80" and ten blocks, with no intermediate readings. The result is some uncertainty about the alignment, perhaps over half a degree or so. There is sometimes dither between the two blocks and their corresponding numerical values, which makes it difficult to read the display. There's a solution to these problems however, as we will shortly see.

I found that the resolution of the horizontal and vertical picture quality readouts is much better than that of the signal-strength indication. Though arbitrary, on a scale of up to 99, these readings are based on the bit error ratio (BER) and provide single-digit resolution. So the LNB's skew alignment can be set with great accuracy – then the dish alignment itself again, since the BER is highly dependent on signal strength. In this way you get a much more precise indication of the signal strength.

With practice I found that I could very quickly align a dish spot-on with this meter, which is just as well as I couldn't achieve the one-hour running time claimed even after a full overnight charge! Despite this we could get through a full day's installation schedule, as only a few minutes' use is required at each site. I found the shorter the periods of use, the longer the total operating time.

The LCD panel is easy to read, both indoors and out. For easy viewing and operating convenience when the meter is hung around the neck, I would have preferred the 80cm-long rubber lanyard to have been anchored at the bottom of the case rather than the top. While griping, I would also have liked an audible tone that rises in pitch with signal strength/quality – I have been spoiled by this with my old analogue meter. I'm sure it could have been done, and would happily have paid extra for it.

Otherwise I commend the excellent design, with its simple two-key operating system, high-visibility and high-impact strength case, protected F socket and battery-charge management system. Initially there's a boost charge, then a steady one, then finally a trickle charge – with elapsed-time and battery-charge status readouts. It takes eight hours to charge the internal battery pack fully from complete exhaustion.

### Verdict

For what it is and what it can do the Digisat meter's trade price of about £190 plus VAT represents very good value for money – never mind my carpings and criticisms above!

Digital TV is with us to stay, and it's not really practical to try to get by without a purpose-designed instrument for installation and testing. Certainly this one looks as if it will last well – so long as it's not dropped from the roof to the ground!

### Variants and Availability

I gather that two further versions of the Digisat meter are in the pipeline, one for ONdigital (terrestrial) use at UHF and another that's designed to search for three satellites rather than just the Astra bird at 28.2°E. It's

## Abridged specification

Size	205 x 100 x 37mm
Weight	650g
Charge time	8 hours
Discharge time	60 minutes
Indications	Bar-graph and 0-99 count
Readings	Battery charge; signal strength; horizontal BER; vertical BER
Display	16-character, two-line LCD
Satellite	Astra 2 (BSkyB) at 28.2°E
Operating temperature	-5 to +30°C
Accessory	Comes with 230V mains battery charger

possible to change and update the instrument's internal software.

The Digisat meter is available from Premier Electronics (GB) Ltd., Springfield House, Springfield Business Park, Grantham, Lincs NG31 7BG, phone 01476 514 661, fax 01476 514 662, e-mail KCE@PremierGB.co.uk

SEME Ltd., Hudson Road, Melton Mowbray, Leics LE13 1BS (phone 01664 484 000, fax 01664 563 976) is an official distributor for the Digisat meter (order code EQU483). The trade price from SEME is £189.95. A discount is available for quantity orders.

SEME can also supply an in-car charger (order code PSU6073) at £19.99, a leather carry case (order code AID3093) at £18.42, a plugtop PSU (order code PSU6074) at £9.95 and a spare 12V, 700mAh battery pack (order code BATT6121) at £12.95 (trade prices).

## Corrections

**Hitachi 46TN series CTVs:** An error occurred in Fig. 1 on page 421 last month, where ZD950 was shown as a 10V zener diode. It's in fact a 6.5V voltage-reference diode, type BZV10.

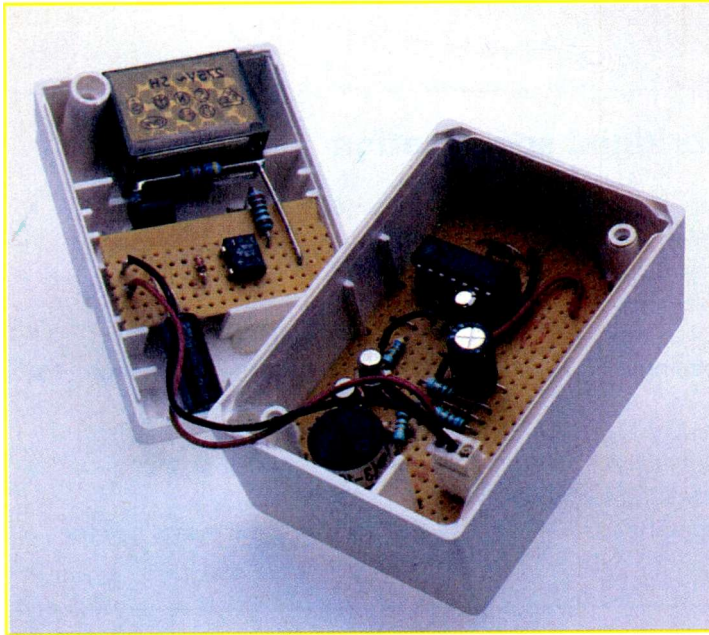
6.5V is the nominal zener voltage rating of the device. Manufacturers quote the rating as 6.2-6.8V. The Hitachi service manual quotes the emitter voltage of the associated error-sensing transistor Q954 as 6.3V.

A voltage-reference diode differs from a standard zener diode (voltage-regulator diode) in that it consists of two zener diodes connected back-to-back. The two have opposite temperature coefficients, the combination providing very low voltage variation with change in temperature.

The device has a power rating of 400mW.

The important point is to use a BZV10 in position ZD950.

**ESR meter:** SW1 was incorrectly specified on page 438 last month. It's a DPDT switch, Maplin order code FH99. The buzzer pin spacing shown in Fig. 8 is incorrect, but there is plenty of space on the board for the specified device. The 0V, -ve supply and VR2 connections should have been shown to the left of the cut-out. To cater for a subsequent upgrade, R14 should be positioned between C7 and D3. See internal view of meter page 427.



This handy unit, designed by **Michael Dranfield**, can left permanently connected to the mains supply ready to check any suspect IR remote-control unit

# A Mains-operated Remote Control Tester

**T**he problem with battery-operated test equipment is that you can get caught out by a flat battery. It's most frustrating to decide to use something and find that it doesn't work. We needed a new remote control tester for the workshop, so I gave thought to the idea of a mains-operated one.

It would be handy if the tester were to plug straight into the mains supply without any trailing leads. I looked through the instrument-case section of our Farnell catalogue and found a case with a built-in 13A plug, the sort commonly used to house multi-output DC adaptors. I started off by ordering one.

## The Wattless Dropper

It was obvious, when the case arrived, that it would not be large enough to house a transformer as well as the electronics required. So the tester would have to be run straight from the mains supply. The easiest solution would be to use a capacitor to reduce the mains voltage to 12V. This idea is sometimes referred to as a 'wattless dropper'. It was used by Thorn back in the Sixties to supply the heater chain in early versions of the 960 series 16in. portable chassis. Unlike a resistor, the capacitor dropper dissipates no power. Hence the name.

The idea is to use a capacitor's reactance at a given frequency to provide a voltage drop.

Capacitive reactance is given by the formula

$$X_c = 1/2\pi fC$$

where  $f$  is the frequency and  $C$  is the capacitor's value in Farads. In the UK the mains frequency is 50Hz. If we use a capacitor of say  $0.47\mu\text{F}$ , the reactance works out at

$$1/2 \times 3.142 \times 50 \times 0.47 \times 10^{-6}$$

$$= 1/0.000147674$$

$$= 6,771\Omega \text{ or say } 6.77\text{k}\Omega.$$

So at 50Hz the capacitor will have an impedance of  $6.77\text{k}\Omega$ . By applying Ohm's Law, we have

$$230\text{V} - 12\text{V} = 218\text{V}/6771 = 0.032, \text{ i.e. } 32\text{mA}.$$

Thus by using an  $0.47\mu\text{F}$  capacitor and a 12V zener diode we can draw 32mA at 12V straight from the mains supply. This supply isn't mains isolated of course, so the device must under no circumstances be housed in a metal case.

## The Power Supply Circuit

The power supply circuit is shown in Fig. 1. The live side of the mains supply is taken to a 100mA Wickman fuse (F1). C1 is the capacitive dropper. R1 is included to discharge C1 at switch off – without it, the charge across C1 would be present across the pins of the mains plug at switch off.

C1 has to be a special, Class X2 capacitor, designed for direct connection to the mains supply. Under no circumstances should any type other than that specified in the parts list be used. R1 is also critical to the safety of the unit: only an  $0.75\text{W}$  metal-film resistor rated at 350V should be used. This should ensure that the resistor does not go high in value or open-circuit, as ordinary carbon resistors tend to do.

R2 is included to limit the surge current via the bridge rectifier at switch on. Again, the use of a metal-film resistor will add to the overall safety. The bridge rectifier itself could be any 50V PIV 1A type. I have chosen one rated at 800V simply because it is readily available to one-off order – lower-voltage bridge rectifiers come in fives from Farnell. C2 is the reservoir capacitor, while D1 provides stabilisation at 12V. The value of C2 is larger than theoretically needed, but this will provide a longer service life.

## Receiver Circuit

Fig. 2 shows the circuit diagram of the receiver section of the unit. Photodiode D1 detects infra-red light. Note that it's reverse biased. When it conducts, an input appears at pin 14 of the TBA2800 chip IC1. This is a dedicated IR amplifier chip that contains three separate amplifier stages and an output inverter. In this applica-



tion however the positive-going output at pin 8 is used. C1 decouples the first amplifier stage while C2 and C3 provide coupling between the successive stages.

The output at pin 8 of IC1 is fed to the base of Tr1, which drives the piezo transducer connected to its collector. Note that the transducer is polarised. Tr2, the LED driver, is held off by R4. When the voltage at the collector of Tr1 falls however Tr2 conducts and the LED flashes. R5 limits the LED current. As the LED is driven in short bursts, R5 can have quite a low value without any threat of LED damage.

To maximise the audible output from the piezo transducer, the output circuit is fed directly from the 12V supply. The TDA2800 chip requires a good-quality supply of not more than 5.5V however. So the 12V supply is connected to R2 which feeds the 5.1V zener diode D2. The following low-pass filter (R1 and C4) removes any 100Hz ripple.

**Construction**

The accompanying photograph shows the internal construction of the unit. The 12V supply is built into the bottom half of the case, with direct connection to the mains input. The receiver is built into the top half. The whole lot is built on Veroboard. As there's nothing critical, no layout or constructional diagrams are included. The only point to watch is that the anode of the photodiode is as close as possible to pin 14 of IC1, to minimise stray pickup. A flat-topped LED was used so that it sits flush in the top of the case.

A small hole was cut in the case, at the bottom, to enable the sound to emerge. To prevent anything being poked into the unit, a small piece of plastic was glued over the hole.

Various photodiodes were tried. The SFH203PFA was found to give the best results. It blocks out IR radiation from the overhead fluorescent lights without need for any external filtering. The small square of IR filter stuck on the front of the case was added for the sake of appearance – it plays no part in the operation of the unit.

Use of a plastic case with no shielding means that the unit is prone to picking up timebase radiation. It should therefore not be used in close proximity to a TV set. A distance of one metre will avoid any problems.

**Testing**

The two sections of the finished unit are best tested separately. Check the receiver section with a 12V battery or a bench power supply. The power supply section should be checked with a multimeter.

If all is well, connect the two sections together and plug the unit in. At switch on the unit should produce a bleep, with a momentary flash from the LED. You can then leave the tester permanently plugged into the mains supply.

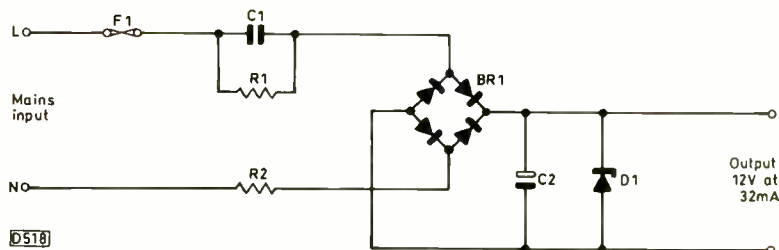


Fig. 1: Circuit diagram of the 'wattless dropper' power supply.

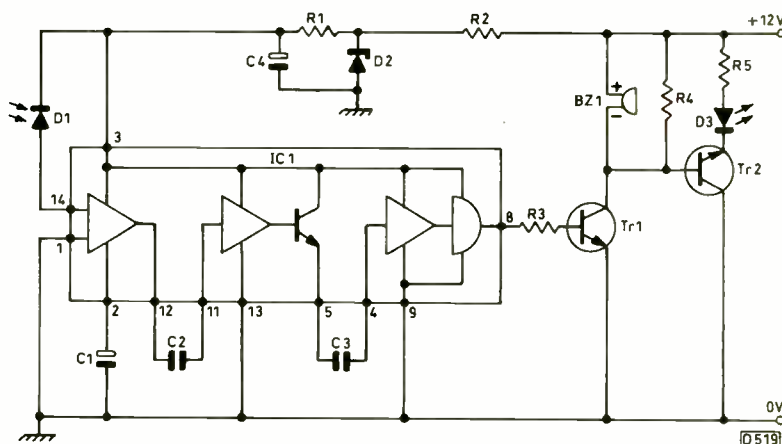


Fig. 2: Circuit diagram of the receiver unit.

**Parts list**

**Power supply**

C1	0.47µF	Farnell 772-847
C2	470µF, 16V, 105°C	
R1	470kΩ	Farnell 337-493
R2	220Ω	Farnell 337-079
D1	12V, 400mW	
BR1	1A, 800V	Farnell 371-180
F1	100mA Wickman fuse	

Note that C1 and R1 are safety components. See text.

**Receiver**

R1	100Ω	R2	680Ω
R3	47kΩ	R4	10kΩ
R5	100Ω		
C1	2.2µF, 16V, 105°C		
C2	1.2nF disc ceramic		
C3	10nF disc ceramic		
C4	47µF, 16V, 105°C		
D1	SFH203PFA	Farnell 212-738	
D2	5.1V, 400mW		
D3	Green LED	Farnell 621-006	
Tr1	BC107		
Tr2	BC179		
IC1	TBA2800		
BZ1	Piezo transducer	Farnell 561-010	
Plug-style case		Farnell 301-693	

Veroboard as required

*continued from page 496*

and pads around K201.

**Distorted sound:** Check C202 (100nF) for leakage, the alignment of L101 and the loudspeaker for damage.

### Colour Section Faults

The RGB output stages are on the tube base panel. The type of colour decoder chip used (IC500) depends on whether or not the set has teletext. Text sets use a TDA3561A chip. The fault guide for this is as follows:

**No picture:** Check for 12V at pin 1. Check the super sandcastle pulses at pin 8. They should be 50/50 height. If not the picture will mute. The blanking signal at pin 9 should be 0V. If not, check the blanking signal from the text IC via D903.

**No colour:** The chroma input at pin 3 of IC500 should be at 0.6V peak-to-peak. To override the colour-killer, connect pin 6 to 12V. The colour level control voltage at pin 6 should vary between 0-2.5V. If it's stuck at 0V, check back to the control panel.

**One colour missing:** If one output is missing at K501, check the 100nF decoupling capacitors C521, C522 and C523.

The TDA3565 colour decoder chip used in non-teletext models is similar but has no RGB inputs for teletext and different pin connections. The fault guide is as for the TDA3561A.

There are two types of CRT base panel, one for 29mm narrow-neck and one for 22mm mini-neck tubes. In most cases R717 is 1Ω for 29mm tubes and 2.2Ω for 22mm tubes. If you have to change bases because of a CRT change, check the value of R717. Here are some faults that can be experienced in this area:

**One colour (blue) full on:** This usually occurs with 22mm bases only and is caused by flashover from the focus pin to the collector of Q703. Replace Q703 (BF869) and bend it away from the CRT socket.

**One colour flashing or full on:** Check the relevant 150pF emitter decoupling capacitor (C701, C705, C708).

**Full brightness with flyback lines:** Check whether R731 (100Ω) is open-circuit. If so, the cause could have been a CRT flashover.

**Cannot set one gun's cut-off:** Check the relevant output transistor (Q700, Q701 and Q703) and diode (D700, D701, D702, type 1N4148).

**Cannot set any cut-offs:** Check Q702 (JA101) and R710 (1.2kΩ).

### AV Module

There are manual and electronic switching versions. Most sets have the manual version with a slide switch at the rear of the cabinet.

The audio section basically consists an RF oscillator which is frequency modulated with audio. The RF (unmodulated) measured at K202 should be 6MHz. The video section consists of an amplifier with a gain of two and a 75Ω input impedance. The video is connected to the main chassis via K100.

The electronic version is controlled from the TCR

panel and is found only in 200 chassis models. See later.

### Tuners

Early sets used the Telefunken 2000 tuner, later ones (including 200 models) the Telefunken 3010 tuner. These tuners give little trouble though the 3010 can cause striations.

The cause of tuning drift is seldom the tuner. To check, disconnect the tuning voltage source and connect a known stable voltage source. Monitor the result. For low gain check the AGC voltage, which should be about 10V. See the following section.

Where striations are a problem, change C009 to 100μF, 25V. It may be necessary to change the tuner to a U910 type.

### The Microcontroller Circuitry

The tuning controller panel also controls the contrast, brightness, colour, volume and teletext. There are three ICs, an SAA1293A microcontroller chip (IC300), an MDA2062 EEPROM chip (IC301) and a 7805 regulator (IC302).

**No display or functions:** Check the 5V regulator IC302, which receives its input from the 16V supply. If its output is low, disconnect everything connected to it in turn until the cause is found.

**No functions, display stuck:** Check the 4.43MHz clock oscillator crystal X300. If you load it with a scope probe you may stop oscillation; so check at pin 13 (tuner control voltage) of IC300 where you should find a 5V peak-to-peak squarewave. Also check the display and keyboard strobe pins, again for 5V peak-to-peak outputs.

**Two or three buttons don't operate:** Almost certainly there will be a common factor: check the connections of the ribbon cable to the control PCB.

**Functions buttons don't perform job allocated:** The set-up conditions for IC300 have almost certainly been corrupted. They are stored in IC301. It is not necessary to replace this device: reprogram it as described in the Mk 2 manual.

**Will not store – though the correct display appears:** IC301 could be faulty, D302 (20V zener diode) could be faulty of D303 (1N4148) short-circuit.

**At power on a blank raster appears (text models only):** See teletext section.

**Failure of IC300 or corruption of IC301. May also show as going to standby:** Can be caused by CRT flashover or a large static build up. Protection can be provided by adding a 470nF capacitor across pins 20 and 27 of IC300.

**Tuning drift:** Use an oscilloscope to check the tuning voltage. This will show any DC voltage variation. Check Q309, C312 which could be leaky, R329 which could be noisy, R330/1/2/3, C314/315 which could be leaky, and the 33V stabiliser D001.

**Analogue control failure:** If the volume, contrast, brightness or colour control operation doesn't function, check the relevant output pin of IC300 for a varying squarewave and the filter components.

**Faulty band switching (applies to Irish sets only):**



This circuit uses a two-line to three-line converter. All components in this area are suspect.

**TV set won't come out of standby:** An extra pair of contacts on the mains switch are used, via K305, to bring the set out of standby. Some users don't operate the switch correctly: it should be held long enough to allow the supply to rise and enable the microcontroller chip to recognise that the contacts are closed.

**TV set goes to standby, usually after a finite time (five minutes):** Caused by incorrect setting of the microcontroller chip initialisation – it's looking for an ident signal from IC100. This signal is not connected, so IC300 will time out. To stop this, look in the memory contents and reset the appropriate bit. (See Mk. 2 manual).

**TV set goes to standby:** May be caused by excessive static build up affecting IC300. To eliminate the problem, add a 470nF capacitor between pins 20 and 27 of IC300 on the track side of the PCB. Alternatively the cause may lie in the power supply – see earlier section.

### Teletext Faults

The teletext chip set is controlled by IC300 via an ITT bus.

**Set will not go into the text mode:** Check that the L200 regulator chip IC904 is providing a 5V output (its input comes from the 16V line). If the output is low, disconnect everything connected to it in turn until the cause is found. The clock oscillator Q900 (JC501)/crystal X900 can stop oscillating at low temperatures if the value of R902 is not 150Ω.

**Corrupt text:** Check the alignment of the video detector coil L102 – try a quarter turn either way to see if this improves matters. IC900 (VAD2150), IC901 (4164) or IC902 (TPU2732) could be faulty.

**Goes to text but with floating header:** There is probably no video input via K900 or a fault with Q905 (JC501).

**Goes to text mode but no data on screen:** Can occur at switch on because the microcontroller chip has reset too fast. Solution is to add a 10µF capacitor between the base and emitter of Q305 on the microcontroller board. If there has been a failure of the EEPROM (IC301) on the microcontroller board the text contrast level, which is stored there, may be incorrect. See Mk 2 manual for resetting procedure.

Check IC902's RGB outputs (pins 6, 7, 8), the emitter-followers Q901/2/3 (JC501) and the five-way ribbon cable between the microcontroller and text PCBs (K308-K901).

**Goes to text but appears negative:** Q904 (JC501) short-circuit.

**Goes to text but with frame jitter:** Sync lead not connected to R933 or disconnected from R412 on main PCB (no connection no.).

### Remote Control

Three types of handset were used with these models. The earliest type was fitted with an SAA1250 chip and can be easily identified by its tapered nose. The later versions are shorter and thinner and contain either an

OSH2006 or an OSH1010 chip. All can be used to programme the EEPROM. If there's no output, check the battery leads and for dry-joints at the IR diodes and the ceramic resonator.

The IR control module in the set is simple and has virtually a zero failure rate. For no operation check IC303, D308 and K302. The wire connections to the PCB can cause problems if the panel has been removed several times.

The control buttons are a four-pin matrix with carbon shorting dots. They give very few problems. Some sets (NEI 1461) used a local supply switch. These are not very reliable and not interchangeable.

### Spares

Spares for these sets should be available from Maplin Electronics (NEI Spares Division), Unit 11, Valley Court, Station Road, Wombwell, Barnsley, S. Yorkshire S73 0BS. Phone 0113 277 4310, fax 0113 277 4312.

### Next Month

The information given above is in general applicable to the 200 version of the chassis: servicing notes specific to this version will be included in Part 2 next month.

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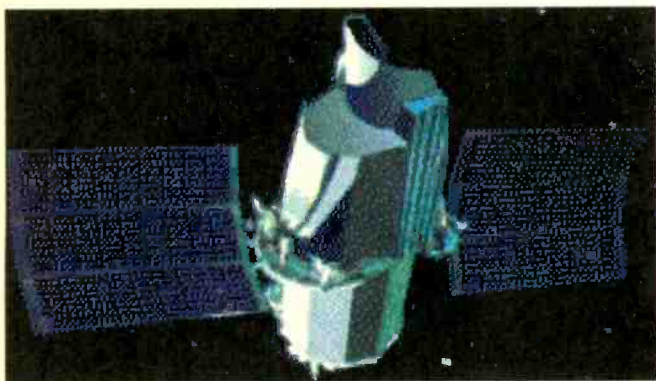
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# DX and Satellite Reception

**Terrestrial DX and satellite TV reception. News from abroad and about satellite developments. The problem of RF interference.**

**Roger Bunney reports**

**T**errestrial DX reception in the UK has been negligible during the past few weeks. There has been an improvement in F2 layer conditions, with higher MUFs, as the maximum in the present sunspot cycle approaches. But the reports I've had suggest that most F2 reception has been confined to areas south of the UK, the exception being transequatorial reception of several 50MHz amateur band signals during the late afternoon in the Channel Islands.

A good aurora on January 13th brought Band I TV signals from the Scandinavian countries to the UK from early evening through to almost midnight.

As F2 conditions improve, low VHF signals such as US paging stations, communications networks including police, radio links to aircraft (e.g. traffic spotters) etc. are heard. If you have a scanner and the

patience, it's worth checking across the band 28MHz to 40MHz from say 0830 to the east of the UK, progressing to due south around mid-day, then checking for American traffic in the afternoon. You need a reasonable outdoor aerial, not the small, helical set-top type.

Now that we are into March, we can hope for evidence of improving Spodic E conditions.

## E Channels

In the February issue I mentioned the original CCIR channels, i.e. E1, 2, 3 etc. Gosta Van der Linden (Rotterdam) points out that there was also a channel E1A, with its vision carrier at 42.25MHz. Austria had a ch. E2A transmitter, vision carrier 49.75MHz (same as the OIRT ch. R1) at Jauerling, while channel E4A with 82.25MHz vision is, of course, the Italian ch. IC.

## Satellite Sightings

An increasing number of signals, both analogue and digital, have been arriving from 36°E now that Eutelsat II F3 has been moved to this position from 16°E. When checking for digital news links on February 24th I found, in the clear at 11.140GHz horizontal (SR 27,500, FEC 3/4 – MOU id), the Transcendental Meditation experience from the Maharishi Open University. The following night it was encrypted, though the programme is often present as a clear analogue signal from Eutelsat at 10°E. Hugh Cocks in the Algarve has received from 36°E at 11.050GHz horizontal (SR 6,111, FEC 3/4) captions seeking reception

reports. I was unable to drag this signal out of the noise here in Hampshire! Nor could I locate the three APTN downlinks between 12.505-12.530GHz horizontal – you probably have to be there at the right time.

Bonum-1, the Russian satellite that's also slotted at 36°E, carries encrypted analogue programming (Syster) between 12.2-12.4GHz. On February 24th I found an analogue feed, SISLINK UKI 264 TEST FRANCE, on test at 11.634GHz horizontal.

Hugh Cocks has received signals from Afristar (which will carry Worldspace programming) at 21°E between 1.477-1.479GHz and 1.4795-1.4815GHz. He made a small H-type aerial, with each dipole leg just under 5cm, and fitted it on to an old 60cm Amstrad dish aimed at 21°E. Digital noise was present at very high levels – there aren't yet any digital radios for programme reception. Hugh has also received strong Algerian PAL signals at 11.720GHz vertical from Arabsat at 30.5°E.

Fred Pilkington (Malaga) received several analogue Ku-band transmissions from Arabsat 3A at 26°E on February 20th. They included Libya at 12.698GHz, JRTV Amman at 12.575GHz, Abu Dhabi at 12.620GHz, MBC at 12.735GHz and the Saudi ch. 2 at 12.715GHz, all horizontal. When I checked this out I found nothing. Perhaps these were tests prior to digital transmissions.

Dean Rogers (London) says fans of Italian football should check the following: 11.148 and 11.190GHz

*Hugh Cocks took this picture of reception from Onda Jerez across the Gulf of Cadiz from his Algarve location. The station transmits on ch. E58.*





(SR 5,632, FEC 3/4), and 11-137GHz (SR 6,111, FEC 3/4), all horizontal, via Eutelsat W2 at 16°E; and 11-556GHz horizontal (SR 6,111, FEC 3/4) and 11-632GHz vertical (SR 5,632, FEC 3/4) via Telecom 2D at 5°W. He reports that W2 carries ENEX news feeds at 12-505GHz (SR 5,632, FEC 3/4).

I missed the Dakar rally, which has previously always been in analogue form. This year it was transmitted in digital form at 12-380GHz vertical from 13°E as part of a package that included links and feeds for Eurosport, RTBF, TF1, the Speedvision facility and an international feed with English commentary.

Bindu Padaki (Bangalore, India) hopes to acquire a digital receiver – they are at present expensive at about 33,000 Rupees (approximately \$700). But the free-to-air channels are in non-English. He subscribes to a local cable service that carries digital downlinks: forty channels at about £3-4 a month is somewhat cheaper than BSkyB UK! For C and Ku band operation Bindu uses a California Amplifier combined feed-horn, type 31976, that allows for both linear (vertical and horizontal) and circular (left- and right-hand) polarisation.

While checking at 13°E recently I found a Thai TV channel, TV5 Bangkok, with programming and commercials. This was at 12-627GHz vertical. At 12-591GHz vertical there was Euronews with additional channels – services 1-10 – though only colour bars were present. These signals were both at SR 27,500 with FEC 3/4.

There has been some dramatic car racing via Intelsat K (21.5°W) on Saturday nights from various North American circuits including Daytona 500 and the North Carolina Speedway.

Reports on NATO talks in Paris on the Kosovo problem from February 22nd were carried by an analogue APTN feed (Starbird Rambouillet) via Eutelsat W2 at 11-021GHz horizontal. Ten days earlier, when President Clinton was cleared from impeachment, the North Atlantic circuits were full of analogue and digital feeds for the European networks – at one stage I noted five simultaneous analogue pictures at 21.5°W.

The funeral of King Hussein of Jordan, a licensed radio amateur (JY1), was carried extensively. Syria helped with uplinking via an Arabsat (30.5°E) news lease transponder – Syria Main Channel,

at 4-080GHz with right-hand circular polarisation.

### Terrestrial News

**UK:** News Datacom Systems has launched a 2-1-2-4GHz band Digital Terrestrial Link (DTL) system. Use of MPEG-2/OFDM technology is expected to enhance live ENG programme insertions from built-up areas where, because of the screening effect of buildings, multipath echoes etc., site-to-studio analogue hook-ups have been difficult to establish. After MPEG-2 encoding, the camera and audio outputs are OFDM modulated and fed via a microwave transmitter/aerial system to the studio, where the receiving system responds to the main signal content rather than the echo signals.

**Spain:** According to a report in the February issue of the 50MHz band amateur radio magazine *Six News*, the TVE Madrid ch. E2 transmitter is to close at the end of the year. TV-DXers will miss this station, which is frequently received via SpE. My very first SpE DX-TV reception, in 1963, was from this site.

**Isle of Wight:** The Newport-based RSL-TV station TV 12 has been given permission to operate relay stations at Brading and Ventnor and increase the Rowridge ch. 54 transmitter ERP from 1kW to 2kW (subject to clearance from Continental authorities). This will extend coverage in the east and south. The Luccombe (Shanklin) relay station has also been approved by the ITC, and initial approval for a transmitter in the Chichester area has been given to extend coverage on the mainland.

**Australia:** Digital terrestrial TV test transmissions from station Channel 7 in Melbourne started on February 10th. Ch. 6 (174-181MHz) is being used for these test transmissions. Viewers are asked to comment on any TV/radio interference problems by phoning or writing to the chief engineer.

### Leonids Activity

Mixed reports on the November 1998 Leonids meteor shower continue to be received. A Swiss amateur writes that the shower was "absolutely outstanding", with many contacts at 50 and 144MHz. The shower began shortly before midnight on November 16th, peaked at approximately 0100 GMT on the 17th, then lasted until about 0600 GMT, with signal levels reaching S9+. The reflected signals were not the usual short bursts (pings), instead lasting

21 TOTAL 99  
GRANADA - DAKAR

3

EUROSPORT

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for several minutes. He says he had never come across such reflections in thirty years of MS activity.

If the peak 1966 pattern is repeated this year the main storm, in conjunction with the Tempel-Tuttle comet stream, is expected to occur at 0147 GMT on November 18th.

*The Granada-Dakar cross-desert rally '99 was carried by Hot Bird (13°E) in digital form. This picture is from Dean Rogers, London, who uses a balloon-mounted 80cm tracking dish.*

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### Aerial Techniques

The new 36-page Aerial Techniques catalogue – it's more like a reference work – has just been published and is available at £1.50 including postage. Masses of equipment for satellite and terrestrial reception, whether domestic, commercial or DX, radio or TV, is listed. If you need a wideband log-periodic aerial for Band III reception, a 36in. dish Superjack arm, a UHF/UHF/UHF aerial triplexer, a radar rejection or double-notch filter or whatever, even an NTSC/SECAM/PAL digital standards converter, you'll probably find it.

Aerial Techniques can usually sort out your requirements – give them a ring on 01202 738 232. The address is Aerial Techniques, 11 Kent Road, Parkstone, Poole, Dorset BH12 2EH.

### Satellite News

Eutelsat's new slot at 12.5°W will for the first time give it transatlantic capability – Eutelsat I F5 and the vintage German TV-SAT 2 are the residents at this location. To provide throughput of TV, data and business communications to North America, Eutelsat has signed an agreement with Teleglobe Communications Corporation. At the US side the signals and data will be fed into fibre-optic links for routing across the continent. Eutelsat W3 is now in orbit at 7°E, replacing II F4.

Intelsat has been carrying out compatibility tests with digital compression equipment from fifteen manufacturers to establish a preferred list of earth station hardware that will provide smooth, efficient transfer of signals between its clients. There have been cases where equipment incompatibility has led to a lost circuit connection.

A new Russian digital TV service, NTV Plus, is now in operation with a package of at least eighteen channels including BBC Discovery, MTV and Nickelodeon: Geographic, Fox Kids and Bloomberg will be added in late March. There are already 200,000 subscribers.

BT Broadcast Services has bought the Dutch Intrax SNG uplinking service. Intrax will however continue as at present, with a fleet of fifteen SNG trucks.

The global cellular service provided by the Iridium LEO (Low Earth Orbiting) fleet of satellites started at the beginning of November last year. 120 countries have signed up to participate. But there remains some uncertainty about the security of links: Nippon Iridium (Japan) won't be charging its customers until April to give time for international connectivity to be proved or otherwise. There's a monthly \$70 service charge, and some 250,000 subscribers have signed up – though only 100,000 satellite telephones had been made by the end of 1998. These are special phones that cost about \$3,000 each. Internal calls cost up to \$2 per minute air time, international calls up to \$7 per minute.

The latest *SatFACTS* bulletin from New Zealand suggests that all is not well with the new PanAmSat PAS-8 craft. Intended to be in orbit at 166°E, NASA says the actual position is 166.5°E. This is bad news for users of PAS-2 at 169°E. This closeness means that the main forward lobe with a dish of less than 3m diameter will be too wide to be able to provide adequate co- and adjacent-channel rejection between the two satellites. A larger dish will sharpen the main forward lobe but could well produce secondary side lobes that could peak on the adjacent satellite. PAS-8 has a spot beam aimed at the West US coast, for direct links to Australasia. At the time of writing, this beam is incorrectly aligned – rather more at Pacific waters, the result being severe loss of anticipated traffic.

The Australian Broadcasting Authority now permits satellite reception of various channels that were previously restricted to areas without terrestrial transmission. The satellite services, via Optus, include Imparja TV, Telecasters Australia, ABC, SBS, TVSN, Horizon and QQQ, in digital rather than B-MAC form.

### RF Interference

Some years ago the RSGB published *The Radio Amateur's Guide to EMC*,

an invaluable book for anyone involved in radio transmission and interference suppression – EMC is the buzz word for interference nowadays. The book has been rewritten, updated and considerably expanded by Robin Page-Jones (G3JWI) and is now entitled *The RSGB Guide to EMC*.

Amateur radio transmitters can cause interference to domestic receiving equipment, for example wideband masthead amplifiers can be overloaded, but such problems are more often caused by shortcomings in the receiver or bad installation. When interference occurs and complaints arise, the amateur has to suppress the interference if possible or ascertain the cause of the problem.

There has been a dramatic increase in the amount of electronic equipment installed in homes. Many households now have computers, baby alarms, cordless or non-BT phones, radio-controlled car locks etc. in addition to TV sets, hi-fi units and so on. Much of this equipment has poor RF immunity and can suffer from interference from a nearby radio transmitter, whether operated by an amateur, taxi service, pager base station or cell phone base. Hence this new RSGB publication.

Though intended primarily for radio amateurs, the book is in fact a comprehensive guide to the use of the RF spectrum, how interference arises from a variety of sources, and the steps that can be taken to suppress/minimise problems.

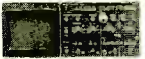
Particular attention is paid to computer systems, on how to silence interconnecting leads and prevent the TV aerial download injecting interference into the domestic TV or distribution system. With satellite systems, VCRs and home cinema, the mass of leads offers many opportunities for breakthrough to occur. But a whole army of preventive devices can be called up for help, such as braid-breakers, band-pass and bandstop filters, ferrite rings and blocks. Once the problem has been understood, it can usually be dealt with. This book explains how.

Having had many years' experience of interference problems, I can wholeheartedly recommend the book. It's well written, i.e. easy to understand, and has plenty of illustrations throughout its 204 pages. There's no maths to confuse things! *The RSGB Guide to EMC* is published by the RSGB, Lambda House, Cranborne Road, Potters Bar, Herts EN6 3JE at £18.75 plus £1.25 postage.



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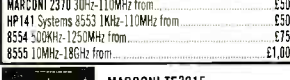


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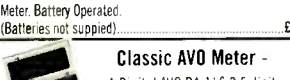
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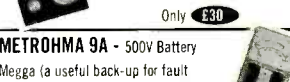
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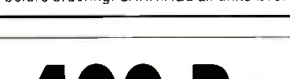
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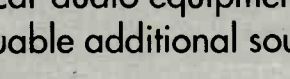
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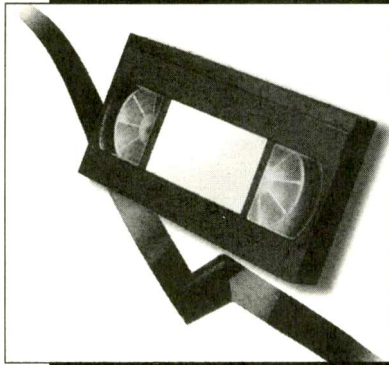
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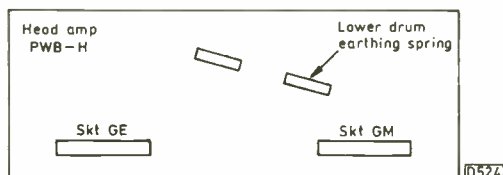
### Grundig VS920

A dead machine because C1626 (47 $\mu$ F, 25V) has failed is a fault that's been reported previously in these pages. Sometimes however C1626 can be the cause of a pulsing power supply. One of the first things the system controller chip does at power up is to energise the threading solenoid once. If the power supply pulses repeatedly, the solenoid can overheat, blowing its internal fuse. The result is that you repair the power supply, the machine powers up, but the deck stops when a cassette is inserted. The VCR won't play or eject the tape, because the solenoid doesn't work.

You can, with care, repair the solenoid by carefully cutting away the clear plastic covering, then the fabric tape underneath, to reveal the thermal fuse (part number 72008-456.00). Ensure that the new fuse is pressed close to the windings and is insulated by adding new tape.

When you work on the power supply it's a good idea to note which direction the green stripe on the black ribbon cables goes, in

**Fig. 1: Mitsubishi HSM50V drum earthing modification.**



# VCR Clinic

case one becomes disconnected. Also take a look at the 220 $\mu$ F capacitors (all nine!) on the secondary side of the power supply – to see if any are leaking electrolyte. **P.B.**

### Mitsubishi HSM50V

An unusual fault can occur with early versions of the J deck. The customer says that the playback picture is snowy, but if the VCR is moved the fault disappears. The cause is a poor connection at the lower drum earthing spring (not the video head earthing spring). There is a paint mark, put there at the factory, where the spring makes contact on the chassis. Clean off the paint and solder the spring to the chassis. Fig. 1 should make this clearer.

Later versions use a different method of earthing the drum to the head amplifier. **P.B.**

### Philips 14PV163/05

If the problem with this TVR combi unit is intermittent loss of the picture, just sound during video playback, check crystal 1800 on the large PCB beneath the video mechanism for dry-joints. **P.B.**

### Panasonic NVHD625

We've recently had several of these machines in which the back-tension arm has jammed against the left-hand tape-loading arm. The fault symptom is that a cassette is taken in then rapidly ejected. The cure is to fit a new back-tension arm and ensure that it is properly engaged with the main mechanism sliding plate. **B.S.**

### Panasonic NVF65

Sound but no E-E video was the complaint with this hi-fi machine. It would play back prerecorded tapes perfectly. After some checks

in the video switching circuitry, then some head scratching, I discovered that the machine has standard-play video only, plus a long-play facility for hi-fi sound recording. Switching the machine back to standard play restored the missing E-E video. **B.S.**

### Akai VS204G

In the March issue (page 346) I described a tape speed fault that was cured by fitting a new capstan motor. Akai has since told me that this is not necessary. The cause of the problem is static discharge from the motor to conductors on the PCB below: there's a modification that involves a wiring change.

Wow! Why can't they circulate details of such known fault conditions to dealers and spares-account holders as well as Akai Service Centres, or at least intercept orders for expensive motors? It's not the easiest fault to diagnose... **E.T.**

### Jammed Cassette

A Ferguson 3V44 came in with a cassette jammed inside. The machine worked in all modes, and when the eject button was pressed the eject mechanism operated. But the cassette remained in the housing. It was loose, but something prevented it from being pulled out.

I removed the cassette housing, expecting to find damage. When I turned it over I discovered the cause of the trouble. One of the cassette's screws was loose and stuck out by a quarter of an inch. I was able to remove the offending screw with tweezers, and after reassembling the machine worked correctly.

This could happen with any VCR of course. **F.B.**

### Ferguson FV72LV

There was no mechanical operation



and a tape was stuck inside. The cause was no supply to the loading motor because D409 was open-circuit. There are two diodes in series, D408 and D409, both type 1N4001. I decided to replace them both. After that the machine worked normally. **D.S.**

### **Panasonic NVJ35**

The capstan motor was very noisy and sometimes ran erratically, the symptoms then being wow and an unstable picture. The cause of the trouble was C22 (330 $\mu$ F, 10V) in the power supply. I fitted a replacement rated at 105°C. **D.S.**

### **GoldStar Q4031**

If the fluorescent display characters are over bright and the blanked segment is partially lit, replace the 33V zener diode ZD104. **J.LeJ.**

### **Samsung SV301K**

No remote-control operation is commonly caused by a damaged PCB track along the front edge of the motherboard, between CN603 and ZD101. This removes the earth connection and all three pins of the IR sensor rise to 5V. **J.LeJ.**

### **Daewoo V21**

If there's no RF and no capstan or drum rotation, check Q861. It's quite common to find that it has gone open-circuit. **L.LeJ.**

### **Samsung VI395**

If there's no power up, check R101, ZD101, C113 and C110. ZD101 tends to go short-circuit. **J.LeJ.**

### **Daewoo DVK985P**

If there's no tape movement, i.e. the loading arms move the tape to the drum but the capstan motor doesn't rotate, check D504 which tends to do short-circuit, look for dry-joints around the capstan motor connector and if necessary check IC502. **J.LeJ.**

### **Hitachi VTM502E**

Various plastic deck parts were broken in this machine. So the relevant service kits were obtained and fitted. The deck was then intact, and was retimed. But in the eject position the threading motor permanently drove the cassette housing in reverse, and wouldn't stop.

I wondered whether the end sensors or the 'butterfly' sensor was faulty, but they proved to be OK. Further checks showed that the threading motor drive chip was turned on at all times. The chip

itself was OK: the TMO line from pin 35 of the microcontroller chip was wrong. The cause of the fault was the microcontroller chip. Once it had been replaced the deck functions worked normally. **M.L.**

### **JVC HRJ425**

Incorrect speed was the complaint with this machine. In playback the capstan ran slightly fast and made a loud, grinding noise. I suspected the motor, but when I removed it the bearings seemed to be OK and it was not noisy when spun by hand. The outputs from the power supply were all OK, though I replaced a few suspect electrolytics just in case, all to no avail. I was beginning to run short of time, so I took a guess and ordered a new BU2884S servo chip (IC401). The new chip completely cured the problem. **M.L.**

### **Hitachi VTM502E**

The E-E picture was OK but there was very poor, low playback video. I used a scope to check the video signal through the playback stages and found that all was well until I reached the emitter of the BC848B surface-mounted transistor Tr7007, where the signal was badly clipped and of low amplitude. A new BC848B cured the problem. **M.L.**

### **Mitsubishi HSB82**

This monster machine came in with very poor video playback and low-gain E-E pictures. The symptoms were the same at the scart socket. I had no manual, so I took a quick look to see if I could spot anything obvious.

I followed the leads from the modulator to the bottom of three boards at the right-hand side of the machine. Access was surprisingly easy. The modulator leads are plugged into the board at the right-hand corner, close to the S-video inputs and phono sockets. Close by there are two surface-mounted, silver-looking capacitors. When they were heated and cooled the symptoms were emphasised. Much to my relief, replacements cured the fault. The offending capacitors were C210, 47 $\mu$ F, 16V and C232, 10 $\mu$ F, 16V. **M.L.**

### **Philips VR665 (Paolina)**

There was a very intermittent problem with this machine: the picture would develop bad tracking errors with the mono sound badly marred by wow/flutter. The cause was capstan speed variation. The culprit turned out to be the BC848B sur-

face-mounted transistor Tr7469 in the control-track amplifier circuit. **K.J.G.**

### **Samsung SR801K**

The complaint with this machine was unstable operation in the LP mode, both record and playback, SP operation being normal. It seemed that the capstan motor could be faulty, but a replacement made no difference. The cause of the trouble was found to be the KA8334 chip IC201. **K.J.G.**

### **Sharp VCM311HM**

Old sound was being left on the tape. Checks showed that the bias oscillator wasn't working: the 2SC3203 oscillator transistor Q651 was leaky, and as a result R658 (4.7 $\Omega$ ) was open-circuit. When these items had been replaced there was still no oscillation. Replacing the DTC323 transistor Q652 brought the oscillator back to life. **K.J.G.**

### **Akai VSG245**

This machine would intermittently fail to play a tape, with error 3 shown in the front display. After some test runs I found that the fault occurred when the machine was left to go into standby with a tape threaded round the drum and play was then pressed. The cause of the problem was drum surface wear. The drum would turn, but not promptly enough, and sometimes the tape would be thrown out a little at the take-up side of the drum. A replacement drum assembly cured this intermittent fault. **G.S.**

### **Sharp VCM26**

The complaint was that the front clock gained one minute each day. I replaced the oscillator crystal and ran the machine on test, but the fault was still present. On closer inspection I found that one of the pair of surface-mounted capacitors in the crystal oscillator circuit was missing – in fact it had never been fitted. Adding this capacitor cured the fault. **G.S.**

### **Akai VSG271**

This machine would intermittently cut off and stop in the play and record modes. On test I found that the tape would spill out on the take-up side of the pinch roller then the machine would stop. A check on the take-up torque showed that it was low at around 50g/cm instead of 80-100g/cm. The cause of the trouble was the reel-drive clutch. **G.S.**

## Answer to Test Case 437

- see page 459 -

We are often fooled into thinking that the microcontroller chip in a TV set or a VCR is faulty. All too often, especially in a VCR, the chip turns out to be perfectly OK. In this situation a feedback signal, typically from a deck sensor, is usually wrong.

In this case however the cause of the fault lay in the power supply circuit. IC301's 5V supply comes via circuit protector PR512, which looks like a resistor. It's rated at 1.25A and, in this design, passes about 130mA in the standby mode and 530mA when the machine is switched on. It feeds three regulators, one for the always 5V supply and a couple more for the two switched 5V supplies.

When the machine was in the standby mode the full 5V was available at the microcontroller chip, which would happily switch on the other two 5V lines when asked. But the increased current through PR512 would result in the always-5V supply falling below 4.5V. At this point the microcontroller chip would reset itself and release the two 5V supply switches, reverting to standby. A negative-going pulse at the output end of PR512 was clearly visible on the screen of Sage's scope when the machine was switched on.

The initial recording problems noticed by the user were caused by the onset of PR512's failure. When it was removed and checked, its resistance was found to be just over 1Ω.

The moral is to check the power supply outputs carefully and beware of fuses and protective resistors whose resistance value may have increased.

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#### Servicing the Panasonic Euro-2 Chassis

The Euro-2 was Panasonic's second chassis to feature digital signal processing. There were several versions. Brian Storm describes the operation of these sets and summarises servicing experience to date.

#### PC Memories

A PC system uses several different types of memory device for various purposes. In Part 3 of his current series K.F. Ibrahim describes the different types of memory and the purposes for which they are used.

#### Servicing Daewoo V50/V60 VCRs

J. LeJeune describes routine servicing and summarises fault experience with these VCRs, which differ only in the VideoPlus option. They use the Daewoo FM deck.

#### A Run-on Timer Circuit

Keith Cummins presents an interesting circuit that can be used to switch equipment off after a time delay of up to half an hour. The design avoids the need for a mains transformer.

#### CD Player Servicing

John Coombes on basic faults and their causes.

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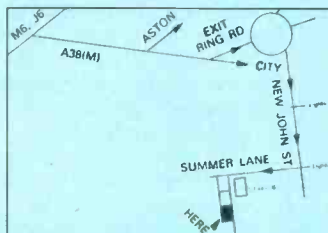
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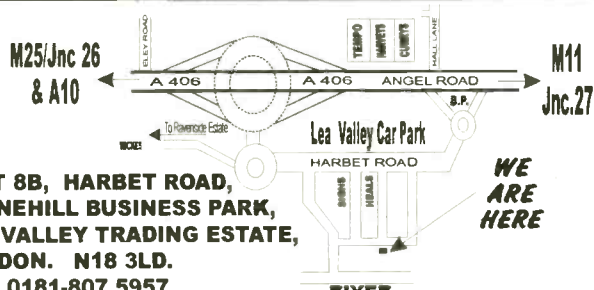
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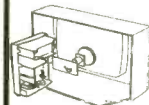
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**Written by Nick Beer for service engineers, enthusiasts and students**

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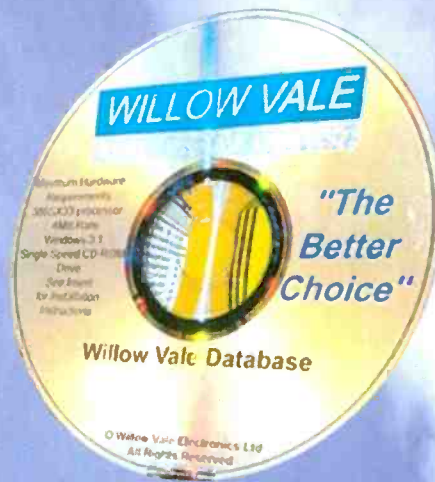


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