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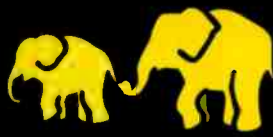
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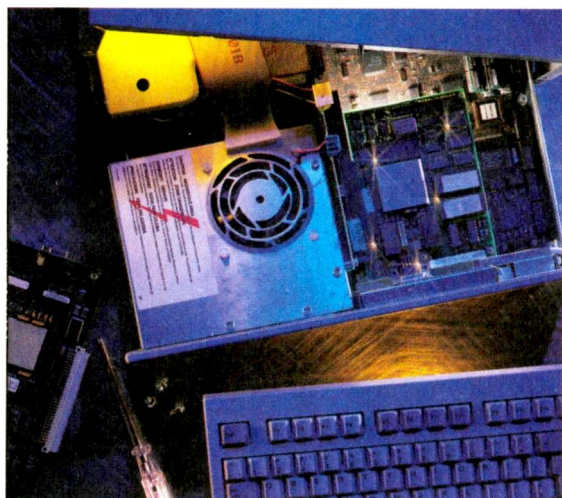
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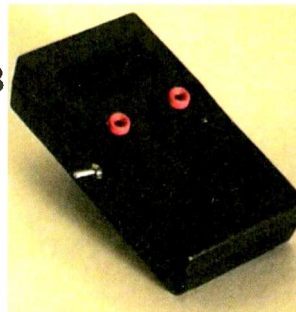


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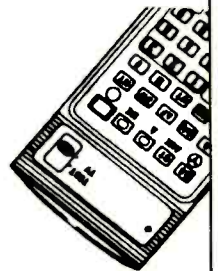
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Ten Years of Sky

It seems almost unbelievable that Sky Television has now been in operation for just over ten years: the actual launch date was February 5th, 1989. I have to confess to being amongst those who thought it would never come off, and that Rupert Murdoch was out of his mind. People had four perfectly adequate TV channels which they received either at UHF or via cable. Who would want to rush out and buy a dish to receive four more channels from a new, upstart broadcaster? It just didn't seem to be on. But I, and many others, were wrong and Rupert Murdoch has proved to be spectacularly right. Mind you he did take a gamble, more than one in fact, and was aware of it.

He seems to have been very worried about whether the Astra satellite would make it into orbit, and whether it would work successfully if it did. And would his new broadcasting technology work? He needn't have been too worried on either of these counts, though delays could have jeopardised the project. After all there was nothing new about satellites, and satellite TV broadcasting had been proved as far back as 1975/6, with the ATS-6 satellite that provided an experimental TV service to the Indian sub-continent. That satellite, working at UHF, started the ball rolling. Though directed at Asia, from 35°E, there was sufficient off-beam signal to provide reception of sorts even in the UK.

The established broadcasters in Europe and elsewhere had been slow to take advantage of the possibilities presented by satellite transmission, though orbital and frequency allocations had been agreed at the World Administration Radio Conference

(WARC) in 1977: the 11.7-12.5GHz band was to be used for DBS (Direct Broadcast by Satellite) services in Europe. Rupert Murdoch wanted to extend his media interests to TV, but there were no terrestrial channels that he could use in the UK and he didn't, of course, have a satellite allocation. Nevertheless certain opportunities were open to him.

The WARC had allocated orbital positions to countries large and small. It was unlikely that indigenous broadcasters in smaller countries would make full use of their allocations. Luxembourg in particular represented an opportunity. It had allocations, which were in the right spot for broadcasting to Western Europe. In fact the Luxembourg government had decided to become involved with satellite broadcasting as early as 1982. By 1985 the Luxembourg-based Societe Europeenne des Satellites (Astra) had decided on a suitable satellite (the RCA 4000 type) and had signed contracts for delivery and launch. Hence Astra 1A, which would be located at 19.2°E.

What about frequencies? Well, there was the fixed satellite service (FSS) band, just below the DBS band at 10.95-11.7GHz, which was intended for fixed communications services such as the delivery of signals to cable distribution systems – and was likely to be underused. Rupert Murdoch seized the opportunity, and in June 1988 signed ten-year contracts for four Astra channels in the FSS band. It's remarkable that he got his act together in time for the February 1989 launch. The rest, as they say, is history.

But how was Murdoch to compete suc-

cessfully with the established broadcasters? With his media experience, Rupert knew what was required. Basically, sports and movies, and plenty of 'em. He set about wheeling and dealing, and built up the programming he required.

He was helped in his efforts by certain technological factors. The cable companies were happy to distribute his channels, and improvements in LNB technology made reception with small dishes possible. Everything was going his way, and once it had become established as part of the broadcasting scene Sky grew and grew. It now has over seven million subscribers, 6.5m in the UK and 576,000 in Ireland. The split between DBS and cable reception of Sky is about 50:50. Sky has proved to be highly profitable, making over £300m in 1997. There has been a sharp decline recently, because of the cost of launching digital TV services. But this seems to have been well handled – the digital subscriptions are rolling in. Once again Rupert Murdoch has revealed a flair for getting it right.

By clever marketing Sky has got the public used to the idea of paying for TV. This can be extended further, with pay-per-view operation. Now we have the digital revolution adding to Sky's prospects: lots of channels and people willing to pay for premium and special-interest programming. To this can be added interactive TV, with more scope for profitability.

The next step for Sky is to extend its operations across Europe. This will require more wheeling and dealing. It is already underway, as our news pages (Teletopics) report. There seems to be no stopping Sky, and many viewers will be thankful for this.

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SATELLITE FAULT FINDING GUIDE

NEW EDITION No. 5

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

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

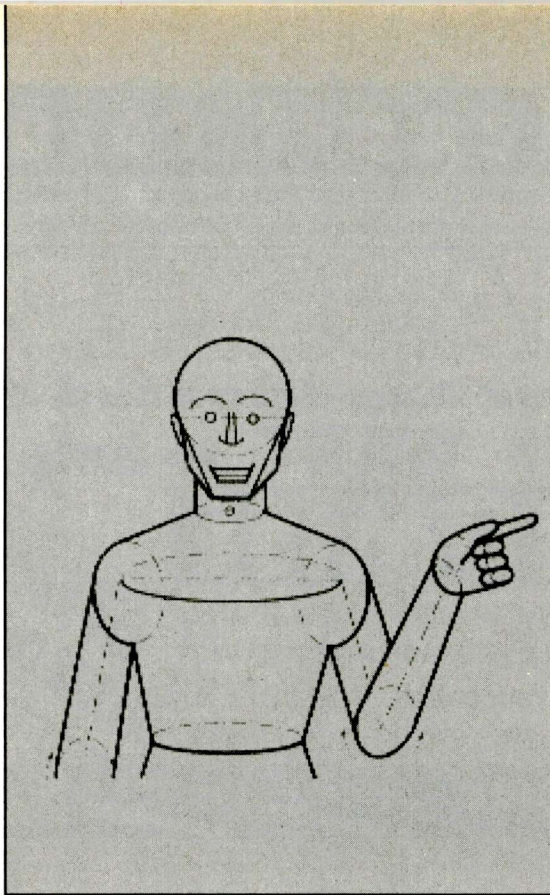


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Toshiba Service Briefs

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TV Sets

2173DB (C7S chassis)

Field scan collapse – to 0.75in.: C323, which is connected to pin 2 of Q501, had developed a 300k Ω leak. It's an 0.68 μ F plastic film capacitor rated at 50V.

2505DB and 2805DB (C90D chassis)

Field scan cramped at the bottom of the screen and stretched at the top: C372, which is connected to pin 15 of the EW chip Q371, had reduced capacitance. The correct value is 2.2 μ F, rating 50V.

2550TB (C4E-R chassis)

Two-inch bands of patterning at the top and bottom of the screen, present only when the set is cold (at first switch on): Line-frequency pulses are being picked up at the base of the DPC amplifier transistor QD03. Cure is to add an 0.001 μ F decoupling capacitor across RD13 on the print side of the PCB. Ensure that it cannot short to other areas of the board.

Service manual note: Power supply transformer T803, type TPW3368AR, is not listed in the manual. Its part no. is 23217352.

2563DB and 2863DB (C6SR chassis)

Pulsating picture with low HT: Occurs when transistor Q828 in the voltage control circuit is leaky. It's type 2SC1815-Y, part no. A6317440.

2877DB (C75S chassis)

White dashes on the picture, sloping down to the right in lines. The fault is video-content dependent and not present on chroma: The TA9090AN digital comb filter chip QZ01 is faulty. Its part no. is B0410688.

28MW7DB and 32MW7DB (C75S chassis)

High level of background hiss (white noise) from the rear speakers: An improved Dolby Digital module,

part no. TSN01467, is available to cure this condition.

The kit includes microcontroller chip QA01 which, when fitted, will also remedy the slow channel change reported in Bulletin AH70 (see *Television* August 1998 page 694).

Kit TSN01467 supersedes kits TCP01421 and TCP01422.

3787DB (C85S chassis)

Very intermittent crackling from all speakers when the set is first switched on from cold. Sounds like static discharge. Flicking through the surround menu options will sometimes trigger the fault: The cause is noise pickup within the Dolby Digital unit U101A (identified by U1 written on the label on it). The cure is to replace the unit with the improved version which has U2 written on it and is available under part no. 23781658 (original) or 23782114 (new).

Alternatively, if a fast repair turnaround is required the original module can be modified as follows. Unsolder the four earth terminals and very carefully unplug the connector from the IMA module H002. Remove the module from the panel, then remove both metal screening cans from the module. Replace the four 100 Ω chip resistors RD03/04/05/06 with 33 Ω chip resistors. Fig. 1 shows the position of these resistors.

40PW8DB (C85S chassis)

Severe convergence errors: Occurs when Digicon module U103 is dislodged from its socket. Refit.

Service manual notes: The correct part no. for the line output transformer T461Z is 23236552, not as shown in the manual. The wide aspect conversion (WAC) block was omitted from the chassis block diagram in the manual. It's connected between the RGB/YUV SW block and the chroma/video/deflection block (Q501).

48PJ6DB/DG and 55PJ6DB/DG (C55S chassis)

Note that circuit diagram 2/5, Power Supply 1, in the service manual shows resistors R843 and R842 in the

optocoupler circuit reversed. They are correct on the PCB.

Repair Kits

When repair kit 40PW8DBKIT, 56PW8DBKIT, 40PW8DGKIT or 56PW8DGKIT is obtained you will find that it includes a detailed instruction sheet. This should be carefully read before undertaking the repair.

VCRs

V218B, V228B and V428B

Intermittent failure to start up from mains off: Cause is TW020 not receiving the correct start-up voltage via RP004/05/06/07/08/10/11/24. It's RP024 (47k Ω) that usually goes high in value.

High pitched noise from the power supply, appears to come from transformer LP050: Replace the 2,200pF capacitor CP041, part no. 24285222.

AC mains input socket on PCB: There has been a report of dry-jointed/cracked solder connections at this socket, with some arcing. Repair was carried out by resoldering. Toshiba has not come across this fault and would like to investigate a machine where it has occurred. If you can help, phone Toshiba Technical on 01276 62222.

Service manual corrections: TW095 on the secondary side of the power supply is shown as an npn instead of

a pnp device in the circuit diagram. Its emitter is connected to RP095. Delete the link shown between the 20V supply (from DP061/CP061) and the PG (power good) control line.

V218B, V228B, V428B, V728B and V858B

Intermittent loss of record colour: Can occur when CV061 (0.047 μ F) is leaky. It's connected to pin 54 (record AFC detection) of the video processor chip IV001. The part no. is 70041704.

V726B

Stuck in standby but responds to remote control: The 2SC2236-Y 12V regulator transistor TW003 on the main PCB is open-circuit. Part no. is A6325549.

V856B and V857B

Intermittent loss of record colour: Can occur when CV030 (0.047 μ F) is leaky. It's connected to pin 29 (record AFC detection) of the video processor chip IV001. The part no. is 70041704.

VideoPlus Programming

S4C has now been allocated VideoPlus Guide channel 11. This means that when installing a VideoPlus VCR you will either have to tune S4C in at programme position 11 or set the VideoPlus Guide channel number 11 to select programme position 4 (if S4C is tuned in at this position).

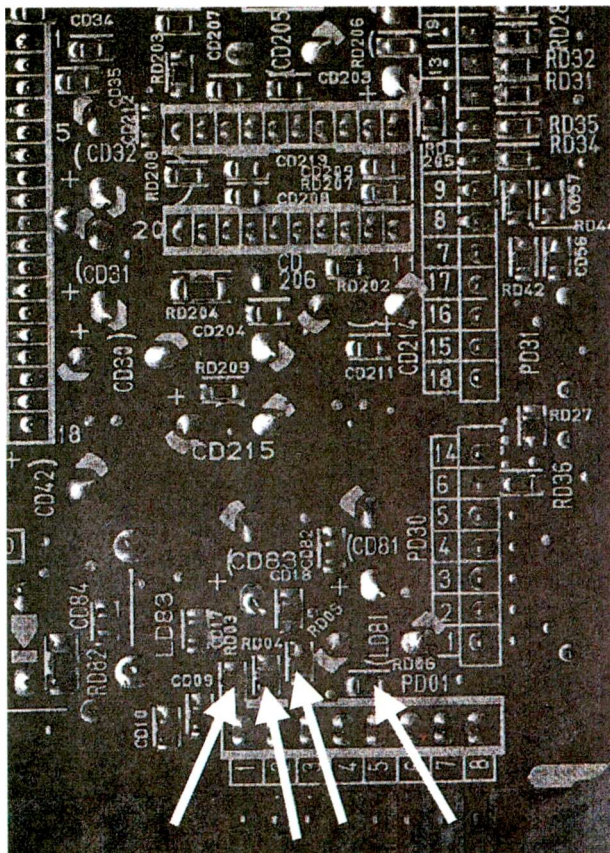


Fig. 1: Modification to the original Dolby Digital unit in Model 3787DB to cure intermittent audio crackles from all speakers when the set is switched on from cold. Replace the arrowed surface-mounted resistors, using 33 Ω instead of 100 Ω resistors.

Make sure you get your copy of *Television*

It can be difficult finding a copy of *Television* at local newsagents. The number of magazines being published keeps on increasing, which means that newsagents have less shelf space for the display of particular titles. Specialist magazines in particular get crowded out.

There's a solution to the problem. Most newsagents provide "shop-save" and/or home-delivery services. There's no charge for a shop save. You simply ask your newsagent to order a copy for you: it will be kept on one side each month ready for you to collect. Home-delivered copies are ordered in the same way, but often incur a delivery charge.

A newsagent can order any magazine for you, whether or not the shop normally stocks it.

If you buy your copies of *Television* from a newsagent and want to make sure you get every issue, just ask at the counter.

TELETOPICS

SkyDigital Success

By the end of January BSKyB had signed up some 350,000 subscribers to its digital satellite TV services. Just over a third were new subscribers to BSKyB, the others converting from Sky's analogue services. SkyDigital has achieved better results than digital satellite broadcasters elsewhere. In the USA, DirectTV signed up 200,000 subscribers during the same period, from a very much larger population base. In France CanalSatellite claimed some 100,000 subscribers at the end of January. SkyDigital exceeded its target of 200,000 subscribers by the end of 1998 by 75,000, and has set itself a new tar-

get of a million subscribers by October 1999.

BSkyB plans to revamp the electronic programme guide currently used for its near video-on-demand service. A pay-per-view film service from the digital broadcasting company is to be added to SkyDigital this spring, when the Open interactive service is also due to start. Argos, Dixons and Somerfield are the latest firms to sign up with Open – they will be offering products when the full service starts next autumn. In addition to home shopping, Open will be providing information, games, banking and e-mail.

Rupert Murdoch's aim is to make

BSkyB part of a Europe-wide pay-TV network. An attempt to buy Telecom Italia's pay-TV subsidiary Stream broke down in early February. More recently, BSKyB has been holding talks with Canal Plus over a possible merger. Canal Plus is now active in Spain, Italy and elsewhere as well as France. There seem, understandably, to be differences between the two over who should run a combined operation. There is also the major point that a merger would almost certainly initiate a full-scale anti-trust investigation by the European Commission, which vets all substantial mergers that affect the single EU market.



Labgear has launched the TriStar Compact set-top UHF TV aerial in response to calls for a smaller version of the well-established TriStar. The new aerial is based on the same log-periodic design, providing good gain across the entire UHF TV band. For further details call Labgear on 01223 366 521.

Predictions

Haruo Nakatsuka of Toshiba came up with some intriguing predictions for the future of TV and video during his keynote speech at the latest International Solid State Circuit Conference (ISSCC), which was held at San Francisco in late February.

A substantial increase in games capability, in which for example you could take part in a 'real' car race, was his first prediction. This would call for a CPU with a five billion floating-point operations/sec (GFlops/sec) capability and a 700 GFlops/sec graphics processor.

For 3D-TV the scene would be filmed from several angles simultaneously, which would enable the TV set to

construct a geometric model of the scene and use real-time ray-tracing to play it back from an arbitrary direction. "A viewer could enjoy a football goal scene from any angle" Nakatsuka said. This would require about 100GFlops, or 10GFlops if done off-line.

Video filtering becomes possible with 900GFlops/sec processing. The TV set could for example use facial recognition to follow the viewer's favourite footballer around a match, always selecting the camera that provides the best view of the player.

Nakatsuka thinks that processing power for real-time ray-tracing will be available by 2005 and for video filtering by 2008.

DTT Installations

The Digital TV Group has published a book entitled *Installing Digital Terrestrial Television – Domestic Systems*. It's very clearly presented, with lots of colour, and provides sound guidance. Copies are available at £10 each from The Digital Television Group Limited, Liss Mill, Liss, Hampshire GU33 7BD. Telephone no. is 01730 893 144, fax 01730 895 460, e-mail

mcook@dtg.org.uk

also web www.dtg.org.uk

Antiference has introduced the RX range of aerials for DTT reception. Features include twin dipoles for optimum signal transfer to the cable across the bandwidth, and a reflector with tuned bars to improve protection against ghost signals. For further details contact Antiference, Eastern Avenue, Lichfield, Staffs WS13 7SB. Phone 01543 267 160, fax 01543 267 104.

DVD Update

According to the DVD Committee well over 50,000 DVD players have been sold in the UK and sales are steadily growing. Over 35,000 region two discs were sold during the pre-Christmas period. Sales in the USA have been very encouraging, and in the UK it appears that the DVD is gaining acceptance amongst video users.

Nimbus manufacturing recently produced the first DVD-9 (dual-layer, single-sided) disc in the UK.

Panasonic has launched a DVD-ROM drive, Model SR8583, that's compatible with DVD-RAM discs. It has a x5 speed mode for DVD-ROM discs and a x32 mode for CD-ROMs. The machine is also compatible with DVD-R, DVD-5, DVD-9, DVD-10, CD-R and CD-RW discs.

Onkyo's new DVD player, Model DVS501, includes 20bit/96kHz audio playback.

Sony has launched several DVD-Video players. Model DVPS7700 plays DVD-Video, Video CD and audio CD discs and is compatible with Dolby Digital and MPEG-2 audio. It has a digital output socket for DTS digital surround-sound. Models DVPS725 and DVPS525 have a built-in Dolby Digital and MPEG-2 decoder and a digital output for DTS.

Philips, Sony and Pioneer have formed a joint licensing programme for DVD technology.



CPC has added Rayvac's unique rechargeable alkaline batteries and chargers to its range. These 1.5V batteries can be recharged up to a hundred times and can be used to replace Ni-Cad and Ni-MH equivalents. They can be stored for up to five years fully charged. For further details check with CPC on 01772 654 455, fax 01772 654 466.

Video News

Sony has announced the first camcorders that use its new Digital-8 technology, enabling users to record digital sound and pictures on Hi-8 tape (see Teletopics, March page 308). There are four models, DCR-TR7000, DCR-TRV110, DCR-TRV310 and DCR-TRV510. With the exception of the first model they all have a built-in LCD screen and an IEEE 1394 digital output socket for connection to a PC or other digital device. Model DCR-TRV510 has a digital still camera function with a built-in 2MB flash memory that enables up to 33 still images to be stored. It also has an RS232 connect-

ing cable and software for image manipulation on a PC. Other features include an electronic image stabiliser, x80 digital zoom, x20 optical zoom, eight picture effects and six digital effects. The Digital-8 system has an optional LaserLink IR connection to enable a camcorder to be linked to a TV set or VCR without the need for cables.

Panasonic has introduced three new VHS-C camcorders, Models NV-VX24B, NV-VX44B and NV-VX54B. All incorporate a 2.5in. colour LCD screen. Model NV-VX54B has a x300 digital zoom. There is also a MiniDV camcorder,

Model NV-DS33B, which is claimed to be the world's smallest conventional-style digital video camera. It uses a newly-developed super compact mechanism with a three-stage mid-drive cylinder that provides an extremely short tape path with optimum tape protection. Another feature is the Progressive Shot System, which is claimed to enhance the resolution of standard-recorded still pictures by 1.5 times, making them better suited to printing or feeding into a PC.

JVC says it expects over 42,000 MiniDV camcorders to be sold in the UK this year compared with 27,000 last year.

Business News

LG Electronics has ceased production of TV sets at its Washington, Durham plant because of excess capacity in the European market.

Japanese manufacturers continue to announce record losses, the result of an over-valued Yen and poor trading conditions in domestic, Asian and other markets. NEC made its largest loss ever, £770m, for the year to March and is to make 15,000 employees redundant; Matsushita has reduced its earnings forecast after a poor third quarter result with pre-tax profits down 49 per cent; Toshiba has suffered its first loss (\$167m) at parent company level since 1951 (the last loss at group level was in 1976); and Hitachi has warned that consolidated net losses for fiscal 1998 will be \$3.3bn, sharply higher than its previous estimate – the dividend is to be halved.

Round-robin Help

Martin Pickering of SatCure now supplies a weekly update of servicing faults/cures by e-mail *only*. The recipient list is restricted to trade repairers, who are expected to contribute new information to this self-help group as well as occasionally asking for help themselves. Fault contributions considered to be of general interest may be published in – and paid for by – *Television*.

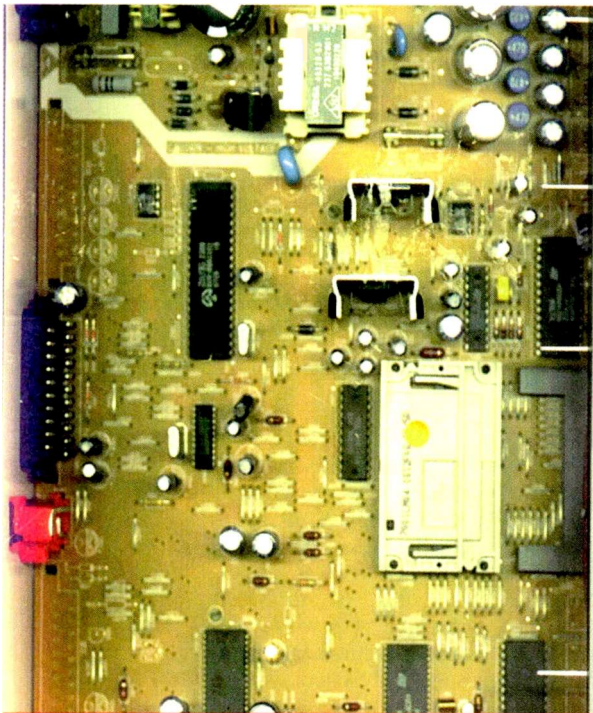
Trade repairers of TV sets, VCRs, monitors or satellite receivers should contact SatCure by e-mail at satcure@netcentral.co.uk

Please mention TV/VCR/monitor Round Robin and provide a brief description of your servicing background, qualifications and current business. Initial subscription is free, but a small annual fee may be requested once the Round Robin is established. Members' details will remain confidential, and you will not be inundated with messages or adverts as a result of joining the group.



A range of three new fully-programmable DC power supplies from Grundig has been introduced by Vann Draper Electronics Ltd. There are three models, PN400, PN300 and PN200. The PN400 provides two 0-40V at 0-4A outputs and a 0-6V 0-5A output. It's fully programmable or controllable via RS232C and IEEE.488.2 ports. The PN300 provides two 0-30V at 0-2.3A outputs and a 0-5V output at 0-2A; other details are basically as Model PN400. Model PN200 provides two 0-20V at 0-0.5A outputs; control is via an RS232C port or a remote control unit. For further details check with Vann Draper on 01162 771 400, fax 01162 773 945.

Satellite WORKSHOP



Jack Armstrong

The phone rang. My 'caller display' box showed that the call was from a town about twenty miles away – outside my normal area. So I answered it in a relatively good mood.

"Jack Armstrong, good morning."

My ears were assaulted by the sound of a child screaming. Then a

voice asked "is that Jack Armstrong?"

"Yes, that's why I said 'Jack Armstrong, good morning'."

"Eh? You want to change your attitude, mate, if you want my business. Anyway, I need some advice before you come."

I replaced the handset gently. Funny how people assume that I'm so desperate for business I'll accept verbal abuse, give free advice and do a free call out.

Pace Apollo 120

Alf is a CB radio enthusiast. He spends his nights on top of Carlton Bank, broadcasting to the whole of North Yorkshire. That probably explains why he's always tired. The Pace Apollo receiver he brought in also looked tired.

"No pictures" he yawned as he handed the receiver to me.

"Hmmm. Get any sound?"

"Sorry, gimme a nine on that. You're a bit ten-one."

"I said do you hear any sound from it?"

"Ah, sound. Think so, but the modge is a bit low you know."

When I tested the receiver the power supply started up but its 14V output was low. My oscilloscope showed that there was massive ripple on the line. A quick in-circuit check with my Genie meter then revealed that C73's ESR was far too high. So I replaced C73 (1,000µF, 25V). Everything was now OK, and no other fault could be found.

Alf was impressed by the speed of the repair, but less impressed with the cost.

"Bloomin' 'eck. The 'Rig Doctor' charges only a fiver for a complete tune up! Oh well, here's your cash. Ten-ten good bud."

Nokia SAT780

Nokia receivers are either very scarce or very reliable, as I seldom get one in for repair. As a result, I'm not too familiar with them. This SAT780 provided the LNB with only a 17V supply, that is it wouldn't change the polarisation by dropping the supply to 13V. Fortunately the cause was simple to

trace: there was a dry-joint at the LM317T variable-voltage regulator.

Helping Hands

More and more I find myself working past midnight just to earn a crust. I frequently find my eyelids drooping, and once woke myself up by nodding off into a switch-mode power supply! Now I have the answer. I bought myself one of those 'helping-hands' contraptions. You know, the one with a magnifying glass and two crocodile clips on articulated arms – see photo.

It's so useful. I fit each clip carefully to an eyelid and peer through the magnifying glass, with my chin resting on a cup of strong coffee. It's painful but it keeps me awake! Just kidding.

Pace Prima, Apollo and all MSS models

I've had lots of no-decoding problems with later Pace receivers that use PTV111, PTV110, PTV115 etc. ICs. Even after swapping every IC and capacitor on the decoder board I've had some that refused to work. Pace have informed me that there are two different types of PTV115 IC in use. The details are as follows.

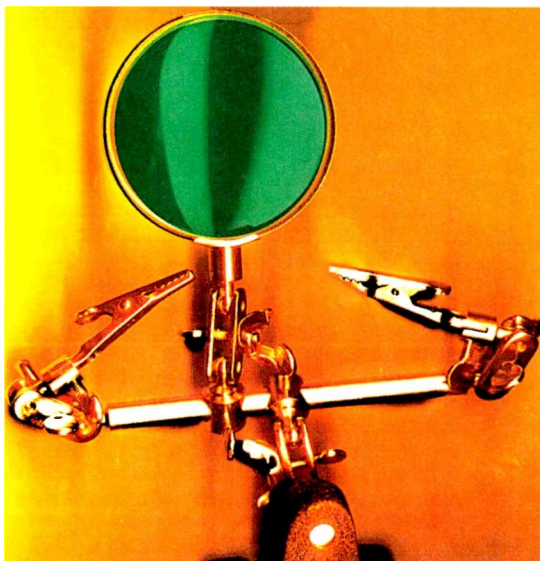
There's a CMOS version of the PTV115, with a C or with bright white marking. When this is used, fit links J301 and J302 so that clock pulses reach pin 18.

The other version is an NMOS type made by Siemens, with dark yellow marking. With this type fit links J300 and J303 so that the clock pulses arrive at pin 19.

Grundig GRD300

You could hear the power supply fire up, but the vacuum fluorescent display didn't light. There was no LNB voltage and, of course, no picture or audio – just snow and hiss. Occasionally, when the tuner module was warmed with a hairdryer, the screen displayed some sort of mistuned picture.

I have to confess that this receiver sat on the bench for several days – and that I had sleepless nights because of it. The owner was a personal friend – isn't that always



the case with tricky repairs? I didn't want to let her down.

I eventually discovered that the cause of the fault was cracked tracks near the tuner's solder lug. I should have known really, because with other Grundig receivers the same fault gives rise to the stuck in standby symptom.

Pace MSS501P

Don't you just hate it when a customer tells you the repair is urgent then adds that he doesn't want to pay very much? In this situation I usually offer a service exchange unit. As I didn't have an MSS501P lying around however that option was out. So I adopted option two.

"Go away."

"Pardon?"

"I said go away. I'm not going to waste my time on someone who brings me a £400 receiver but doesn't want to pay more than £25 for a good repair.

He suddenly became more reasonable and slapped a fifty pound note on the counter.

"Horizontal channels go off when it's hot" he said, "if it costs more than that let me know. Discount for cash, mind!"

He hopped into his Discovery and roared off, leaving his business card on the counter. A solicitor – oops!

Anyway I didn't need to trace the cause of the fault, because fitting the relevant reliability kit of ultra-low ESR capacitors, Relkit 10, cured it. For details of the kit phone 01270 753 311.

Memory Loss

I sometimes get "loss of memory" or "loses its position" complaints with motorised receivers. There is usually nothing wrong with the receiver or positioner, the cause of the problem being interference produced by the installation itself. Interference has two main effects with a motorised system. If the positioner finds that there are too many pulses, it won't reach the true satellite position. The other problem is that noise from the motor produces interference on the TV picture. Neighbours' TV and radio equipment may also be affected.

The main cause of interference is the use of unscreened caravan or telephone cable. The remedy is to use proper cable. The motor wires should have a screen. Pulse and

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.

polariser wires should be screened separately. All screening braids should be connected to earth at the receiver/positioner only. They should not be connected to the dish. The dish assembly must have a separate earth connection – preferably to a long copper rod hammered into adjacent soil. This will help to remove the static charge that otherwise builds up on the dish – it's carried by dust particles, and is particularly bad on dry, windy days. In some parts of Europe earthing the dish is a safety requirement.

Test Case 436

Because of the high cost of house calls, collection and delivery, most chargeable TV repairs are nowadays brought to our workshop. But some people simply don't have the means of doing this. So it was that Mr Davis had us call to look at his TV set – at a reduced rate, mind you, because he's a pensioner.

The set in question, a Panasonic TC2175, is itself rather ancient. It was completely dead and Doc Colin, our electromechanical paramedic, found that the mains fuse inside it (F801, 3-15A) had blown. A replacement fuse restored normal operation, and no other fault could be found – even though Colin banged and tapped the PCBs and switched the set on and off at the mains plug several times. So off he went, having charged Mr Davis for the call-out and a fuse. This wasn't the end of the story of course!

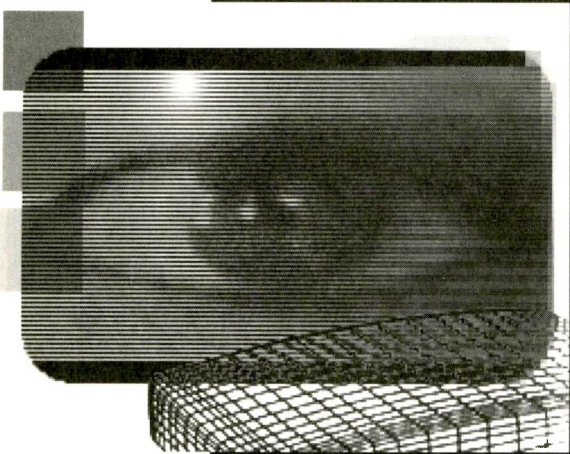
Three days later Mr D was back on the phone to say that his set had once again failed. On his follow-up call Colin replaced the fuse and also the filter capacitors across the 230V AC input to the set. He told his customer to keep an eye on the set. Mr D promised to do that, and was back on the phone a couple of days later: the set had failed yet again! This time Colin, by now somewhat disgruntled, decided to take the set back to the workshop.

Now Television Ted, our top man for all television matters, was off on holiday. So the set fell into the clutches of TechnoCrat, a good man but, by his own admission, maybe not quite as good as Ted at diagnosing faults of this sort. What, mused TC, could cause the fuse to blow at intervals,

with never any sign of other damage and with the set always returning to good working order once a new fuse had been fitted? He looked at the fuse that had just failed. While it had not shattered, and its glass envelope was intact, it was completely black inside. This showed that the overload had not been a slight one: there had been no gradual increase in temperature until the melting point of the wire inside the fuse had been reached. He knew too that the mains filter capacitors were not responsible – they had already been replaced.

After studying the circuit diagram, TechnoCrat decided to replace the mains bridge rectifier (D801). He could see no signs of distress in the associated surge-limiter resistor R802 and the reservoir capacitor C807. He also decided to resolder all the connections to the chopper transformer T801, the LOPT and the line driver transformer. He then took the set to the soak-test bench and got on with other things. The set worked for the rest of the day and the whole of the following day. In fact it wasn't until day three that the next failure occurred: there was, at the moment of first switch on in the morning, a brief splutter followed by a pop as the fuse blew.

All that TC could now think of doing was to start a trial-and-error replacement of suspect components in turn. So, as a start, he replaced the chopper chip IC801 and the snubber-network diode D810. This didn't do the trick either, because the mains fuse blew again at switch on later that day. What was the cause of the trouble? For the solution, turn to page 439.



Reports from
Gerry Mumford
Alan Bonhomme
Chris Hawkins
Russ Phillips and
Ian Field

Apple Multiple-scan 15 M2978 (GoldStar chassis)

If there is no line hold or the side edges of the display are bulging and rippling, rather like asymmetrical EW bowing, check the output from the 7812PI 12V regulator IC951. You often find that the output is slightly low. This disrupts the operation of the VCO in the horizontal deflection generator section of the TDA9102C chip IC701, because the VCO uses the regulated 12V supply as a reference. Replace IC951 if its output is less than 11.9V. **G.M.**

Digital PCX13V-SA

There was very little frame scan, only about 0.5cm at the centre of the screen. A measurable short-circuit was present at the frame output, the cause being C317 (10nF Mylar) which is connected in parallel with the frame scan coils. **G.M.**

Hyundai HL5864

This monitor powered up, but there was no display as the line output stage was not running. The arrangement here is a bit unusual: the line drive is applied to the emitter of the output transistor, via a small driver transistor, while its base is held at a constant voltage by a biasing network. The drive was missing, which led me to the TDA9102C chip U301. Because of a short-circuit at pin 19 (voltage reference) the line oscillator section wasn't running. The cause of the trouble was C402 (100nF, 25V). **G.M.**

Monitors

IPC VDVGA15

This monitor was dead with a blown mains fuse. The primary side of the power supply had blown up, killing the 2SK1507 chopper FET Q501, its feed resistor R527 (0.22Ω, 2W fusible), gate resistor R528 (47Ω, 2W) and the UC3842 chopper control chip U502. In addition a flashover had occurred at D509 (1N4148), melting the leg off its neighbouring capacitor C519 (10nF, 100V) which also had to be replaced. **G.M.**

Smile CA6415DL

This monitor was dead with no power anywhere, not even at the mains fuse – I thought for a moment that my meter was playing up! I started to disconnect the line output transformer pin by pin however. When every pin had been disconnected, power returned but R143 caught alight. This led me to Q122 and Q103. When I replaced these items (I had to guess the value of R143) Q103 quickly became very hot. I then checked further and found that the DTV64 damper diode D103 was open-circuit. Once this had been replaced there was normal operation. Q103 is type TIP122A while Q122 is a Darlington set-up with two transistors, a 2SD669A and a complementary 2SB669A. My thanks to Don of Smile who provided the correct value for R143: 22Ω, 1W. **A.B.**

AOC 7HLRT Spectrum Series

This monitor was brought in by a customer of Russian origin. He complained that the display jumped from side to side and up and down, and said repair was urgent. So I told him to come back in an hour's time.

When I took the back off and connected the monitor to my PC I could see what he was on about, though the cause took some while to trace. C448 (330nF, 63V), which is connected to pin 2 of the line output transformer, was dry-jointed. I had just managed to resolder the

joint when the monitor's owner returned, carrying two glasses and a bottle of Vodka.

Fortunately no other customers came in and, thinking that all was well, I left the monitor running while we enjoyed the Vodka. Then, suddenly, the display disappeared. To cut a long story short, I had to wait till morning for my head to clear sufficiently and discover that C453, C436 and C832 had failed. They are all 4.7nF capacitors rated at 2kV. Once they had been replaced there was a bright, rock-steady raster – which is more than I can say for the owner. **C.H.**

KFC/Smile CA1716DL

This monitor produced a mauve-coloured display, which means no green. I found that Q414 (2SC3953) on the CRT's base panel was dead short base-to-emitter. If you get the same problem with red or blue, check Q415 or Q410.

Note that the video processor chip U401 is type MN1203. It can be replaced with an LM1203N if necessary. **C.H.**

Targa Low-radiation MPRII

This monitor is made by a Taiwanese company called Shamrock. It's display was twitching from left to right. I took a guess and decided to check the separate, vertically-mounted geometry control PCB, which is a maze of double-sided circuitry. There were numerous doubtful soldered joints here, particularly at connector BB03. It took about two hours to deal with them. Fortunately the monitor then produced a stable raster. **C.H.**

Tatung TM4523

If the colours are incorrect, check for dry-joints around transistors TR201 and TR202 in the red output stage, TR203 and TR204 in the green output stage and TR205 and TR206 in the blue output stage. One of these transistors in each

stage is a 2SC3953 the other a PH2369. If these stages are OK, check the U2203B video processor chip – an LM1203B can be used as a replacement if necessary.

If the display is dim or missing, check the blue disc capacitor C229 (10nF, 2kV) which tends to develop leakage.

If there's only a horizontal line when the monitor is hot, the TDA8172 chip IC402 is the likely cause. **C.H.**

Dell D1528LS

This monitor would lose its display after four hours. In the fault condition the green power LED went orange and there was no line drive. The cause of the trouble was Q806 (2SA931), which had an intermittent fault. Note that a 2SA931 *must* be used in this position. 'Equivalents' don't work, even though they may have the same or a superior specification.

This monitor can be run with the line output transistor removed. In this condition the power LED will be orange instead of green, the line output transistor's collector voltage will rise from 75V to 84V and the 75V supply to the CRT base panel will rise to 103V. **R.P.**

Essex PV564M

This monitor was dead with the reservoir capacitor for the 15V supply to the UC3842 chopper control chip short-circuit. Its value is 68µF. **R.P.**

IBM 6322-R22

You sometimes find that the picture is bright with no contrast, i.e. very washy with no punch, because of a fault in the XC86211B microcontroller chip Z500. To check, disconnect pin 22. If the picture then comes up, the IC has failed. **R.P.**

Samsung CQA4147L

The job card said "picture went small – smokes 30 a day". D618 was in two pieces and C626 (100µF, 100V) had an expanded top. Both are in the HT supply. The 2SC5149 line output transistor Q403 was short-circuit base-to-emitter, FET Q408 (IRF9610) was short-circuit drain-to-source while D406 (RU4DS, mounted on a heatsink) was short-circuit. Replacements restored normal operation. **R.P.**

AST TE1464G

This monitor was dead with a blown mains fuse. It has a discrete-component chopper power supply,

and in this situation a little patience is required to check all the diodes, transistors and resistors. Miss one and a rebuilt power supply will go bang at switch on!

Q901 (2SC3680) was short-circuit. Q905 (BC638 – I used a BD238), Q904 (2SC945) and Q902 (2SB857) had also been damaged. Q904 (BC637) was the only undamaged transistor on the primary side of the circuit. D904 (1N4148 suitable) and ZD903 (5V1B2) were both short-circuit, as were all connections to the transistor section of the optocoupler. A second check through the power supply revealed that D912 was short-circuit. I mislaid the faulty diode before recording its type number, but I had made a note of its specification: an RGP15D should do.

In most cases visual inspection will show whether any resistors are in need of replacement – none in this case. Once the components listed above had been replaced, the monitor worked when powered. **I.F.**

IBM 6314-002

When this monitor was switched on the power LED flashed at a rate that increased to a dim flicker then went out altogether. In addition the power supply made distressed noises. The cause of these symptoms turned out to be dry-joints at the scan-coil plug.

Several of these monitors had come in at the same time. The complaint with the rest of them was "inability to store user settings". The procedure is to press the mode button while holding down the save button: all seven LEDs should flash three times simultaneously, then you release the mode button. While setting up these monitors I occasionally had the LEDs flash like a crossing signal – alternating in two groups! Assuming that this was an error indication, I repeated the entry sequence. On each occasion that this happened the seven LEDs flashed three times simultaneously on the second attempt and the changes were successfully saved. **I.F.**

Dell 1528LS

There was no rustle up at switch on and the power indicator was yellow. The latter means that there's loss of line drive or the 25V supply. I checked back to the power supply and found that Q806 (2SA965) was not being driven by Q804 (2SC945). When bias was temporarily applied to Q804, the

monitor started up and ran. To cut a long story short, the cause of the instant shut down at start up was C826 (1,000µF, 16V) in the 6-3V supply.

A word of warning about I803 (TC4010BP) which drives Q804. Most suppliers list this 4000-series CMOS chip as obsolete and may offer a 4050 as a "pin-for-pin" replacement. This is not correct! Pin 16 is not used with the 4050. In the Dell 1528LS pin 16 is connected to the 5V rail via what appears to be a start-up capacitor, C845 (1µF, 50V). I feel that the use of a 4050 in this position is likely to compromise the correct operation of the safety shut-down circuit.

These monitors are more recent than any data books that list the 4010 as obsolete, so someone must still make the device. Try to find the correct type if replacement is required. **I.F.**

Dell Vi1428E

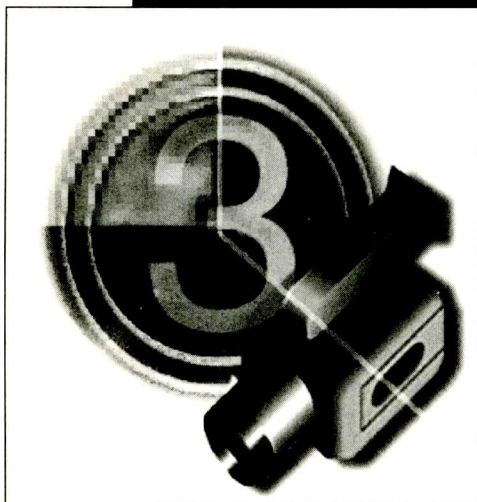
The chopper transformer's primary winding had shorted turns, effectively reducing its step-down ratio. Because of this the MCR100-6 over-voltage thyristor Q102 was coming into operation, removing the supply at pin 7 of the UC3842 chopper control chip IC101. I had the same fault recently with an identical monitor that another customer decided to donate to the graveyard, so it could be a common failure.

To check this quickly, disconnect the drain of the 2SK1118 chopper FET Q101 and use a 60W bulb to complete the circuit to the transformer's primary winding. With a faulty primary winding there will be 320V across the bulb.

Note that IC102 (4N35) has nothing to do with regulation, which is based on sampling the voltage produced by the winding that supplies the chopper control chip – IC102 couples line sync pulses to the chopper circuit. This makes it safe to disconnect all the rectifiers on the secondary side of the circuit to make sure that the short is in the transformer and not on the PCB.

The above test is meaningful only if Q102 is disabled – do this by shorting across C110 (10µF, 50V).

If there's a more common fault that destroys the 2SK1118 FET, you can use an MTP6N60 as a replacement provided the silicone rubber heatsink insulator is free from defects. There is a fully-insulated version of the 6N60, but it's extremely rare. **I.F.**



**Reports from
David C. Woodnott
and
Adrian Spriddell**

Sony CCD-TR780E

This newish camcorder arrived with a tape stuck in its mechanism (Sony A type). The mechanism was completely jammed, and even the trusty mode box couldn't evict the tape. General dismantling, bit by bit, eventually enabled me to extract the tape. I then removed the LS chassis to gain access to the deck section.

Some of the teeth of cam gear B (L) were missing, a condition that's not uncommon. I replaced the gear, along with arm assembly FF which was bent and arm assembly GL which was similarly afflicted. I also replaced the mode encoder switch, as it can be the cause of mechanical failure of this type. Once the unit had been reassembled and checked all was found to be well. A service completed the repair. **D.C.W.**

Sony CCD-FX200E

No camera picture was the complaint with one of these popular camcorders. Playback and all the mechanical functions proved to be OK. The first item I checked was the camera/VTR switch: being of the type used in some previous models (F series), it was suspect – you often find that it works intermittently. This one proved to be OK however.

I then checked the record/pause (trigger) switch. On examination the cause of the fault was obvious: the switch actuating lever had broken off, leaving the switch permanently in the pause position. When

Camcorner

it was pushed into the record position the camera picture appeared with all functions operative. The reason for the damage was that the record/pause button assembly, which is fitted to the grip case, had been forced and had lost its end stops. As a result there had been excessive movement of the record/pause button and the switch actuator had sheared off. A new button assembly and switch cured the problem.

Since I carried out the original repair another similar model has arrived with the same fault. The unit will work if the switch only is replaced, but it's highly likely that this will be damaged at some stage – and you will be expected to repair it free-of-charge under guarantee! **D.C.W.**

Sharp VLE37H

This Viewcam produced good playback pictures but no E-E pictures. Internal inspection of the camera section revealed that the iris assembly was stuck because of leakage of oil on to the iris vanes. As separate lens parts are not available for this model, a complete lens unit had to be obtained. When it arrived I removed the iris assembly and fitted it to the existing lens unit.

This is the most satisfactory way of carrying out the repair, as it avoids the setting up (autofocus tracking etc.) that would be required if a complete new lens unit was fitted. I then checked the unit at various light levels, using a calibrated light source, and found that it operated satisfactorily. A service completed the repair. **D.C.W.**

Sony CCD-FX300E

The complaint with this camcorder, which came from the local technical college, was that it produced "strange pictures". Playback of previously recorded tapes was OK, but the E-E pictures were optically distorted – the picture was 'oval', with multicoloured aberrations at the right-hand side. There was no zoom or autofocus operation.

I removed and dismantled the lens unit for inspection. It was evi-

dent that the unit had been subject to an impact, as the internal sections were detached from their locations. Fortunately no actual damage had occurred, and when the unit had been reassembled correctly it worked perfectly. It seems that the impact had merely displaced the internal moving sections, a most unexpected event! **D.C.W.**

Panasonic NVMS90

The cause of field collapse in the electronic viewfinder was traced to the 3.9Ω surface-mounted resistor that couples the AN2514S timebase chip to the field scan coils – it was open-circuit. You will find it next to the scan coil plug, connected to one end of the height potentiometer. **A.S.**

Sony CCD-TR55E

This well-used unit came with a report that it had seized up after a trip to the beach. Sand was the likely cause of the problem. But not masses of it: just one grain was enough! The offending grain had lodged in one of the gear teeth of the capstan motor's rotor. It was sufficient to jam the motor, with the result that the unit was in the caution mode.

After removing the motor and cleaning its gear I removed the LS chassis from the deck to check for any other foreign matter that could cause problems. All was well, but I decided to replace the conversion gear, drive belt and midway pulley. They often become noisy in operation – the result is knocking noises or a general mechanical unpleasantness. It's much better to replace these items on spec rather than have to dismantle the unit again after reassembly. **D.C.W.**

Sony CCD-TR330E

The note that came with this machine said it was dead. I found that CP002 on the power supply PCB was open-circuit. As no cause could be found, despite carrying out all the usual tests, I fitted a replacement. The machine then worked normally, and a soak test proved that it was OK. **D.C.W.**



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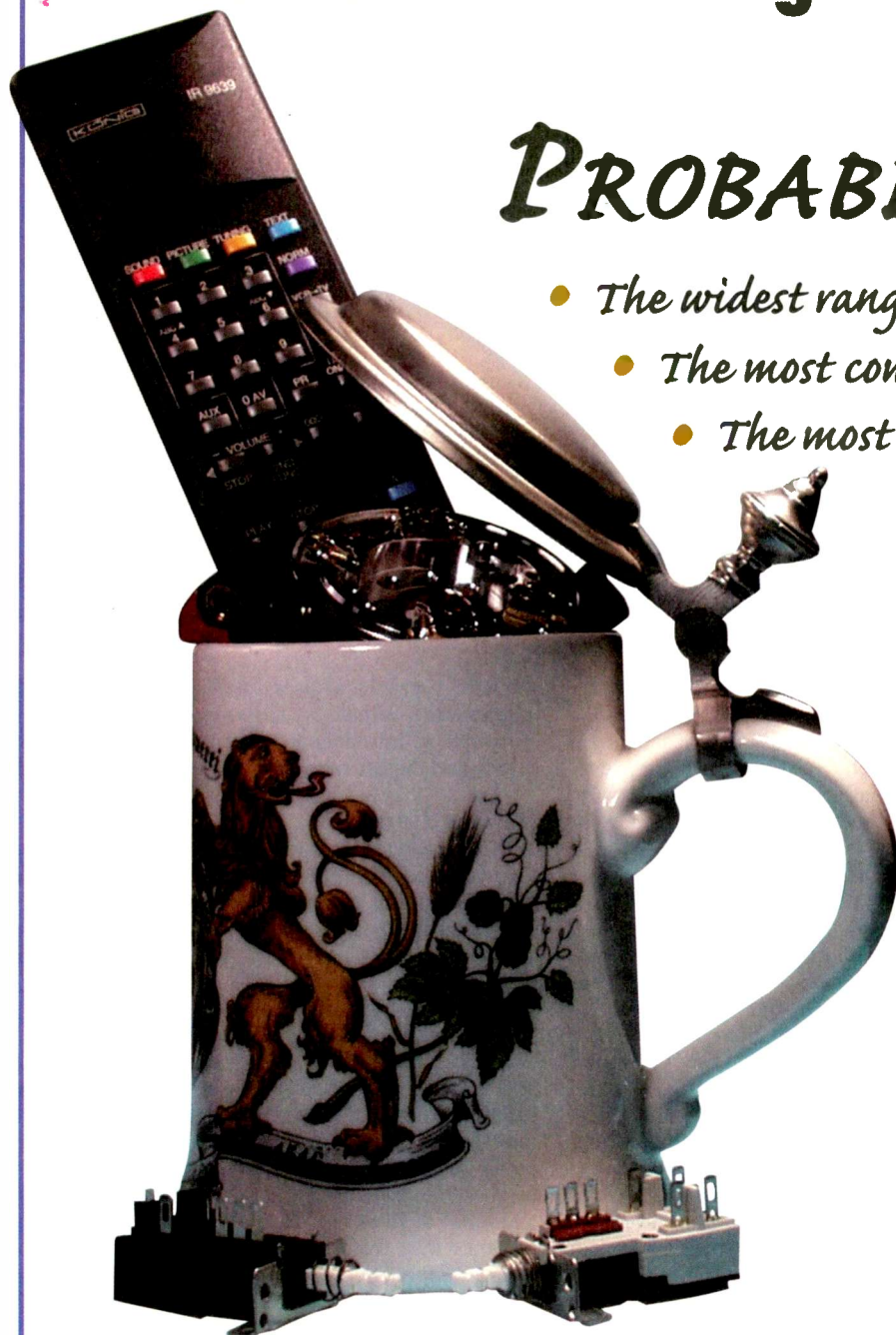
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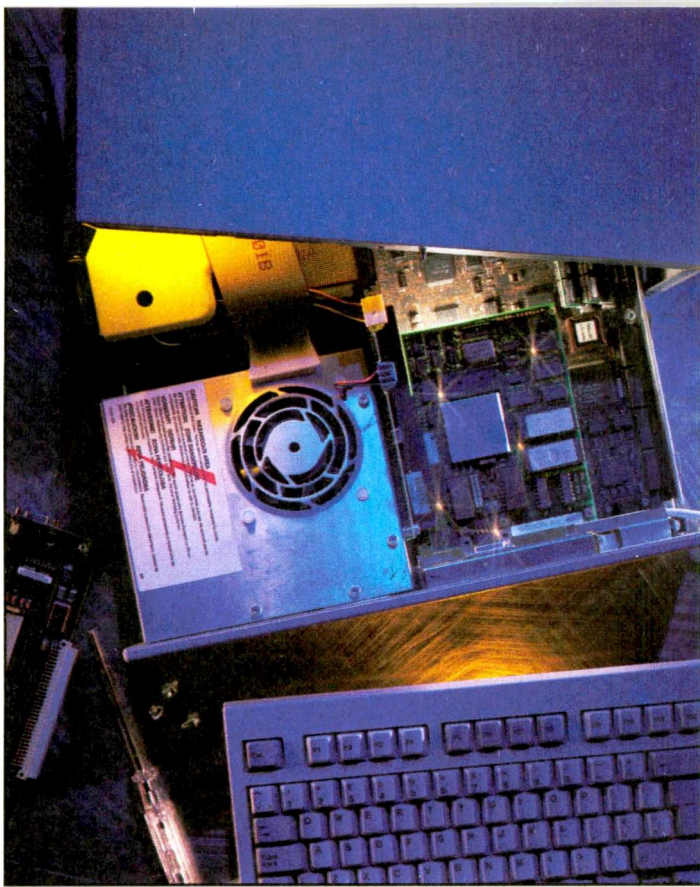


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Why not add PCs to the range of equipment you service? It's a logical step after TV sets and monitors. You need to know how a PC's hardware and software operate, then how to go about testing. In this first part of a new series **K.F. Ibrahim** describes basic PC hardware

PC

Operation & Repair

K.F. Ibrahim is a Senior Lecturer at the College of North West London. This series of articles is based on Mr Ibrahim's book *PC Operation and Repair* which was published in April last year by AWL under the Longman imprint.

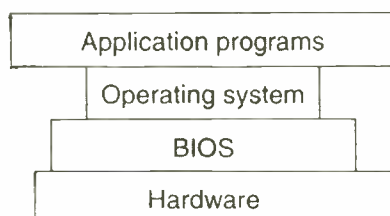
The operation of a computer depends on hardware, i.e. physical units and circuitry, and software, i.e. coded instructions and programs. Fig. 1 shows the software/hardware 'hierarchy'. At the 'highest' level there are software application programs that provide word processing, spreadsheets or computer games for example.

Such programs will work only within the computer environment for which they are designed. This environment is the operating system, the next level down, which is also a collection of programs/routines. These routines are called up by the application program as necessary.

There are a number of operating systems, the most common being MS-DOS (Microsoft Disc Operating System) and Windows 95. Others include OS/2 and Unix. Note that Windows 3.1 is an application program, not an operating system: Windows 95 is an operating system that incorporates DOS.

A personal computer (PC) is a general-purpose system designed to accommodate different operating systems. The link between the hardware and an operating system is a set of software routines known as BIOS, i.e. Basic Input and Output System. The BIOS enables the software to take control of the hardware at a very basic, fundamental level. Its program routines are permanently stored in a ROM or a PROM memory chip. Because of their permanent nature, BIOS routines are referred to as firmware.

Fig. 1: PC software/hardware hierarchy.



Where a graphical user interface (GUI) is used, for example the Windows' icon system, a further level of software is introduced between the application programs and the operating system in the PC hierarchy.

PC Hardware

A PC's hardware consists of four essential components: a power supply, disk drives (for hard and floppy disks), a motherboard, and expansion (option) cards (PCBs) that fit into expansion slots on the motherboard. We'll consider each of these in turn. Fig. 2 shows a typical layout.

The Power Supply

The power supply is a self-contained, sealed unit in which all the high-voltage circuitry is incorporated. A metal container is provided to prevent high-frequency interference affecting the digital circuitry, where it could cause havoc. The power supply is cooled by an electric fan, which also helps to cool the motherboard and other devices and cards. In addition, the flow of air prevents dust from settling on the ICs and other electronic components. The noise that you hear when a computer is turned on is produced by the cooling fan.

A PC requires a number of stabilised DC voltages to supply the motherboard and the other devices and expansion cards. These are typically as follows:

Voltage	Colour	Current	Power
+5V	red	20A	100W
-5V	white	0.5A	2.5W
+12V	yellow	8A	96W
-12V	blue	0.5A	6W

The +5V supply powers all the TTL circuitry while the +12V supply is used to drive the disk drive motors and

CD-ROMs. Some applications, for example a serial port, require bipolar (positive and negative) supplies, hence the -5V and -12V rails. All voltages have to be regulated to within ± 5 per cent. This means a maximum of 5.25V and a minimum of 4.75V for the +5V supply, and a maximum of 12.6V and a minimum of 11.4V for the +12V supply. When no loads are connected, the outputs fall to zero.

A switch-mode (chopper) power supply is more efficient than a linear (series regulator) type, generating less heat and requiring less space. These advantages more than compensate for the added complexity. For this reason switch-mode power supplies are universally used in PCs.

Some CMOS and NMOS processors require a 3.3V or 3.45V supply. This is obtained from the +5V line via a subassembly. ATX motherboards require this supply directly, so the power supply has to provide an additional 3.3/3.45V output.

A power supply's power rating is the total power it can deliver in watts. It can be calculated by multiplying each output voltage by the individual current rating and adding the results together. Most modern PCs require a power supply rated at 220-280W. Computers that have multiple disk drives and/or numerous optional extras require a more powerful supply that can meet this extra loading. The mains fuse rating is usually 2A or 3A.

Protection

A PC's power supply incorporates protection arrangements to minimise damage that could be caused by a permanent or intermittent fault. Excess-current protection is mandatory. It shuts the power supply down if the current drawn exceeds a safe level. An excessive current demand will arise if there is a short-circuit on the motherboard or in any other device or subsystem, or alternatively if extra loading has resulted in the supply's power rating being exceeded. The shut down continues until the power switch is recycled (switched off and on again).

A good-quality power supply should protect the computer in the event of a short-duration, say 50-100msec, dip in the mains voltage. It should also provide automatic restart following such a dip, which is known as a brown out. There is normally a delay of a few seconds in the restart, to give peripheral devices and subsystems time to reset before everything starts up again.

A thermal cut-out should be included to shut down the power supply in the event of excessive heat. There is again usually a restart delay. The power supply will also shut down if the cooling fan fails to rotate, either because the fan is faulty or because its 12V supply has failed.

Finally, the power supply will shut down when none of its outputs are connected to a load.

The Power Good Signal

A power good (PG) signal is generated by the power supply when all its internal tests have been passed and stabilised outputs have been established. This normally takes 0.1-0.5secs after switching on the power.

The PG signal is used to generate a power-up reset signal to start up the microprocessor chip (CPU), see Fig. 3. In this arrangement C1 charges via R1 when the PG signal goes high. Once C1 has been fully charged, pin 11 of the 82284 timer/clock generator starts up. After a short delay, pin 12 (reset) goes high, taking the reset pin of the microprocessor chip high to start up the system.

The circuit shown in Fig. 3 includes a push-button for

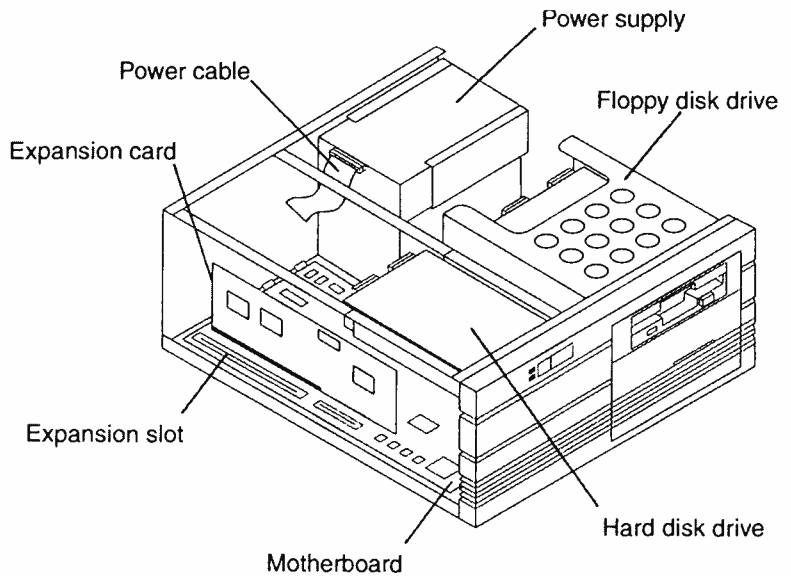


Fig. 2: Typical PC layout.

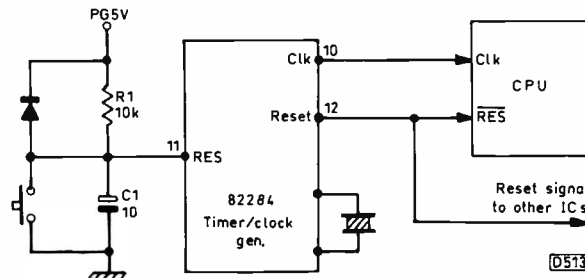


Fig. 3: PC reset via the timer/clock generator chip.

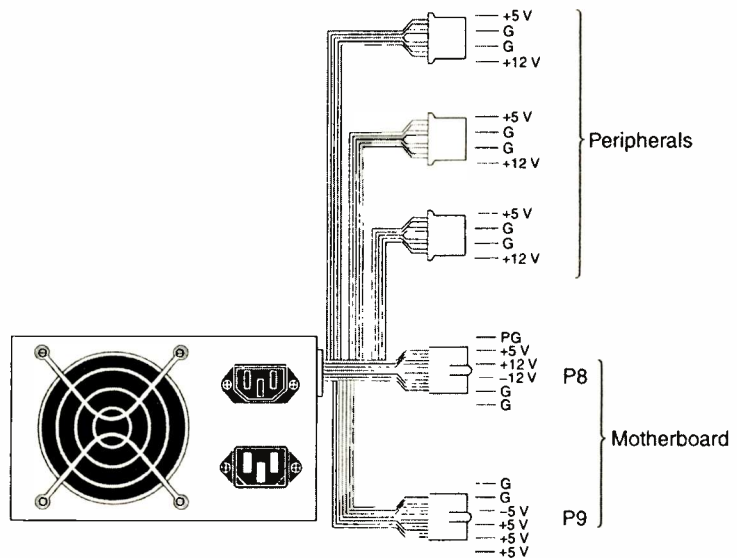


Fig. 4: Power supply connectors.

manual reset of the microprocessor. As an alternative, reset can be instigated by connecting the power good line to chassis via a 1k Ω resistor.

Connectors

There are two types of connector for the outputs from a PC power supply box: two six-way connectors for the motherboard and either three or four five-way connec-

Table 1: Function and colour-coding of motherboard power connector leads.

Pin	Colour	Function
1	orange	Power good
2	red	+5V
3	yellow	+12V
4	blue	-12V
5	black	0V
6	black	0V
7	black	0V
8	black	0V
9	white	-5V
10	red	+5V
11	red	+5V
12	red	+5V

tors to supply disk and CD-ROM drives, see Fig. 4.

The two motherboard connectors, shown as P8 and P9 in Fig. 4, are plugged into the motherboard with the black (0V) leads adjacent to each other, see Fig. 5. The functions of the connector leads are listed in Table 1.

An ATX motherboard has ten-pin connectors, with a total of twenty leads, to cater for the extra 3.3/3.4V supplies. See Fig. 6.

Disk Drives

Disk drives are mass data storage devices. PCs generally employ two types of disc drive, for floppy (plastic) and hard (metal) disks. Both types of disk are coated with a very thin layer of electromagnetic material. Data is stored on concentric tracks that have been appropriately formatted.

The disk drives are connected to the motherboard either directly or via an adaptor card, using multi-line, flat ribbon cables. A 24-way cable is used for floppy disk drive connection. For hard disk drive connection either a 40-way IDE (Integrated Drive Electronics) or a 50-way SCSI (Small Computer System Interface) type cable is used. Pin 1 of the ribbon cable is identified by a red or blue stripe.

Motherboards

Different types of motherboard can be identified by the processor, the size and type of system and cache memories, the type and number of expansion slots, and any other functions provided by on-board ICs, e.g. on-board disk drive and video display controllers. Fig. 7 shows a typical Pentium motherboard layout.

The microprocessor chip (CPU – Central Processor Unit) determines the motherboard’s processing power. Table 2 lists various Intel microprocessor chips in order of release.

A coprocessor chip, also known as a maths or numeric processor unit (NPU), may be included on the motherboard. Examples are the 80287 and 80387. Alternatively the coprocessor may be incorporated in the main microprocessor as with the 80486 and Pentium chips. The coprocessor is a programmable logic device that’s designed to handle what are known as floating-point mathematical operations. Software that can take advantage of the coprocessor enables substantial improvements in the performance of the system to be achieved.

Support Chips

A number of what are called support chips (the ‘chip set’) are required for computer operation. Examples are the clock generator, interrupt and DMA (Direct Memory Access) controllers.

The computer system’s operating memory banks are incorporated on the motherboard: modern PCs use SIMM (Single In-line Memory Module) or DIMM (Dual In-line Memory Module) slots for the purpose. There are four SIMM slots and two DIMM slots in the board layout shown in Fig. 7. Two cache fast-memory chips are also shown – there may be IC sockets or module slots for the cache memory (the cache memory technique will be explained in Part 3). The size of cache is determined by the type of motherboard.

The computer system relies on a number of configuration information and software routines which are stored in ROM or RAM devices. These are as follows.

The BIOS (Basic Input and Output System) routines are stored in a DIL ROM or EPROM package such as a 27PC512-15. Flash BIOS memory may be used instead. The BIOS chip usually has a paper sticker that

Fig. 5: Motherboard power connectors.

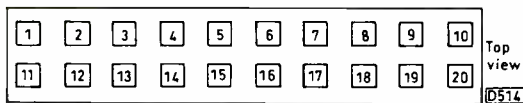
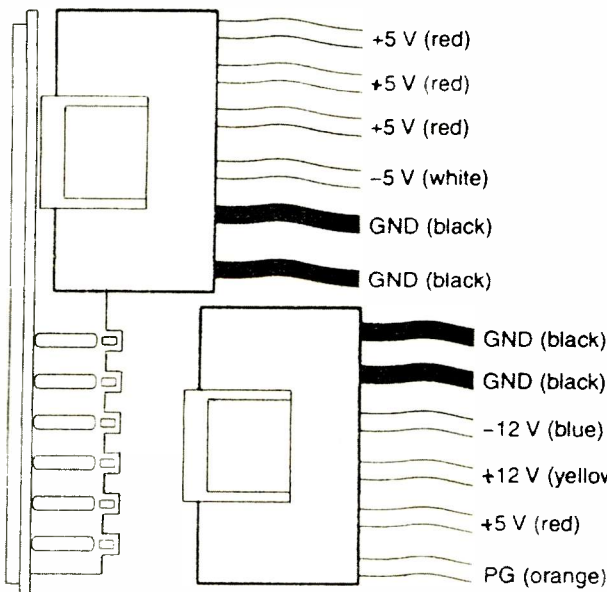


Fig. 6: The ATX motherboard power supply connector. Pins 1 and 2 orange 3.33V; pin 3 black ground; pin 4 red 5V; pin 5 black ground; pin 6 red 5V; pin 7 black ground; pin 8 grey power good 5V; pin 9 purple 5V; pin 10 yellow 12V; pin 11 orange 3.33V; pin 12 blue -12V; pins 13-17 black ground; pin 18 white -5V; pins 19 and 20 red 5V.

Table 2: Intel microprocessor generations.

Type	Launch date	Bits	Speed
8086	1978	16	8MHz
8088	1979	8	5MHz
80286	1982	16	8-12MHz
80386	1985	32	16-25MHz
80486	1989	32	25-100MHz
Pentium	1993	32/64	60-200MHz
P II (MMX)	1997	32/64	300MHz +

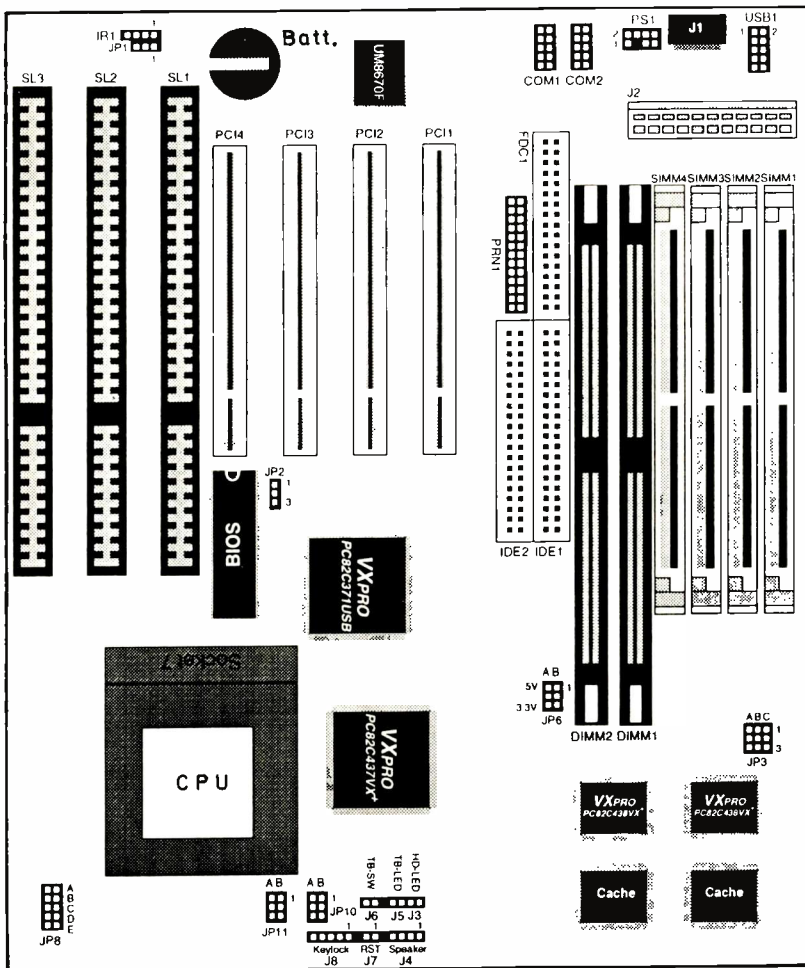


Fig. 7: A typical Pentium motherboard layout. SL1, 2 and 3 are ISA connectors; J2 is the power connector; PRN1 is the LPT1 connector; COM1 and 2 are serial ports.

Table 3: Expansion slot types.

Type	Data (bits)	Speed	Comment
ISA	8 or 16	8-33MHz	Extensively used
VESA	32/64	33MHz	Used mainly for fast video graphics: cannot be used for 64-bit systems
PCI	32/64	33MHz	Processor independent: may come to predominate

Table 4: Common connector types.

Type	Application
25-way D	Male type: series (RS232), COM1, COM2, COM3, COM4 Female type: parallel (Centronics), LPT1, LPT2, LPT3
9-way D	Male type: (a) serial (RS232), COM1, COM2, COM3, COM4 (b) mouse Female type: video (CGA, EGA)
15-way D (3 rows)	VGA or SVGA video, network. Female type only
15-way D (2 rows)	Games port. Female type only
DIN 5/6-way	Keyboard connector
BNC	Network connection

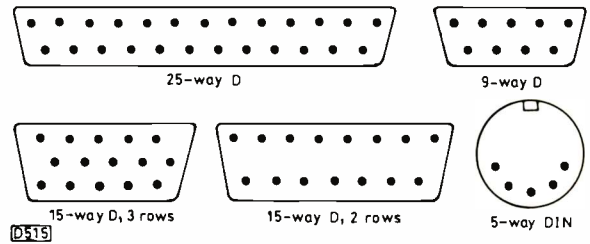


Fig. 8: Common connectors. See Table 4.

provides the name of the manufacturer, the date and version.

The keyboard controller (KBC), also known as the keyboard BIOS, converts serial codes from the keyboard into ASCII (American Standard Code for Information Interchange) codes that can be understood by the computer system. Examples are the 8042 and 8742.

The CMOS set-up chip, for example the MC146818 or Dallas 1287 or 1387, is a small battery-backed RAM that stores the set-up and configuration information required for the BIOS routine when the computing system is initialised following power up or a reset. It also contains time and date information. The battery is usually soldered to the motherboard. It ensures that the CMOS set-up chip retains its data even when the PC is switched off. If the battery has to be replaced, the data stored in the CMOS set-up chip will be lost and must be re-entered. Jumper connections can be used to delete the CMOS set-up chip's contents without disconnecting the battery: this may be necessary where, for example, a password stored in the chip has been mislaid.

A timing/clock generator chip, e.g. an 82284, and crystals are required. To ensure accuracy and stability, the system clock is based on a crystal-controlled oscillator. A second clock signal, using a separate 14-318MHz crystal, is available on the motherboard for the ISA expansion bus.

Connectors

Expansion slots/buses provide access to the motherboard via double-sided edge connectors. More than one type of expansion slot may be included on the motherboard. There are three main types: ISA (Industry Standard Architecture), PCI (Peripheral Component Interface) and VESA (Video Electronic Standards Association). Table 3 shows a com-

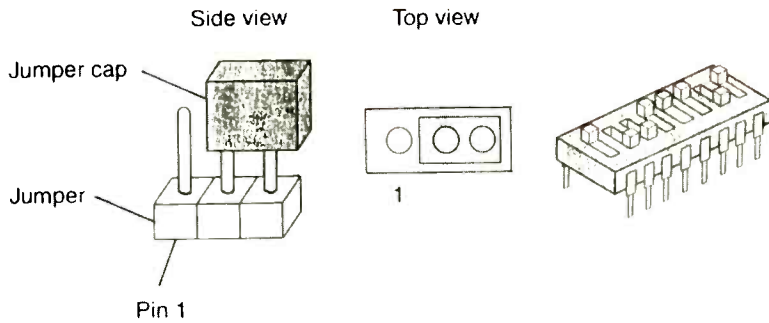


Fig. 9: Jumpers and DIP switches for motherboard configuration.

parison between these three types. In Fig. 7 there are three ISA slots and four PCI slots. Options such as a modem or sound are provided by inserting a card into one of the available slots. One essential is the video card, which is connected to the PC monitor via a 15-way (three rows) female-type port.

A standard AT-style five-pin (six-pin for IBM) connector is provided for the keyboard cable, usually at the rear of the motherboard.

The majority of motherboards have a standard 12-pin power supply connector. With ATX motherboards a 20-pin connector provides the extra 3.3/3.45V supplies.

Table 4 and Fig. 8 show the most common types of ports available at the back of a PC.

Jumpers and DIP Switches

A number of jumpers and DIP (Dual In-line Package) switches – see Fig. 9 – are provided to configure the motherboard for the system’s specific arrangements and requirements. When a motherboard is upgraded or changed, the configuration jumpers and DIP switches must be set in accordance with the details in the manufacturer’s handbook. Configuration arrangements are typically for mono-colour display, CPU power requirements and speed, and cache memory size.

Modern Motherboards

More modern motherboards incorporate a number of functions that were in the past provided via expansion cards. They include built-in IDE (hard disk) and floppy disk interfaces, two serial ports, an enhanced parallel port and a mouse interface.

The two IDE connectors are known as primary and secondary. Each can accommodate two hard-disk drives or two CD-ROM drives or a combination of both. One is known as the master, the other the slave.

The serial and parallel connectors are linked to corresponding ports at the back of the PC. The serial ports are referred to as COM1 and COM2, and may be of the nine-way or 25-way female variety. The parallel port, known as LPT1, is of the 25-way male type.

In part 2 next month we will take a detailed look at the booting-up process – what happens when a PC is switched on – and consider basic system configuring and customising.

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Panasonic TX21S1T (Z5 chassis)

This set produced sound but no picture. I marked the position of the tube's first anode supply control then turned it up, expecting to see field collapse. But what I saw was a blank raster with flyback lines. After returning the A1 control to its original setting I decided to check the line-frequency feedback pulses at pin 38 of the TDA8361 chip IC601, which contains the IF strip, the colour decoder, the timebase generators and one or two other items.

Bingo! Although some sort of pulse waveform was present, there were certainly no line-frequency pulses. So I traced back and came to the collector of the BC847B surface-mounted transistor Q504. There was a 1.5V peak-to-peak line-rate squarewave at its base, but a messy, inconclusive waveform at its collector.

I was about to switch the set off and check the transistor when a perfect picture suddenly appeared on the screen. This is never a good omen. The fault can clear and refuse to come back – until the set has been returned to the customer. This time I was lucky however. A slight prod on the body of the transistor with the end of a pencil made the picture appear or blank out. The soldering at the legs of the transistor looked OK, but when fresh solder had been applied there were line pulses at pin 38 of the TDA8361 chip and the picture remained no matter how much prodding was applied to the transistor.

Grundig 8787

This ageing portable was dead. I removed the back and noticed that safety resistors RU05 and RU15 had sprung open. Also obvious was the open-circuit fuse VU09. As I didn't have the circuit diagram, I decided to resolder the sprung resistors, renew the fuse and slowly apply power via my variac. Expecting the worst, I was delighted when the set sprang to life with a nice picture and sound.

After a couple of hours there was still no sign of distress. So I replaced the resistors and ran the set for another day. It behaved impeccably. I'll never know what caused the resistors to spring and the fuse to blow. Perhaps just age.

Hitachi CPT2598 (G8Q chassis)

"Won't switch on" the customer said. Before I had the back off I suspected thermistor TH902 in the start-up circuit, so it was no surprise to find that there was no voltage at pin 7 of the UC3844 chopper control chip IC901 and discolouring of the PCB where the thermistor lived. I soon had a replacement fitted, then switched on. There was still no supply to the chip however, as the 27V zener diode ZD901 was short-circuit. When this had been replaced the

power supply worked, producing an HT output of 145V, but the set remained lifeless.

A scope check at the base of the line output transistor showed that the line drive was missing. The TDA2579 timebase generator chip IC701 had only 4V instead of 12V at its supply pin 10. This was remedied by replacing C933 (2,200µF, 25V), the reservoir capacitor in the feed to the 12V regulator. To get reliable operation I also had to replace the reservoir capacitors in the 8V and 10V supplies, C932 (470µF, 16V) and C934 (220µF, 16V) respectively.

Sony KVM2130U (BE1 chassis)

This set was stuck in standby with the BU506DF line output transistor short-circuit. But a replacement failed to restore line output stage operation. PS802 in the HT feed to the transformer was open-circuit, and there was no line drive.

I replaced PS802 then found that the soldering at the pins of the TDA2579A timebase generator chip IC551 looked dull and crumbly. So I renewed the solder. This time the set burst into life when it was switched on, and rigorous tapping in a search for more dry-joints had no effect. A nice one for a change!

Toshiba 216T9B

The field scanning was stretched at the top, with no scan below the centre line of the screen. The cause of the trouble was the field ramp capacitor C303 (2.2µF), which is connected to pin 31 of the TA8659A colour decoder/timebase generator chip IC501.

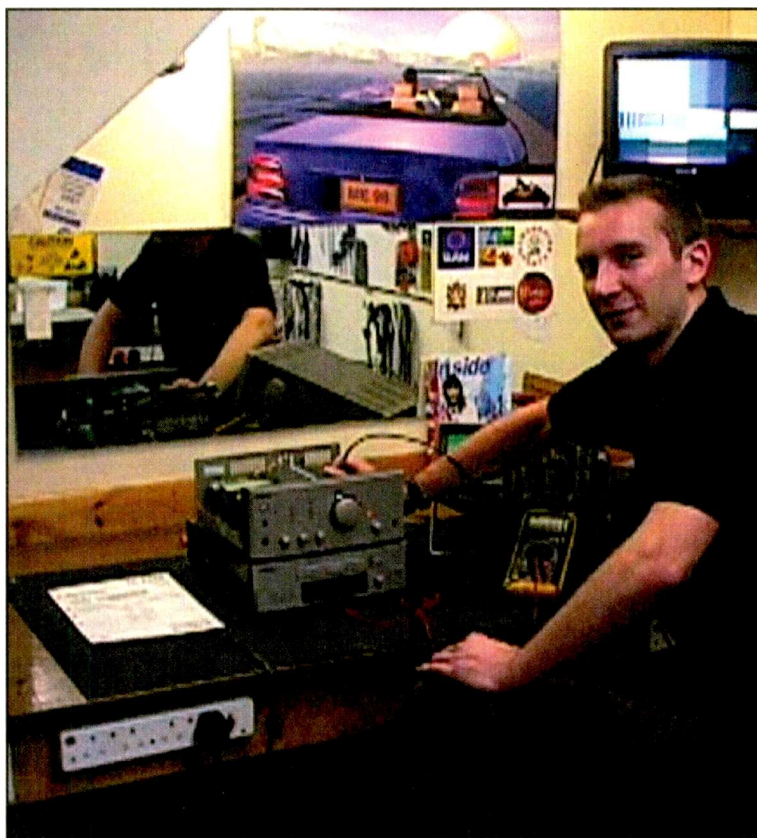
Sony KVM2130U (BE1 chassis)

The owner of this set rang up as I was turning the lock on the workshop door at the end of the day. Our conversation wasn't helped by the fact that he was almost totally deaf. Considering the sort of day I'd had however, the chance of earning a few bob appealed. Fifteen minutes later I was ringing his door bell.

I was shown the set, whose picture had severe foldover at the bottom of the screen and stretching at the top. This was almost certainly caused by capacitor trouble, the suspects being the field scan coupling capacitor C531 (680µF, 25V) and the flyback boost capacitor C532 (100µF, 50V). I had to write a note to tell him I'd be back in the morning with the parts required.

Next day the repair went without hitch. Once the two capacitors had been replaced the field scanning was correct.

If you want to take your business a stage further, why not consider becoming a manufacturer's ASC? This should guarantee you plenty of work and a secure future, but calls for a lot of effort and, probably, investment. Cliff Martin explains what running an ASC involves



Setting up as an Authorised Service Centre

... at least one technician needs to be good enough to be able to sort out the real nasties.

Photographs taken at ICTV (Southern) Ltd., a Sony ASC. Above, Seth Butt, engineer.

The aim of this article is to provide guidance on setting up a workshop as an authorised service centre (ASC) or, as Grundig prefers to call it, a regional service centre (RSC). It can't be done without considerable knowledge of the brown goods servicing trade today, either from the management or engineer's point of view. In fact it would be a definite advantage to have both types of experience. A manager who has been an engineer is likely to be more in tune with what is viable and what isn't, and is less likely to be misled by engineers who are doing the job inadequately. In other words it's necessary to be streetwise.

Setting up from scratch as an ASC is not easy. You will be seeking work directly from manufacturers or referrals from them. Now look at it from their point of view. They will expect any business up for consideration as an ASC to have a good track record in the trade, something that a fledgling company will take some

time to acquire. Most ASCs have been around for a long time.

Place of Work

Anyone who thinks they can set up as an ASC in a garden shed or a garage can think again, no matter how good they are. Security is very important, also accessibility – especially if a lot of contact with the public is envisaged. Carriers will be used to deliver products to you for repair, and adequate space will be needed to cater for them.

A light industrial unit is ideal. These are normally in an area that automatically takes into account the points mentioned above. Security is vital: once word gets around that large quantities of TV sets and VCRs are being held, the local burglary brigade will be only too happy to relieve you of them. A decent alarm system is essential, and doors and windows must be protected so that they are difficult to force. A professional thief will always find

any weaknesses. Break-ins are always a distressing experience, but at least you know afterwards of any security weaknesses. But it's best to beat them at their own game and get it right first time. The local police will be happy to inspect your arrangements and advise on appropriate improvements.

Another factor is whether or not there is another ASC in the locality. Manufacturers are not keen to have more than one within a specific radius.

Requirements

If a manufacturer is interested in appointing your company as an ASC you will almost certainly be paid a visit. The area TLO is usually given this task, and is often accompanied by senior management. They will be looking for a neat, tidy workshop with a proper reception area. Always bear in mind that your reputation will reflect on them as well. First impressions

count a lot. They will also want to be satisfied that there is adequate insurance cover.

The variety of test gear available will be taken into account: in fact certain items will be mandatory. A decent scope with a bandwidth of 60MHz or more on every bench goes down well. Some method of SMD rework, using one of the commercially available units, with its own static-free workstation, is a certain requirement. Some companies grade their ASCs according to how well they are equipped, which relates to the products you will be expected to service. While a firm with a lower grading will be expected to take in equipment of any type, it will be expected to pass items outside its skill range to a higher-grade firm.

A TLO will probably assume that if a company has a lot of gear it knows how to use it. This is where the quality of staff comes in. By the time a product has been referred to an ASC it may have been subjected to a repair attempt by someone else, possible a dealer or even another ASC. Such jobs will nearly always be difficult, with perhaps a few more faults introduced along the way – though this will often be conveniently omitted in any service report you receive.

It follows that staff needs to be of above average calibre in order to deal with such problems. It may not be possible for all your engineers to be at this level, but at least one tech-

nician needs to be good enough to be able to sort out the real nasties.

Workshop layout obviously depends on the equipment being serviced. For example the audio section will generate more noise than the camcorder section. The camcorder specialist might not appreciate a quick blast of heavy metal at 100W in his right ear while he is checking around a 100-pin flat pack!

Workbenches should be of decent size and well lit, and carry only as much test gear as is regularly used. Items such as frequency counters can be shared. A bench lamp that incorporates a magnifier is very useful.

Information Technology

Those used to a manual paperwork system may be a bit dubious about using computers to do the same job. My opinion is that once a computerised booking and invoicing system has been installed and its use has been mastered the previous manual set-up will be history. A dedicated software system, such as the Servicebase one available from PC Control Systems, is ideal.

An ASC that repairs camcorders regularly will need a PC as a standard item of equipment – it will be required for set-up routines etc. A good computer system will save time and money and give you access to the awesome amount of information that's now available to the trade. Bear in mind that over a rela-

tively short period of time a vast amount of data will be accumulated: there's nothing better than a PC in which to store and retrieve it.

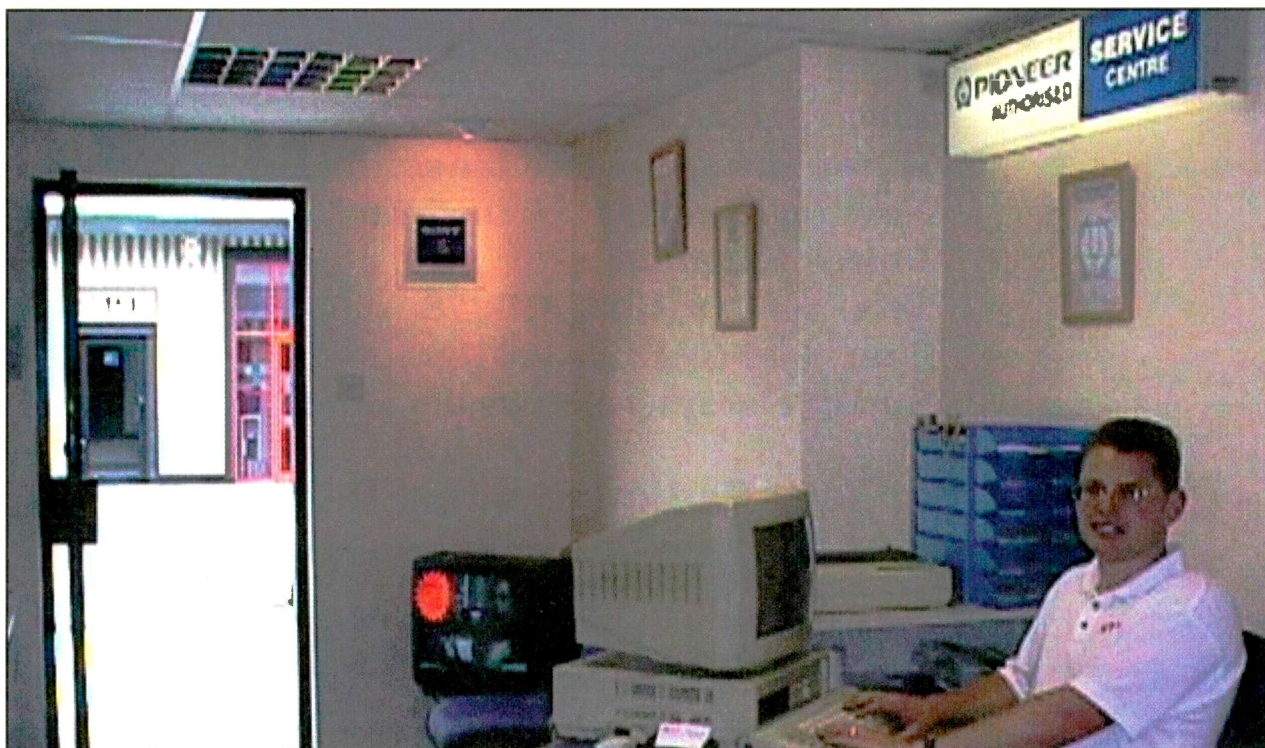
Ordering spares via the internet is now an option that an increasing number of manufacturers and spares suppliers offer, and it may be possible to obtain a discount when this method of ordering is used. Whether it's faster than simply picking up the phone is, however, debatable.

The Manufacturer's Role

Be in no doubt that any manufacturer will consider sales to be its primary concern over service. But if you are working on behalf of a major manufacturer you have a right to expect to be provided with a decent standard of spares and back-up service. Some manufacturers have their own fully-equipped workshops, while others have only very limited facilities.

It's becoming more commonplace for manufacturers to farm out repairs instead of dealing with this aspect of the business themselves. So, if you find yourself with a repair that, having explored all avenues, you cannot do, the manufacturer will probably arrange for a TLO visit. Some TLOs are prepared to get their hands dirty, while others see themselves as being more in an advisory capacity. If they cannot come up with a solution, they will usually arrange for the equipment to be taken to a specialist repairer or their own workshops.

A proper reception area will be expected. Graham Atkins, managing director, mans the desk.



It's obviously important to obtain accounts with as many manufacturers' spares departments as possible, as this will ensure that correct parts are available for fitting and will also guarantee that technical advice can be obtained. But the quality of this advice does vary. You will sometimes be given clear and accurate advice. At other times you will find that the engineer you speak to doesn't have much specific knowledge of the item that's causing you trouble and can offer only general advice. It's worthwhile making a note of the specialists in a particular field so that you can ask for them by name.

Warranty Work

Part of the agreement with a manufacturer will be a requirement to take in warranty repairs. The payment for these comes straight from the manufacturer, in the form of a warranty claimback. Rates vary, but on average the equivalent of about an hour's time is typical. If you have to spend two or three hours you are likely to find yourself well out of pocket. This may explain why a lot of dealers are inclined to shift such

jobs to an ASC. It would be reasonable to expect the dealer to pay the difference between the actual cost of the job and the claimback rate, but most of them will not agree to this. Some manufacturers actually forbid such a charge being levied.

There are cases where the original dealer has ceased to trade or the customer has moved, so you get the job from the customer directly. This will be a manufacturer's referral. Products purchased abroad will also turn up. It's important to stand your ground if an item doesn't constitute a warranty repair, and charge the dealer accordingly.

Field Service

Some level of service of this type will need to be offered, even if it's only an uplift to the workshop and delivery back. This is especially so with the current tendency to produce larger and larger sets. With the exception of some projection models, modern colour TV receivers are not built with field servicing in mind. So it's far more cost-effective to request a customer to bring the product to the workshop.

As far as warranty repairs are con-

cerned, most manufacturers won't pay extra on their claimback rates for a field call. They will simply give the customer a list of repairers, the onus being on the owner to arrange for transport of the unit.

Field calls to audio units are a complete waste of time, and current VCRs are almost as bad. The upshot of all this is don't waste money on providing a high-level field-service facility. Instead, aim at creating an efficient workshop so that you can achieve a decent throughput and a good turn-round time.

In Conclusion

I hope that the above has been of interest, especially to those wishing to broaden their horizons a bit. To run an ASC needs total dedication, but it will bring you into contact with a lot of people, some of whom can be quite influential. It can also broaden the product range that comes your way. Items such as PC monitors, security equipment, LCD projectors and industrial electronic products may well cross your path. You'll need a few black cats as well, plus a nice, friendly bank manager!

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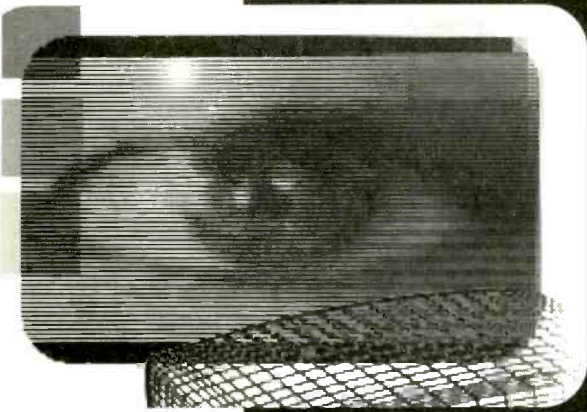
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Philip Blundell, AMI/Elec
Michael Maurice
Pete Gurney, LCGI
Giles Pilbrow
Gerald Smith
Ed Rowland
Steven Leatherbarrow
Alan J. Roberts and
Colin J. Guy

NEI 2591FTXN

If there is no line oscillator operation – the set comes out of standby, the red LED goes out but the green LED fails to come on – check the resistance between the tuner's can and the line output transistor's heatsink. If the reading is 22Ω , check for a dry-joint at the wire link by capacitor C130. This capacitor is near the line output transformer.

If there's no remote-control operation, check whether the TFMT4380N infra-red receiver module is producing a data output.

If you unplug the line scan coil plug to remove the chassis, take care to reconnect it. Should you switch on accidentally with the plug disconnected, R371 (1Ω , 0.25W safety) will go open-circuit. The result is excessive width with bowed verticals. **P.B.**

Philips 14PT1332/05 (L6.1AA chassis)

If the set is dead and the power supply has failed, with transistor 7503 short-circuit and resistors 3514 and 3515 open-circuit, don't just fit the power supply kit and switch on. There could be a fault in the line output stage – the transformer, transistor (7422), optocoupler (7420) or diode 6426 for example – power supply failure being caused by the overload.

TV Fault Finding

Certain component values/types in the power supply have been altered to provide improved performance. The changes are as follows: 2503 changed from $2.2nF$ to $33nF$, part no. 5322 121 42489; 2512 changed from $220\mu F$ to $470\mu F$, part no. 4822 124 40198; 3512 changed from $56k\Omega$ to $68k\Omega$, part no. 4822 116 52297; and 6510 changed from type C15V to type BZX79-C12, part no. 4822 130 34197. These upgrades should be carried out in any set that has the original component values/types.

In common with many other small-screen portables, the power supply in this model will not work with a 60W bulb as a dummy HT load. It will start when the mains input is increased gradually, using a variac, and the line output transistor has been removed. Monitor the power supply's HT output constantly while doing this, in case there's a voltage runaway. **P.B.**

Philips 25PT727B/05 (GR2.4AA chassis)

The picture was lacking in contrast and the teletext had no red in the display. Checks at the pins of the video processor chip IC7309 showed that the DC voltage at pin 2 (red text input) was low (2V). The $22nF$ chip capacitor C2358 was leaky. **P.B.**

Grundig T55-730 (CUC7301 chassis)

The mains fuse had blown and the chopper transistor was short-circuit. The snag was that the transistor was short-circuit collector-to-base: 300V at the drive circuit can cause havoc! I had to replace the following components: T665 type MJE18004C; D664 and D666 both type 1N4003; CD654 and CD656 both type LS4148; IC630 type UC3842A; D663, a 6.3V zener diode; and R661 220Ω . In addition

there was a dry-joint at capacitor C669. **P.B.**

JVC CS2190EK (BXII chassis)

The tuning drifted for the first half hour after switching on from cold. Once a steady picture had appeared it was marred by a Venetian-blind effect. Checks showed that the tuning voltage was varying though the supply rails were OK.

The tuning voltage is derived from the station select module, which contains the microcontroller and EEPROM. Apart from resoldering dry-joints at the crystal and microcontroller, the module is regarded as being unserviceable. In this particular set however the three surface-mounted capacitors on the right-hand side of the module responded to heat/freeze treatment. I replaced all four surface-mounted electrolytics, whose values are $3.3\mu F$, 50V (two of these); $0.47\mu F$, 50V; and $22\mu F$, 25V. This cured the fault. **M.M.**

Ferguson TX10 Chassis

The original fault was a dim and then no picture. It was cured by resoldering dry-joints on the tube base PCB, but the picture that appeared was out of focus. So the focus control was adjusted. Then, as the set warmed up, a few bright lines appeared at the bottom of the picture. A squirt of freezer confirmed that the TDA3654 field output chip was responsible for this. The customer said he had not seen these lines before, probably because they were masked by the poor focus. Once the repair work had been completed I was rewarded with an excellent picture. **M.M.**

Sony KVX2432U (AE1B chassis)

The customer said there was intermittent loss of the picture. Dry-

joints in the IF can be the usual cause, but not this time. When the tube's first anode voltage was turned up there was a picture with no blue content. The blue output transistor Q709's collector connection was dry-jointed. Lack of blue drive to the tube was upsetting the TDA4580 video processor chip IC301. **M.M.**

Ferguson C51F (ICC6 chassis)

The customer said that it required several goes before the set would switch on. Checks showed that the set was dead when switched on from cold. For once the mains switch was not to blame. The culprit was the chopper transistor's 470µF, 16V base drive coupling capacitor CP29. **M.M.**

Pioneer SD21AVI

When this set was switched on all you got was a blank screen with a purple haze at the left-hand side. Checks showed that there was no video output from the tuner/IF module. When a colour-bar signal was injected at this point, there were colour bars on the screen and TV programme sound came from the speakers. A check on the 12V rail showed that a lot of ripple was present. Once C522 (100µF, 25V) and C525 (10µF, 25V) had been replaced the ripple was gone, but there was still no video from the tuner. Video demodulation is carried out by a TDA5930 chip inside the tuner. A replacement IC cured the fault. **M.M.**

Philips G110 Chassis

This set had originally failed because of a defective LOPT. A couple of weeks later it came back. Once again it was dead, but the LED glowed orange for a moment then went out. I brought the set back to life by shorting the protection line, but it died when I tried to switch to standby. To find the cause of the trouble, I disconnected each of the feeds to the protection circuit. The culprit turned out to be D6657 (LLZ-C20), which monitors the 16V supply. When I removed it the set went to standby as it should. A new 20V zener diode restored normal operation. **M.M.**

Hitachi C2564TN

There was reduced height, some cramping, and intermittent field collapse. Numerous dry-joints were found in the field timebase circuit, particularly around the TDA8178 output chip IC601. Resoldering

them cured the intermittent field collapse, but the scan distortion was still present. Voltage checks then revealed that the supply at pin 2 of IC601 was low – it was 16V instead of 27V. The cause was R609, the surge-limiter resistor (1Ω safety type) in the 27V rectifier circuit. It had risen in value to almost 40Ω. **P.G.**

Matsui 14V1R (Grundig CUC7301 chassis)

The complaint was low sound. In fact the sound couldn't be increased above the half way position on the on-screen graphics. This suggested that the set had a hotel mode and was stuck in it, which turned out to be the case.

The hotel mode is activated/deactivated via the service menu. To gain access, use the on/off switch to switch the set off then press and hold the 'i' button on the remote-control unit while you switch the set on again. Use the remote-control unit's selection arrows to select the hotel mode then off.

When the hotel mode is applied, the maximum volume remains at the last setting used and the station channel menu is not available. **P.G.**

Philips CP90 Chassis

This set came in with a blown mains fuse. On investigation I found that the degaussing resistor had disintegrated. So I replaced it and also the 4.7Ω surge-limiter resistor R3657 in the feed to the bridge rectifier. Checks were carried out in the power supply, but no short-circuits were found. The 1nF, 2kV capacitor in the snubber network (C2679) was replaced as a matter of course – it tends to break down under load.

At switch on the surge-limiter resistor and fuse died, but again no measurable fault could be found. This time I replaced the 4.7Ω resistor with a bulb and then applied power. The cause of the trouble was eventually found to be the BUT11AF chopper transistor Tr7677. It had developed a crack in its plastic casing and was breaking down to the heatsink, although the transistor's junctions were found to be still intact when checked. **P.G.**

NEI 14NE3743

This portable refused to store channels. The customer noticed it only when some of the already stored channels required fine tuning. He then discovered that the store function on the menu had vanished.

I had no service information, but

the set appeared to use a conventional microcontroller chip plus an EEPROM for the channel memory and customer control settings.

These memory chips are susceptible to corruption or just general failure. So I decided to try a replacement. The EEPROM fitted is a 24C02, which is a 2Kbit I2C memory. As I didn't have this particular type I used a 24C04. The two types have the same protocol and address system, the difference being the memory size – the 04 version stores 4Kbits. Once the 04 had been installed the store function reappeared as a menu option and operation was back to normal.

I've found that with most of these I2C memory chips the next available size up can be fitted if necessary. The microcontroller chip simply ignores the extra memory locations. **P.G.**

Bush 2867NTX

There was no sound output. I've had several of these sets recently with this fault. The TDA1521A sound output chip goes short-circuit and its 4.7Ω supply feed resistor R811 open-circuit. The resistor is on the main PCB while the IC is on the Nicam stereo module.

Be careful with replacement chips – some makes refuse to work here, though I've had no trouble with ICs of Philips manufacture. As a matter of course I always replace the speaker coupling capacitors C365/366 (both 1,000µF): they tend to develop leakage and kill the IC – use capacitors rated at 63V.

This time however the sound still refused to come on, with the right channel output voltage at 3V instead of the mid-supply voltage. The sound section uses few components, and the cause of the trouble was soon traced to C374 (470nF) which had a measurable 22MΩ leak. It's the right-hand channel input coupling capacitor. In the interests of reliability I replaced the left-hand channel input coupling capacitor C358 as well. **P.G.**

Toshiba 2101T

No picture or sound was the complaint with this set. On test it displayed a channel ident on a blue background (video mute) with no sound. The tuning voltage varied with station selection, and there was a video output at pin 8 of the IF board, but it didn't get as far as the LSI jungle chip IC501 which, amongst other things, carries out the colour decoding and video processing.

On its way to IC501 the signal goes to the AV switching board, where it's split into separate Y and C components. A signal fed in at the scart 1 connector similarly vanished. Most of the processing on this panel is carried out by QV01 (TA8720AN), which controls the audio and video switching for both scart inputs, for the S video socket and the tuner signals. Switching is controlled by pins 15 and 16, whose status is determined by the main microcontroller chip. For TV these pins should both be high (5V). This voltage was correct, the cause of the signal loss being QV01 itself. **P.G.**

Sony K VX2572U (AE2B chassis)

There was intermittently reduced width, with the HT at about 90V instead of 135V. The cause was transistor Q281, which forms part of the audio protection circuit and is mounted on the scart PCB. **G.P.**

Sanyo ED1 chassis

At switch on the set would trip a couple of times then die completely. The cause was the TDA1521 audio output chip IC390, which was leaky. Part number is 410 030 8806. **G.P.**

Sony KVA2542U (AE2B chassis)

There was no picture on any channel except AV. A look at the manual program preset menu revealed that all program positions were set to EXT (AV input), and this could not be changed. I put the set in the service mode and looked at the INIT BYTE menu. This revealed that all the available TV systems were set to off. Normal operation was restored by switching System I back on and resetting the system for each program position.

I don't know whether the set had suffered memory corruption or had been fiddled with. But for good measure I replaced the non-volatile memory chip IC072 – after first noting down the settings! **G.P.**

Sanyo ED1 chassis

The sound came on and there were on-screen displays, but there was no picture. The VCU2136 chip IC501 on the digital PCB was the culprit. Its part number is 409 212 0608. **G.P.**

Sony K VX2982 (BE3B chassis)

The cause of insufficient width with no EW correction was circuit

protector PS801 (ICPF10), which was open-circuit. The part number is 1-532-605-21. **G.P.**

Nikkai Tara 10

There were two intermittent faults with this portable, either loss of the picture or field collapse. Both were caused by dry-joints – at D103 and the field chip respectively. Resoldering cured the problems. **G.S.**

Nokia 3725

There was a dull picture: the chroma was OK, but there was lack of luminance. The output at pin 7 of IC DD01 to the text PCB was OK, but when it returned to pin 13 the luminance was cramped. As it's a low-cost plug-in PCB I simply fitted a replacement. This cured the fault. **G.S.**

Finlux 3821 (8500 chassis)

Heavy black lines appeared intermittently at the right-hand side of the screen. They would gradually get worse until the picture blanked out completely. The video inputs to the colour decoder chip I311 were OK, but the RGB outputs were faulty. The cause of the trouble was noise on the blanking input because of a bad earth lead to the text PCB at pin 5 of St4. Hardwiring this earth connection cured the problem. **G.S.**

Akai CT2870

The customer said this set was dead. In fact it was tripping. He was surprised when I told him that it would have to be taken away for repair. Back in the workshop the LOPT proved to be the cause of the trouble. **E.R.**

Samsung Z68 Chassis

If you get one of these sets with about half an inch of foldover at the top of the screen, replace the TDA8350 field/EW output chip IC301. **E.R.**

Samsung CI3352 (P68 chassis)

This 14in. portable had a dead power supply. A common cause of the fault is the SDH209B chopper control chip IC801, but a replacement made no difference. The culprits turned out to be diodes D810/811 (both type 1N4148) and the 7.5V zener diode DZ825. As a precaution I also replaced C852 (470µF, 16V), though it read all right when checked with a capacitance meter. It's the LT reservoir capacitor on the primary side of the power supply. **E.R.**

Philips 21PT166B

One of these sets came in with the P6NA60F1 chopper FET short-circuit. As nothing else appeared to be faulty I simply fitted a replacement. Unfortunately the set remained dead. The MC44603P control chip had failed. **S.L.**

Ferguson T59F (TX92 chassis)

This set sometimes failed to come on from cold, pulsing three or four times. Heating and freezing would not instigate or cure the fault. I eventually discovered that RP28 had gone high-resistance. It's a coil that connects the on/off switch circuit to pin 11 of the TDA4605 chopper control chip. It measured 7Ω: the replacement was nearer to 1Ω. **S.L.**

Sony KV25F3 (BE3D chassis)

At switch on this set tripped off to standby. As no obvious cause could be found, I decided to disable the protection and run the set up using a variac. This showed, in a spectacular fashion, that the LOPT was faulty. It's important to quote the set's serial number, as the LOPTs differ.

After fitting the replacement transformer I had good colour pictures but there was no sound and EW distortion was present. IC1200 (TDA7264) was responsible for the loss of sound. The causes of the EW fault were IC800 (LM393P) and D800 (ISS133T), which were both leaky. Some slight adjustments then produced normal results. Entry to the service mode is obtained by pressing on screen display, digit5, vol+ and TT. **S.L.**

Ferguson D59F (ICC9 chassis)

The cause of intermittent loss of line sync when warm was the STV2160 chip IV01. When you fit the modified chip now supplied, CV46 should be changed from 10nF to 33nF – a surface-mounted 22nF capacitor is provided for connection in parallel with the original CV46.

The chip can fail as a result of flashovers. There's another modification to deal with this problem. Remove the SMD jumper JV56 and replace it with a 4.7kΩ resistor, part no. 60079900. **S.L.**

Toshiba 2512DB

The symptoms with this set were lack of width with severe cogging

from cold. The cause was C424 (4.7µF, 100V) which is on a sub-panel at the front right of the chassis. S.L.

Sony KV2096

The customer complained about intermittent red and green flashing. I've had quite a few Sony tubes produce this, and suspected the worst. Fortunately the tube proved to be faultless. I resoldered the usual resistors, using HMP solder, and left the set running. After about half an hour strange things began to happen to the picture. Red and green streaks appeared, and at one point there were small red and green squares all over the screen. Just as suddenly the fault would clear.

Somewhere in the back of my mind I recalled a similar fault and reached for the remote control unit. Pressing the teletext button had no effect, except that now I couldn't change channels. So the text mode was being selected but not displayed. I pulled the cover off the text panel and found the SAA5243P chip sitting in a holder.

I've known these holders to go high-resistance. So I removed the chip and the holder, then soldered the chip in directly. The set - and teletext - then behaved correctly. A.J.R.

Philips 28DC2070 (D16-III chassis)

Picture flashing was the complaint with this set. When I tested it I found that the picture would blank for a split second at irregular intervals. The signal was fine up to the digital video panel: after that the signals blanked on and off. There is no parts list for the digital board - you have to order a service exchange. Everything was OK when one had been fitted. A.J.R.

NEI CTV61R (Indiana 100 chassis)

This set operated intermittently because of dry-joints at the start-up potistor and D805 (1N4007), which is in the chopper transistor's drive circuit. It also suffered from tuning drift. A replacement ZTK33 tuning voltage stabiliser (D001) cured the drift problem A.J.R.

Philips 14PV182 TV/VCR combi





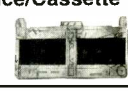

This almost new unit was cycling on and off at about one second intervals. No shorts could be found anywhere, and the line output transformer wasn't suspect as the unit was in standby. The cause of the fault was the MC44603 chip in the power supply (IC7130). C.J.G.

Goodmans 205N (Daewoo CP365 chassis)

The fault symptoms with this set were poor field linearity and tuning drift. Both were caused by the 8V regulator I402 which was running very hot, though the load on it was not excessive. C.J.G.

Hitachi CMT2700

This complex multistandard set claimed to be a G7PI chassis, but was nothing like the G7PS we all know and love (!). The complaint was loss of field sync. With the aid of the circuit diagram thoughtfully provided by the set's owner I eventually traced the cause to a 10µF electrolytic capacitor on the NTSC subpanel. C.J.G.

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<p>4 WAY UNIVERSAL REMOTE</p> <p><i>Unique illuminated key (TV, VCR, SAT, CD/Hi-Fi)</i></p> <p><i>macro function key</i></p> <p><i>24 bit processor</i></p> <p><i>Ergonomically designed keypad</i></p> <p><i>Replaces up to 4 remote controls</i></p> <p><i>Child security feature</i></p> <p><i>Fastext/teletext</i></p> <p>£12.99</p> 	<table border="1"> <tr> <th colspan="2">AKAI</th> <th colspan="2">MITSUBISHI</th> </tr> <tr> <td>CT1215</td><td>£16.99</td> <td>CT2145</td><td>£16.99</td> </tr> <tr> <td>CT2570</td><td>£16.99</td> <td>CT2528STX</td><td>£16.99</td> </tr> <tr> <td>CT2870</td><td>£16.99</td> <td>NEI</td><td>£16.99</td> </tr> <tr> <td>CT2879</td><td>£16.99</td> <td>1451R</td><td>£16.99</td> </tr> <tr> <td>AKURA</td><td>£16.99</td> <td>NIKKAI</td><td>£16.99</td> </tr> <tr> <td>CX10.18</td><td>£16.99</td> <td>NT14.20</td><td>£16.99</td> </tr> <tr> <td>AMSTRAD</td><td>£16.99</td> <td>PANASONIC</td><td>£16.99</td> </tr> <tr> <td>TR12.3.4</td><td>£16.99</td> <td>TLF14567</td><td>£16.99</td> </tr> <tr> <td>BEKO</td><td>£16.99</td> <td>TLF14586</td><td>£16.99</td> </tr> <tr> <td>15225T</td><td>£16.99</td> <td>TLF14592</td><td>£16.99</td> </tr> <tr> <td>16228NX</td><td>£16.99</td> <td>TLF15505</td><td>£16.99</td> </tr> <tr> <td>BUSH</td><td>£16.99</td> <td>TLF15506</td><td>£16.99</td> </tr> <tr> <td>1427T</td><td>£16.99</td> <td>TLF15514</td><td>£16.99</td> </tr> <tr> <td>2059NTX</td><td>£16.99</td> <td>TLF15542</td><td>£16.99</td> </tr> <tr> <td>DECCA</td><td>£16.99</td> <td>TLF15548</td><td>£16.99</td> </tr> <tr> <td>DN8652</td><td>£16.99</td> <td>TLF15606</td><td>£16.99</td> </tr> <tr> <td>DT9476</td><td>£16.99</td> <td>PHILIPS</td><td>£16.99</td> </tr> <tr> <td>DV9499</td><td>£16.99</td> <td>2A, 3A</td><td>£14.99</td> </tr> <tr> <td>TN9422</td><td>£16.99</td> <td>GR2.2</td><td>£16.99</td> </tr> <tr> <td>FERGUSON</td><td>£16.99</td> <td>CP90</td><td>£14.99</td> </tr> <tr> <td>TX85/86</td><td>£16.99</td> <td>CTXE. S</td><td>£14.99</td> </tr> <tr> <td>TX99</td><td>£12.99</td> <td>ANUBIS A</td><td>£14.99</td> </tr> <tr> <td>TX100</td><td>£12.99</td> <td>G90AE</td><td>£14.99</td> </tr> <tr> <td>ICX3</td><td>£16.99</td> <td>SAISHO</td><td>£16.99</td> </tr> <tr> <td>ICX5</td><td>£16.99</td> <td>CT142FX</td><td>£16.99</td> </tr> <tr> <td>IC27</td><td>£16.99</td> <td>CT149TXA</td><td>£16.99</td> </tr> <tr> <td>IC28</td><td>£18.70</td> <td>SAMSUNG</td><td>£16.99</td> </tr> <tr> <td>IC29</td><td>£16.99</td> <td>CI338</td><td>£16.99</td> </tr> <tr> <td>IC99</td><td>£16.99</td> <td>CI5012</td><td>£16.99</td> </tr> <tr> <td>41H2</td><td>£16.99</td> <td>CI5322</td><td>£16.99</td> </tr> <tr> <td>59L7</td><td>£16.99</td> <td>CX1541</td><td>£16.99</td> </tr> <tr> <td>A59F</td><td>£16.99</td> <td>CX3312</td><td>£16.99</td> </tr> <tr> <td>B59F</td><td>£16.99</td> <td>CX5012Z</td><td>£16.99</td> </tr> <tr> <td>CS1ND</td><td>£16.99</td> <td>SANYO</td><td>£21.27</td> </tr> <tr> <td>D59F</td><td>£16.99</td> <td>CBP2145</td><td>£21.27</td> </tr> <tr> <td>D78N</td><td>£16.99</td> <td>SHARP</td><td>£16.99</td> </tr> <tr> <td>FINLUX</td><td>£16.99</td> <td>C3705N</td><td>£16.99</td> </tr> <tr> <td>1000 SERIES</td><td>£16.99</td> <td>C3720H</td><td>£16.99</td> </tr> <tr> <td>GRUNDIG</td><td>£14.99</td> <td>C2123H</td><td>£16.99</td> </tr> <tr> <td>CUC3300</td><td>£16.99</td> <td>DV3761</td><td>£16.99</td> </tr> <tr> <td>HINARI</td><td>£16.99</td> <td>DV5103H</td><td>£16.99</td> </tr> <tr> <td>CTV14RC</td><td>£16.99</td> <td>DV5132</td><td>£16.99</td> </tr> <tr> <td>TV20RC</td><td>£16.99</td> <td>SONY</td><td>£16.99</td> </tr> <tr> <td>HITACHI</td><td>£16.99</td> <td>KV2066</td><td>£16.99</td> </tr> <tr> <td>C2114T</td><td>£16.99</td> <td>KV2096</td><td>£16.99</td> </tr> <tr> <td>C2119T</td><td>£16.99</td> <td>KV21XRTU</td><td>£16.99</td> </tr> <tr> <td>C21P228</td><td>£21.25</td> <td>KV21XMTU</td><td>£16.99</td> </tr> <tr> <td>C2509T</td><td>£21.27</td> <td>KVA2921</td><td>£16.99</td> </tr> <tr> <td>C2519T</td><td>£21.27</td> <td>LVDX21TU</td><td>£16.99</td> </tr> <tr> <td>C2558T</td><td>£14.99</td> <td>KV2911</td><td>£16.99</td> </tr> <tr> <td>CP11476</td><td>£14.99</td> <td>KVM2511</td><td>£16.99</td> </tr> <tr> <td>CP21178</td><td>£14.99</td> <td>KVX2131</td><td>£16.99</td> </tr> <tr> <td>CP22278</td><td>£16.99</td> <td>KVX2532</td><td>£16.99</td> </tr> <tr> <td>CP22478</td><td>£16.99</td> <td>KVX2552</td><td>£16.99</td> </tr> <tr> <td>CP22568</td><td>£16.99</td> <td>1400F4B</td><td>£16.99</td> </tr> <tr> <td>CP22598</td><td>£16.99</td> <td>TOSHIBA</td><td>£16.99</td> </tr> <tr> <td>ITT</td><td>£16.99</td> <td>1400TB</td><td>£14.50</td> </tr> <tr> <td>DIGI 3</td><td>£16.99</td> <td>14288T</td><td>£15.50</td> </tr> <tr> <td>TX3876</td><td>£16.99</td> <td>145E7B</td><td>£15.50</td> </tr> <tr> <td>TX3537</td><td>£16.99</td> <td>150R6B</td><td>£15.50</td> </tr> <tr> <td>JVC</td><td>£16.99</td> <td>150T0BT</td><td>£14.50</td> </tr> <tr> <td>CI4E1</td><td>£16.99</td> <td>155T9B</td><td>£16.99</td> </tr> <tr> <td>AV25F1</td><td>£21.25</td> <td>175T9B</td><td>£14.50</td> </tr> <tr> <td>AV28F1</td><td>£21.25</td> <td>2100TB</td><td>£18.70</td> </tr> <tr> <td>MATSUI</td><td>£16.99</td> <td>215T8B</td><td>£14.45</td> </tr> <tr> <td>2091T</td><td>£16.99</td> <td>2512DBT</td><td>£18.70</td> </tr> <tr> <td>2092T</td><td>£16.99</td> <td>2812DBT</td><td>£18.70</td> </tr> </table>	AKAI		MITSUBISHI		CT1215	£16.99	CT2145	£16.99	CT2570	£16.99	CT2528STX	£16.99	CT2870	£16.99	NEI	£16.99	CT2879	£16.99	1451R	£16.99	AKURA	£16.99	NIKKAI	£16.99	CX10.18	£16.99	NT14.20	£16.99	AMSTRAD	£16.99	PANASONIC	£16.99	TR12.3.4	£16.99	TLF14567	£16.99	BEKO	£16.99	TLF14586	£16.99	15225T	£16.99	TLF14592	£16.99	16228NX	£16.99	TLF15505	£16.99	BUSH	£16.99	TLF15506	£16.99	1427T	£16.99	TLF15514	£16.99	2059NTX	£16.99	TLF15542	£16.99	DECCA	£16.99	TLF15548	£16.99	DN8652	£16.99	TLF15606	£16.99	DT9476	£16.99	PHILIPS	£16.99	DV9499	£16.99	2A, 3A	£14.99	TN9422	£16.99	GR2.2	£16.99	FERGUSON	£16.99	CP90	£14.99	TX85/86	£16.99	CTXE. S	£14.99	TX99	£12.99	ANUBIS A	£14.99	TX100	£12.99	G90AE	£14.99	ICX3	£16.99	SAISHO	£16.99	ICX5	£16.99	CT142FX	£16.99	IC27	£16.99	CT149TXA	£16.99	IC28	£18.70	SAMSUNG	£16.99	IC29	£16.99	CI338	£16.99	IC99	£16.99	CI5012	£16.99	41H2	£16.99	CI5322	£16.99	59L7	£16.99	CX1541	£16.99	A59F	£16.99	CX3312	£16.99	B59F	£16.99	CX5012Z	£16.99	CS1ND	£16.99	SANYO	£21.27	D59F	£16.99	CBP2145	£21.27	D78N	£16.99	SHARP	£16.99	FINLUX	£16.99	C3705N	£16.99	1000 SERIES	£16.99	C3720H	£16.99	GRUNDIG	£14.99	C2123H	£16.99	CUC3300	£16.99	DV3761	£16.99	HINARI	£16.99	DV5103H	£16.99	CTV14RC	£16.99	DV5132	£16.99	TV20RC	£16.99	SONY	£16.99	HITACHI	£16.99	KV2066	£16.99	C2114T	£16.99	KV2096	£16.99	C2119T	£16.99	KV21XRTU	£16.99	C21P228	£21.25	KV21XMTU	£16.99	C2509T	£21.27	KVA2921	£16.99	C2519T	£21.27	LVDX21TU	£16.99	C2558T	£14.99	KV2911	£16.99	CP11476	£14.99	KVM2511	£16.99	CP21178	£14.99	KVX2131	£16.99	CP22278	£16.99	KVX2532	£16.99	CP22478	£16.99	KVX2552	£16.99	CP22568	£16.99	1400F4B	£16.99	CP22598	£16.99	TOSHIBA	£16.99	ITT	£16.99	1400TB	£14.50	DIGI 3	£16.99	14288T	£15.50	TX3876	£16.99	145E7B	£15.50	TX3537	£16.99	150R6B	£15.50	JVC	£16.99	150T0BT	£14.50	CI4E1	£16.99	155T9B	£16.99	AV25F1	£21.25	175T9B	£14.50	AV28F1	£21.25	2100TB	£18.70	MATSUI	£16.99	215T8B	£14.45	2091T	£16.99	2512DBT	£18.70	2092T	£16.99	2812DBT	£18.70	<table border="1"> <tr> <th colspan="2">IC'S TRANSISTORS AT LOW PRICES</th> </tr> <tr> <td>AN5515</td><td>£1.50</td> </tr> <tr> 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<td>PA32029B</td><td>£8.50</td> </tr> <tr> <td>PAL003A</td><td>£9.99</td> </tr> <tr> <td>STK463</td><td>£10.00</td> </tr> <tr> <td>STK465</td><td>£11.00</td> </tr> <tr> <td>STK4132H</td><td>£7.00</td> </tr> <tr> <td>STK4141V</td><td>£8.00</td> </tr> <tr> <td>STK4142H</td><td>£7.00</td> </tr> <tr> <td>STK4162H</td><td>£8.00</td> </tr> <tr> <td>STK4172H</td><td>£9.00</td> </tr> <tr> <td>STK4182H</td><td>£10.00</td> </tr> <tr> <td>STK730-060</td><td>£8.50</td> </tr> <tr> <td>STK7348</td><td>£4.00</td> </tr> <tr> <td>STR10006</td><td>£4.50</td> </tr> <tr> <td>STR5020</td><td>£4.00</td> </tr> <tr> <td>STR50103</td><td>£3.00</td> </tr> <tr> <td>STR54041</td><td>£3.50</td> </tr> <tr> <td>STR58041</td><td>£3.50</td> </tr> <tr> <td>STR59041</td><td>£3.50</td> </tr> <tr> <td>STRD1816</td><td>£3.50</td> </tr> <tr> <td>STRD4420</td><td>£5.00</td> </tr> <tr> <td>STRD5441</td><td>£5.00</td> </tr> <tr> <td>STRM6545</td><td>£10.00</td> </tr> <tr> <td>STRM6549</td><td>£11.00</td> </tr> <tr> <td>STRS6307</td><td>£6.00</td> </tr> <tr> <td>STRS6308</td><td>£6.00</td> </tr> <tr> <td>STRS6309</td><td>£6.00</td> </tr> <tr> <td>STR9379</td><td>£6.99</td> </tr> <tr> <td>TA7288</td><td>£2.50</td> </tr> <tr> <td>TAB205</td><td>£3.00</td> </tr> <tr> <td>TAB215</td><td>£3.00</td> </tr> <tr> <td>TAB217</td><td>£2.00</td> </tr> <tr> <td>TAB218</td><td>£7.00</td> </tr> <tr> <td>TAB220</td><td>£5.00</td> </tr> <tr> <td>TAB221</td><td>£6.00</td> </tr> <tr> <td>TAB223</td><td>£5.00</td> </tr> <tr> <td>TAB227</td><td>£2.50</td> </tr> <tr> <td>TAB229</td><td>£3.00</td> </tr> </table>	IC'S TRANSISTORS AT LOW 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22, 47, 100, 220. 5 OF EACH VALUE 63 VOLTS £3.99</p> <p>33 PIECE TAMPER PROOF SECURITY BITS £5.99</p>  <p>CLAMP METER 200 AMPS AC/DC DIGITAL £59.99</p>  <p>TRANSMISTORS</p> <table border="1"> <tr><td>BU2508AF</td><td>£1.50</td></tr> <tr><td>BU2508DF</td><td>£1.50</td></tr> <tr><td>BU2525AF</td><td>£2.50</td></tr> <tr><td>BU290A</td><td>£1.75</td></tr> <tr><td>BU291A</td><td>£2.60</td></tr> <tr><td>S2000AF</td><td>£1.50</td></tr> <tr><td>S2055AF</td><td>£1.50</td></tr> <tr><td>SA1302</td><td>£2.99</td></tr> <tr><td>2SC3281</td><td>£2.99</td></tr> <tr><td>2SD1555</td><td>£1.99</td></tr> <tr><td>2SD1878</td><td>£1.99</td></tr> <tr><td>2SD1887</td><td>£2.60</td></tr> </table>	BU2508AF	£1.50	BU2508DF	£1.50	BU2525AF	£2.50	BU290A	£1.75	BU291A	£2.60	S2000AF	£1.50	S2055AF	£1.50	SA1302	£2.99	2SC3281	£2.99	2SD1555	£1.99	2SD1878	£1.99	2SD1887	£2.60	<p>VHS ALIGNMENT TAPE BAND TRACKING, TAPE TRANSPORT, FM PICTU CURVE, AUDIO SYNC HEAD AZIMUTH TRACKING PLAYBACK SWITCHING POINT £29.99 only</p> <p>PATTERN GENERATOR Colour bar, Cross hatch, Staircase. COMPACT PORTABLE £84.99 only</p> <p>Capacitance Meters Capacitance Meter PG015</p>  <p>An accurate, capacitance meter providing measurements over a very wide range. 0 TO 2000UF ACCURACY 0.5% £29.99</p> <p>Transparent Service/Cassette</p> <p>£1.99 Special</p>  <p>MITSUBISHI Capstan Motor Pulley ONLY £3.95</p>  <p>£74.99 only</p> <p>CD TEST DISC £9.99 FREQUENCY COUNTER £99 SOLDERING STATION £50.00 DIGITAL MULTIMETER FROM £9.99</p>
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TR12.3.4	£16.99	TLF14567	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
BEKO	£16.99	TLF14586	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
15225T	£16.99	TLF14592	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
16228NX	£16.99	TLF15505	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
BUSH	£16.99	TLF15506	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
1427T	£16.99	TLF15514	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
2059NTX	£16.99	TLF15542	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
DECCA	£16.99	TLF15548	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
DN8652	£16.99	TLF15606	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
DT9476	£16.99	PHILIPS	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
DV9499	£16.99	2A, 3A	£14.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
TN9422	£16.99	GR2.2	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
FERGUSON	£16.99	CP90	£14.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
TX85/86	£16.99	CTXE. S	£14.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
TX99	£12.99	ANUBIS A	£14.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
TX100	£12.99	G90AE	£14.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
ICX3	£16.99	SAISHO	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
ICX5	£16.99	CT142FX	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
IC27	£16.99	CT149TXA	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
IC28	£18.70	SAMSUNG	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
IC29	£16.99	CI338	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
IC99	£16.99	CI5012	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
41H2	£16.99	CI5322	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
59L7	£16.99	CX1541	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
A59F	£16.99	CX3312	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
B59F	£16.99	CX5012Z	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
CS1ND	£16.99	SANYO	£21.27																																																																																																																																																																																																																																																																																																																																																																																																																																							
D59F	£16.99	CBP2145	£21.27																																																																																																																																																																																																																																																																																																																																																																																																																																							
D78N	£16.99	SHARP	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
FINLUX	£16.99	C3705N	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
1000 SERIES	£16.99	C3720H	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
GRUNDIG	£14.99	C2123H	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
CUC3300	£16.99	DV3761	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
HINARI	£16.99	DV5103H	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
CTV14RC	£16.99	DV5132	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
TV20RC	£16.99	SONY	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
HITACHI	£16.99	KV2066	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
C2114T	£16.99	KV2096	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
C2119T	£16.99	KV21XRTU	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
C21P228	£21.25	KV21XMTU	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
C2509T	£21.27	KVA2921	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
C2519T	£21.27	LVDX21TU	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
C2558T	£14.99	KV2911	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
CP11476	£14.99	KVM2511	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
CP21178	£14.99	KVX2131	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
CP22278	£16.99	KVX2532	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
CP22478	£16.99	KVX2552	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
CP22568	£16.99	1400F4B	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
CP22598	£16.99	TOSHIBA	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
ITT	£16.99	1400TB	£14.50																																																																																																																																																																																																																																																																																																																																																																																																																																							
DIGI 3	£16.99	14288T	£15.50																																																																																																																																																																																																																																																																																																																																																																																																																																							
TX3876	£16.99	145E7B	£15.50																																																																																																																																																																																																																																																																																																																																																																																																																																							
TX3537	£16.99	150R6B	£15.50																																																																																																																																																																																																																																																																																																																																																																																																																																							
JVC	£16.99	150T0BT	£14.50																																																																																																																																																																																																																																																																																																																																																																																																																																							
CI4E1	£16.99	155T9B	£16.99																																																																																																																																																																																																																																																																																																																																																																																																																																							
AV25F1	£21.25	175T9B	£14.50																																																																																																																																																																																																																																																																																																																																																																																																																																							
AV28F1	£21.25	2100TB	£18.70																																																																																																																																																																																																																																																																																																																																																																																																																																							
MATSUI	£16.99	215T8B	£14.45																																																																																																																																																																																																																																																																																																																																																																																																																																							
2091T	£16.99	2512DBT	£18.70																																																																																																																																																																																																																																																																																																																																																																																																																																							
2092T	£16.99	2812DBT	£18.70																																																																																																																																																																																																																																																																																																																																																																																																																																							
IC'S TRANSISTORS AT LOW PRICES																																																																																																																																																																																																																																																																																																																																																																																																																																										
AN5515	£1.50																																																																																																																																																																																																																																																																																																																																																																																																																																									
BA3910	£7.99																																																																																																																																																																																																																																																																																																																																																																																																																																									
BA3918	£7.99																																																																																																																																																																																																																																																																																																																																																																																																																																									
BA3920	£3.00																																																																																																																																																																																																																																																																																																																																																																																																																																									
BA5412	£2.50																																																																																																																																																																																																																																																																																																																																																																																																																																									
CNX62A	£1.50																																																																																																																																																																																																																																																																																																																																																																																																																																									
CNX82A	£1.50																																																																																																																																																																																																																																																																																																																																																																																																																																									
H8NA80F1	£4.00																																																																																																																																																																																																																																																																																																																																																																																																																																									
HA13128	£4.00																																																																																																																																																																																																																																																																																																																																																																																																																																									
HA13130	£4.50																																																																																																																																																																																																																																																																																																																																																																																																																																									
HA13150	£11.00																																																																																																																																																																																																																																																																																																																																																																																																																																									
HA13151	£8.50																																																																																																																																																																																																																																																																																																																																																																																																																																									
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LA4280	£2.50																																																																																																																																																																																																																																																																																																																																																																																																																																									
LA4400	£2.50																																																																																																																																																																																																																																																																																																																																																																																																																																									
LA4445	£2.00																																																																																																																																																																																																																																																																																																																																																																																																																																									
LA4475	£2.25																																																																																																																																																																																																																																																																																																																																																																																																																																									
LA4496	£2.50																																																																																																																																																																																																																																																																																																																																																																																																																																									
LA4700	£3.50																																																																																																																																																																																																																																																																																																																																																																																																																																									
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LA7830	£1.50																																																																																																																																																																																																																																																																																																																																																																																																																																									
LA7832	£2.50																																																																																																																																																																																																																																																																																																																																																																																																																																									
LA7835	£1.50																																																																																																																																																																																																																																																																																																																																																																																																																																									
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PA32029B	£8.50																																																																																																																																																																																																																																																																																																																																																																																																																																									
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STK463	£10.00																																																																																																																																																																																																																																																																																																																																																																																																																																									
STK465	£11.00																																																																																																																																																																																																																																																																																																																																																																																																																																									
STK4132H	£7.00																																																																																																																																																																																																																																																																																																																																																																																																																																									
STK4141V	£8.00																																																																																																																																																																																																																																																																																																																																																																																																																																									
STK4142H	£7.00																																																																																																																																																																																																																																																																																																																																																																																																																																									
STK4162H	£8.00																																																																																																																																																																																																																																																																																																																																																																																																																																									
STK4172H	£9.00																																																																																																																																																																																																																																																																																																																																																																																																																																									
STK4182H	£10.00																																																																																																																																																																																																																																																																																																																																																																																																																																									
STK730-060	£8.50																																																																																																																																																																																																																																																																																																																																																																																																																																									
STK7348	£4.00																																																																																																																																																																																																																																																																																																																																																																																																																																									
STR10006	£4.50																																																																																																																																																																																																																																																																																																																																																																																																																																									
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STR54041	£3.50																																																																																																																																																																																																																																																																																																																																																																																																																																									
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STR59041	£3.50																																																																																																																																																																																																																																																																																																																																																																																																																																									
STRD1816	£3.50																																																																																																																																																																																																																																																																																																																																																																																																																																									
STRD4420	£5.00																																																																																																																																																																																																																																																																																																																																																																																																																																									
STRD5441	£5.00																																																																																																																																																																																																																																																																																																																																																																																																																																									
STRM6545	£10.00																																																																																																																																																																																																																																																																																																																																																																																																																																									
STRM6549	£11.00																																																																																																																																																																																																																																																																																																																																																																																																																																									
STRS6307	£6.00																																																																																																																																																																																																																																																																																																																																																																																																																																									
STRS6308	£6.00																																																																																																																																																																																																																																																																																																																																																																																																																																									
STRS6309	£6.00																																																																																																																																																																																																																																																																																																																																																																																																																																									
STR9379	£6.99																																																																																																																																																																																																																																																																																																																																																																																																																																									
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What a Life!

A varied collection of TV problems – and problem customers. Donald Bullock's servicing commentary

I was tidying up the counter the other day when a strange-looking chap appeared at the door. He flung out his arm, looked along it as though it was a rifle, and came in.

"Nothing the matter with my nerves" he announced, "but I'll tell you now. That bus was terrible. Never known anything like it."

I went outside and looked up and down the road but couldn't see a bus. "Where is it?" I asked.

"In the set" he replied, then ran out and came back with a 25in. Mitsubishi Model CT25B2STX, which he plonked on the counter.

I waved him out just as Stephen entered. He plugged the set in and switched it on. There was a prominent buzz over the sound.

"It'll be the usual IF strip trouble" he commented, "dry-joints for a start, and probably some of the 0.47 μ F, 50V electrolytics will be low."

He was right. When we checked the sound IF circuit it was full of dry-joints. Resoldering brought about an improvement, but the electrolytic capacitors had to be replaced to clear the trouble completely.

Nothin' Wrong

Our next visitor, Mr Clandon, brought with him a Sanyo CTP6134 colour set (83P chassis).

"Don't get me wrong" he started off, "there's nuffin' wrong with 'im. Not at first, anyhow."

"Then why have you brought it here?" I asked.

He looked at me scornfully. "Cos he's faulty, of course" he replied.

I patted my pockets for my tablets and leaned forward. "What's wrong then?" I asked quietly.

"We switches 'im on, right?" I nodded.

"E works OK, right?"

I nodded again.

"Then, just as the cat starts whining to go out, 'e changes channels. Zonk, zonk he goes. Just like that. Zonk, zonk, BBC1. Zonk, zonk, BBC2. I 'ates BBC2. Zonk, zonk, Channel 5. That 'ent too bad. But, I meaner say, surely I've got a right to say what channel I watches, in my own 'ouse anyways?"

"I should think so" I agreed, "I think it's shameful. Leave it with us Mr Clandon. We'll get it right."

Paul tuned in a picture and studied the screen. A slight hum bar was present on the picture, and after a while the set began to change channels of its own accord. "Ripple on the HT I reckon" he said, "case of checking the electrolytics I suppose, biggest first." He found the culprit almost immediately. It was the 130 μ F, 400V electrolytic on the primary side of the chopper circuit. There was visible leakage and on test it was almost open-circuit.

Quick Departure

There are some folk I just don't like. Yobbos. This fellow barged in with with an ancient Ferguson set – one fitted with the TX10 chassis.

"OK mate?" he asked as he dropped it on my hand, "now I don't wanna spend much on this 'un. That thin bloke at Snoddies almost got a clout earlier. Wanted forty quid. I don't mind parting with a fiver or a tenner, but that's it."

My attention began to stray. Stephen noticed and stepped in. "Why not have an estimate, sir?" he smiled, "it'll cost you only ten pounds, and if you accept we'll deduct that from your repair bill."

There was a bit of banter, then our visitor picked up his old banger. "Ta-la" mate he called as he departed through the door.

Mixed Pair

Mr Ansell lives out in the sticks. He came in clutching a coiled length of coaxial lead in his hand.

Paul stepped forward. "Hello, sir" he beamed, "how can we help you?"

"Me ol' telly's gone a bit dim. Merry Widow next door reckons it's the tube. Anyway I brought this for you to check over." He handed over the length of coaxial cable.

As Paul's face started to contort, Mrs Harpson glided in and smiled sweetly at me. "My set's causing trouble again, Donnie" she cooed, "will you help me bring it in from the car?"

"Leave it to me" I replied. As I went out I glanced at Paul, who was doing his best with Mr Ansell.

"What do you mean Mr Bullock – this ain't the tube?" he was saying.

Mrs Harpson's set was an old Amstrad 20in. TV/VCR combi, Model TVR3. "Takes a while to get going" she said. I went straight to the chopper power supply and found that the 1 μ F, 50V feedback capacitor C307 had gone low in value. It nearly always does. A replacement got the set working, but a terrible scream now came from the power supply. This was caused by the 3,300pF, 1kV disc capacitor C310 in the snubber network.

Paul was still busy with Mr Ansell but seemed to be making some progress, albeit slow. "So you'll bring it in then" he said.

"Yes" replied Mr Ansell. "Now, do I bring the whole set in, or only this glass thing you reckon is the tube?"

Paul pulled up his stool and prepared himself for more of the same.

Later, while we were having lunch, he said "this trade seems to be a non-stop pantomime. When I

go out to do the calls I'll get more of the same. Do we get all the odd-balls, or just our share?"

"Take it from me" I replied, "it's the same throughout the trade. Always has been. And I've worked in all sorts of workshops."

Coarse Lines

At which point Sid Porter came in with a 21in. Toshiba set, Model 210T6BT. "Hello Don" he started off, looking back through the door, "what do they charge in the pie shop across the road?"

"About forty pounds each" I replied, but he was gone.

Stephen plugged the set in and found that the display consisted of a screenful of coarse lines. He located the field timebase and started to check the electrolytics. When he came to the linearity feedback capacitor C317 (2.2 μ F, 50V) he made happy noises. "Down to less than 1 μ F" he said. A new one restored normal field scanning. Then Sid reappeared, pie in hand.

"I likes comin' here" he said.

"Ta" I said, "but we're not all that special."

"Ain't that" he replied. "You've a good pie shop opposite. Better than Fat Florrie's place next door to Snoddys. By the way, what do I owe you?"

"Ten pounds" I said, "but if there are any more funnies it'll go up to thirty."

Interference

Mr McCorquadales is a tidy man with a little toothbrush moustache. He speaks in a whisper.

"We've got three sets at home" he leant over and whispered, "and they're all faulty. The pictures keep breaking up every few seconds."

"What about the sound?" I asked quietly, speaking close to his ear.

"It sort of squelches in sympathy with the picture disturbance" he replied, barely audibly. "It all began when we bought the Sony out of the paper."

I pursed my lips and studied my kneecaps for a few seconds. Then I leant across to his ear. "You'd better bring us the Sony" I breathed.

"Thank you Mr Buttock, I'll get my wife to drop it in" he said as he made off.

A while later Mrs McCorquadales appeared with the Sony set, a KVM2151U (BE2A chassis). I turned my ear towards her as she breathed in to speak, then wished I hadn't.

"I've brought the Sony" she blared with a voice like a foghorn.

"Give us a ring dear, would you?"

We plugged it in and sure enough it began to flash right away, with the colour dropping out in unison. What's more, it produced similar troubles with every other working set in the place.

Stephen knew all about this one. The cause is dry-joints at the line output transistor's heatsink, which should be solidly at chassis potential. The earthing becomes intermittent. He reckons it's become quite a common fault. Resoldering the joints cured the problem – with the set and all the others it was affecting.

Grundig G1000 chassis

I don't like sets that are fitted with the Grundig G1000 chassis. There are a lot of them about, and they seem to bounce quite often. This particular example was a Matsui 14R1. The fault was no sound.

After resoldering dozens of dry-joints in various stages I checked R550, the 4.7 Ω resistor in the 9V supply to the TDA2822M audio output chip IC550. It was open-circuit. A replacement restored the sound.

No Colour

Mrs Wixey is a big, calm woman. We spied her, in her sheepskin coat, sailing along the pavement towards the shop like an ocean liner. She had a Mitsubishi 21in. Model CT2145BM in her arms. When she arrived she plonked it on the counter.

"He's old, dear, but aren't we all?" she breezily announced to me.

I drew myself up to my full height, but she continued to look down at me.

"Colourless" she added.

"Now look here" I began.

"No colour at all on this set" she continued, "and I ain't paying for a colour licence only to watch a black-and-white picture. No way."

Paul had a go at this one, which was refreshingly easy. The chassis is the Euro 6 and the colour decoder is IC252, type TDA3565. It was discoloured and was running hot. A replacement restored the colour.

The New TX90 Chassis

This is the Thomson chassis, not the older Ferguson one with the same designation. We had two of them in that day. The one Mrs Finnegar brought along was a 20in. Ferguson Model C49F which wouldn't tune. This was also a straightforward fault.

A check at pin 4 of the tuner



"You've a good pie shop opposite."

module showed that there was no 33V input. It's derived from the 180V line – the one used for the RGB output stages. The feed to the ZPD33 33V stabiliser DH04 is via RH04 (27k Ω , 0.43W) and RH06 (12k Ω), an arrangement I've always felt to be a bit unsatisfactory. In this case RH04 had gone open-circuit.

Mrs Cheesman's Ferguson C39F was dead. The cause of the trouble was RP23 (0.22 Ω , 0.5W safety) on the secondary side of the chopper transformer. It was open-circuit, the result being no line oscillator start-up voltage.

A Philips GR1-AX

It was getting on and we were clearing up after a busy day when Dr Pascall phoned about his Philips 14GR1227/05B.

"What's up with the Doctor's set?" I asked Stephen.

"Line output transformer" he replied.

"Your set needs a heart transplant" I told the doctor, "forty pounds or so altogether."

The symptoms were sound and EHT but no picture, because the tube's first anode voltage was missing. It's becoming quite a common fault with these sets. We tend to fit an HR Diemen manufactured transformer that we obtain from Grandata under part no. LOT90.



We welcome letters from our readers and try to publish as many as we can. You can send them typed, handwritten, or on disc. Address them to the Letters Editor, Room L302, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Digital Quality

I read with interest the letters (March) regarding poor digital TV picture quality. While I agree with the comments made, I feel that there is more to be said.

An increasing number of programmes are being recorded digitally, particularly by the BBC, and some older programmes, notably *Last of the Summer Wine* and *Red Dwarf*, are being repeated in 'digitally-remastered' form.

A number of irritating anomalies are seen with these digitally-processed programmes when viewed using normal PAL equipment. Poor lip-sync between sound and vision for example. The cause of this may be the way in which MPEG compression processes moving images in order to reduce the transmitted data rate. I've noticed that facial expressions and eye-blinks are often 'slurred' by varying amounts that could depend on the amount of data compression used. It would be interesting to know whether deaf viewers find it more difficult to lip-read with such pictures.

Other anomalies are judder with fast-moving objects, 'cogging' with difficult images such as the edges of bright metal objects, particularly chromium plating, and a peculiar 'cardboard cutout' effect around people standing in front of a background. The latter effect varies as the camera pans sideways.

Like E.C. Westcott, I've noticed that with digital TV the definition

Letters

is often compromised and that peak white often looks crushed, particularly with outdoor scenes that include a lot of sky.

Overall I find that, in comparison with analogue TV, these anomalies make digital images fatiguing to watch. Considerable improvement will be required to bring digital picture quality up to the standard achieved with current analogue technology. I will certainly be sticking with my analogue TV sets for the foreseeable future!

*Simon Pearson,
Chipping Norton, Oxon.*

Salora M Chassis Problem

"Some you win and some you lose" they say. This one I lost big time! The set was an Hitachi Model C25P759, which is fitted with the Salora M chassis. If ever there was a job to shatter your confidence and belief in your abilities, this was it.

It started off as a routine "dead, no functions" job. I followed the guide provided by Chris Watton in his excellent article on this chassis in the August 1997 issue, and soon discovered that the line output transistor was leaky base-to-collector. I was now quite enjoying myself. After fitting a new transistor I switched on, and felt good as I heard the rustle of EHT and watched the tube's heaters start to glow. Life isn't so bad really, I thought. I should have known better of course. As soon as the picture appeared I became totally depressed and stared viciously at the screen, demanding that the east-west bowing go away. It didn't.

The BS208 EW driver FET TB526 had split in half. Though it's very expensive at about £10 (including VAT, post etc.) I didn't have a choice – the set couldn't be returned with a picture like this. I ordered a replacement and fitted it. There was no difference, and the new transistor was getting very hot. In fact it split in half before I had a chance to switch off.

My next step was to check the

estimate I'd given. Two more transistors and there'd be a loss. Just in case, I upped the estimate by £20. This was very reluctantly accepted, so I knew there would be no more funds available for the job. I ordered two more transistors and, feeling rather lonely, had a long conversation with a very helpful, or at least sympathetic, man at the supplier (Chas Hyde). He explained that the transistor was expensive because it had to be specially approved by Hitachi and was costly to buy at source. Normally however it was all that was required to fix the problem. He even phoned Hitachi Technical, then phoned back to confirm this. I was very impressed, but reluctant to possibly destroy two more transistors at a cost of a further £20.

Guided by Chris Watton's article, I checked everything to do with the EW circuitry. I replaced three transistors and, once again, the BS208. Capacitors and resistors were replaced, though I could find nothing wrong with the originals. Ever hopeful, I switched on. There was a perfect picture, and a warm glow spread over my body as I started to write out the invoice. Bet it was a dry-joint I thought.

I confidently turned and glanced at the picture. The warm glow turned to desperation. The raster sides flickered in, out, then finally in again, coming to rest in the original EW bowed state – with a blown BS208. One to go!

The only component that hadn't been replaced was the pincushion modulation transformer. I removed it for closer examination, but there were no signs of stress. Still, what else could I do? It had become a do-or-die situation. The cost of the special-order coil is £22. This, with the remaining BS208, would turn the job into a loss – taking labour into account, it had long since become one. But if I was correct and the transformer was the culprit, at least I might earn something and learn a bit for next time.

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VIDEO SERVICE KITS

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Name	Models	Code	Price	Name	Models	Code	Price	Name	Models	Code	Price
AKAI	VS35, VS53, VS55,			FERGUSON	FV31R	CH19	4300p	TELEFUNKEN	VCA103, 103GV, 106, 106GVM,		
	VS56, VS75	CH18	3200p		HRD515, 520, 527, 540, 550, 580,				254GVM	CH23	2500p
GRANADA	VHSDP1	CH05	1100p	600, 610, 620, 660, 670, HRD830,			VCS211, 244, 5055, 605, VCB230,				
	VHSVJ2	CH01	2800p	840, 850, 860, 4050, 6600, FV37H	CH20	2200p	VCD806G, 810G, VCT212, 310,				
GOLOSTAR	GHV1290P, 1291P, 1295P, 3400,			HRD540, 580, 830, 860, 910, 960,			410G, 610	CH24	2500p		
	73401, GSE1295P, GSE1891P,			HRD970, HRD920,			VR2970	CH02	2800p		
	200010, 200510, VCP4200, 4300,			FV57H	CH27	2400p	V320, 321, 323, 326, 4200, 4300	CH01	2800p		
	4301, 4305, VCP4306, 4311, 4315,	CH25	2000p	VR3605, VR3905	CH01	2800p	V342, 343, 352, 353, 360, 364, 368,				
4316, 4320, 4321, 4325			VR3916, 3926, 3946, 3948, 3976,	CH02	2800p	4210, 4230, 4260, 4400, V5500,					
GHV51, 1221, 1232, 1240, 1241,			3986, 3995, 3997, 6948			6000, 8540	CH02	2800p			
1242, 1244, 1246, 1248, GHV8300,	CH26	2900p	VR3916, 3926, 3946, 3948, 3976,	CH02	2800p	V55, V57	CH01	2800p			
8200			3986, 3995, 3997, 6948			V65, V66	CH02	2800p			
FERGUSON & J.V.C.	3V38, 3V39, 8943, 8944, 8951,			NATIONAL PANASONIC	NV730	CH06	4300p	☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆ AMSTRAD MOD KIT ☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆ FITS : VCR 4500, 4600, 4700, 5200, TVR 1,2,3 PRICE : £2.25 + VAT each ☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆			
	3V35, 3V36, 3V49, HRD 110, 111,	CH01	2800p	N.E.C.	N830EG, N831EG, N831EG, N832, N833EG, N895	CH01	2800p				
	120, 121, 225			PHILIPS	CASSETTE LIFT ASSEMBLY (69120366)						
	3V42, 3V43, 3V44, 3V45, 3V48,			DV186, 190, 286, 471, 562, 761,							
3V53, 3V54, 3V55, 3V57, 8945,			VR6180, 6182, 6185, 6285, VR6290,								
8947, 8948, HRD 140,			6291, 6293, 6362, 6367, 6393, 6467,								
141, 150, 157, 158, 160, 250,			6468, 6470, VR6561, 6670, 6760,								
HRD257, 455, 565, 566, 725, 755	CH02	2800p	6761, 6870, 6970	CH05	1100p						
8948, 8950, FV10B, 12L, 13H, 14T,			VR6443	CH22	2900p						
20B, 21R, 22L, 26, 39S, HRD230,			VR6448	CH23	2500p						
430, 530	CH03	2800p	49S86	CH24	2500p						
3V58, 3V59, 3V64, 3V65, FV11R,			VCA100, VCH851, VCH852	CH22	2900p						
8950, 8951, HRD170, HRD180,	CH04	2800p									
HRD370											

TELEVISION

TV/VCR SPARES GUIDE 1999

The following list gives spares department addresses and telephone numbers or, where these are the same, service department or head office addresses and telephone numbers. Also included are details of various spares distributors. Stocks of spares may no longer be available for defunct brands.

Aiwa UK Ltd., P.O. Box 443, West Drayton, Middx UB7 0NZ.
0181 899 5520
Fax 0181 899 0055/0181 564 9067
See also CPC and Willow Vale.

Akai UK Ltd., Haslemere Heathrow Estate, 12 Silver Jubilee Way, Parkway, Hounslow, Middx TW4 6NQ.
0181 897 6388
Fax 0181 759 6118 (Service)
See also CPC, Wizard, Willow Vale and Chas Hyde.

Akura Spares available from CPC.

Alba Radio Ltd., 12 Thames Road, Barking, Essex IG11 0HZ. Spares for Alba, Bush, Roadstar. Some Goodmans and Hinari models and some Brother microwave and Dirt Devil.
0181 787 3000

Fax 0181 787 3110
See also Willow Vale, CPC, Wizard.

Ambassador Brand name used by Sentra Electronics.

Amstrad Spares handled by CPC Ltd. See also Chas Hyde & Son Ltd., Willow Vale and Wizard.

Autovox See Comet Group plc.

Beko (UK) Ltd., 40 Caxton Way, Watford Business Park, Watford, Herts WD1 8QZ.
01923 818 121
Fax 01923 819 652/3.

Beovision/Beocord Bang and Olufsen UK Ltd., Unit 630, Wharfedale Road, Winnersh, Wokingham, Berks RG41 5TP.
0118 969 2288
Fax 0118 969 3388
See also CPC.

Binatone Electronics plc., Unit 1, Ponders End Industrial Estate, East Duck, Lees Lane, Enfield EN3 7SP.
0181 344 8888
Fax 0181 344 8877.
Trade only.

Blair's Electrical Services, 13 Belgrave Road, Dresden, Stoke-on-Trent ST3 4PR.
Spares for Saba, Thomson, Telefunken and NordMende.
01782 599 377
Fax 01782 599 378.

Blaupunkt Merrivale Television Services, 1 Lockside, Tatbank Road, Oldbury, Warley, W. Midlands B69 4NS.
0121 544 6250
Fax 0121 552 1503.

BPL Spares for these TV sets

available from Falmouth Hi Fi, 14 Market Strand, Falmouth, Cornwall TR11 3DE.
Spares also available for Crown, Dansai, Datsurai, Kuro and Zenor
01326 313 412
Fax 01326 211 210.

Bush See Alba Radio Ltd. Also HRS and Willow Vale.

Cambridge Spares available from SEME.

Canon UK Ltd., Photo Division, Brent Trading Centre, North Circular Road, Neasdon, London NW10 0JF.
0181 459 1266
Fax 0181 459 4202.
See also CPC.

Cathay Spares available from Diamond Television.

Comet Group plc., After Sales H.Q., Unit 5, City Park Ind. Estate, Gelderd Road, Leeds LS12 6DR.
01132 310 523
Fax 01132 311 463.

CPC Ltd., Component House, Faraday Drive, Fulwood, Preston, Lancs PR2 4PP.
01772-654 455
Fax 01772-654 466.

Authorised spares distributor for Akura, Ferguson, Fidelity, Goodmans, Grundig, Hinari, Ingersoll, LG Goldstar, Logik, Matsui, Orion, Osumo, Pace, Phillips, Pye, Saisho, Samsung, Sony, Thompson, Toshiba and Triumph.

Compatible spares available for Akai, Baird, Bang and Olufsen, Beko, Blaupunkt, Brandt, BT, Cambridge, Canon, Casio, Crown, Daewoo, Decca, Dual, Finlux, Fisher, Fujitsu, Funai, GEC Granada, Hantrex, Hitachi, ITT, JVC, Kenwood,

Loewe, Luxor, Marantz, Maspro, Memorex, Mitsubishi, NEC, Nikkai, Nokia, Normende, Panasonic, Pioneer, Proline, Questar, Rediffusion, Roadstar, Saba, Salora, Sansui, Sanyo, Schneider, Sentra, Sharp, Shintom, Siemens, Skantic, Solavox, Tashiko, Tatung TEC, Telefunken, Tensai, and Thorn.

Crown Corporation Spares available from Key Electronics. See also CPC, HRS. Made in India models see BPL.

Daewoo Electronic Sales UK Ltd., Daewoo Building, 640 Wharfedale Road, Winnersh Triangle, Wokingham, Berks RG41 5TP.
0118 925 2500
Fax 0118 925 2532
Note: Daewoo brand products only, not OEM products. For the latter, refer to the original distributor. Account holders only. See also CPC and Seme.

Decca See Tatung (UK) Ltd., CPC and Wizard Distributors. Spares for chassis up to and including the 110/115 series available from D&S Electronic Services, Building 15, Unit 4, Stanmore Industrial Estate, Bridgnorth, Salop WV15 5HR.
01746 766 641
Fax 01746 766 641.

Denon Spares available from Hayden Laboratories Ltd., Hayden House, Chiltern Hill, Chalfont St Peter, Gerrards Cross, Bucks SL9 9UG.
01753 888 447
Fax 01753 880 109.

Diamond Television 15/15a Rodbourne Road, Rodbourne, Swindon, SN2 2AG. Spares for Cathay and Venturer products. Murphy TVs with model numbers starting CTV, the Murphy VCR7101, Sansui SV77 VCR and



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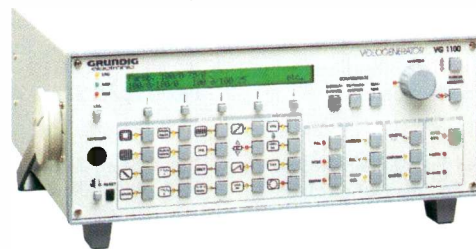
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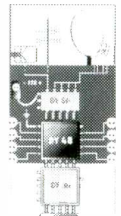


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01793 497 591
Fax 01793 431 687.

Dynatron.— Pre 1981 sets, see Philips Service, post -1981 sets spares from SEME.

Elftone Electronics Ltd., 4 Beresford Avenue, Wembley, Middx HA0 1YZ
0181 902 6222
Fax 0181 903 5011.

Etron Brand name used by Nikkai Imports Ltd.

Eurosaf Distribution Ltd., 1, Oxgate Centre, Oxgate Lane, London NW2 7JA.
0181 452 6699
Fax 0181 452 6777.

Expert. Sets use Tatung, GEC, or Luxor chassis.

Ferguson Spares available from Thomson Multimedia Sales UK Ltd., Sales Dept, Crown Rd, Enfield, Middx EN1 1DZ.
0181 344 4411/2
Fax 0181 344 4452.
See also CPC, HRS, Chas Hyde, SEME, Willow Vale and Wizard.

Fidelity Spares available from SEME, HRS, CPC, Wizard and Willow Vale.

Finlux Spares available from Genserve Ltd. and CPC.

Finlandia Spares available from Granada Rental Services.

Fisher Spares available from Sanyo UK Sales Ltd., Sanyo House, Otterspool Way, Watford, Herts. WD2 8JX.
01923 222 244
Fax 01923 818 251.
See also Chas Hyde.

Fujitsu General Ground Floor, Elstree House, Elstree Way, Boreham Wood, Herts, WD6 1LS.
0181 421 7000
Fax 0181 421 7029

GEC Spares available from CPC, HRS, SEME and Willow Vale.
General See Fujitsu General

Genserve (GTS) Ltd., Bridgemoor Close, Westmead Industrial Estate, Westmead, Swindon, Wilts SN5 7TS.
01793 556 002
Fax 01793 556 015.

GoldStar See LG Electronics UK Ltd.

Goodmans. See Alba Radio Ltd. or Comet Group plc. depending on model. Also CPC.

Granada Rental Services Unit 37, Roman Way Ind. Estate, Longridge Road, Ribbleson, Preston, Lancs PR2 5BD.
01772 470 480/1/2
Fax 01772 265 4551
Spares for Decca, Finlandia, Granada, Matsui, Rediffusion, Sanyo, Tashiko and Tatung.
Trade only.

Granada Spares available from Granada Rental Services.

Grundig Spares available from GCAS, Unit 35, Woodside Park, Wood Street, Rugby CV21 2NP.
01788 570 088
Fax 01788 577 227
Account holders only supplied. See also Willow Vale. Spares for VCR4000 and SVR4004 ranges available only from Willow Vale.

Harwood Spares available from Key Electronics.

Hinari Spares available from CPC, Chas Hyde and SEME.

Hira The Hira Co., Ltd., Hira House, 1 Elizabeth Street, Manchester M8 8JJ.
01618 347 432
Fax 01618 324 566.

Hitachi Sales (UK) Ltd., Hitachi House, Station Road, Hayes, Middx UB3 4DR.
0181 569 2570
Fax 0181 569 1441.
See also Chas Hyde and Willow Vale.

HMV Sets use Ferguson or Fidelity chassis.

HRS Electronics Ltd., Electron House, 100 Great Barr Street, Birmingham, B9 4BB.
0121 766 6668
Freefax orderline 0800 212 179
Tuedata orderline 0121 766 7247
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01759-303 068
Fax 01759-303 620.
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ITT Spares available from Genserve Ltd. See also CPC and Wizard.

JVC (UK) Ltd., JVC House, JVC Business Park, Priestley Way, Staples Corner, London NW2 7BA.
0181 450 3282
0181 452 5415
Account holders only.
Fax 0181452 2534.
See also CPC, Chas Hyde and Willow Vale.

Kenwood Electronics UK Ltd., Kenwood House, Dwight Road, Watford, Herts WD1 8EB.
01923 816 444
Fax 01923 819 131
See also CPC.

Key Electronics Unit 5, Brow Mills Industrial Estate, Brighouse Road, Hipperholme, Halifax HX3 8EF.
01422 203 676
Fax 01422 203 674.
Spares for Crown Corporation, Harwood, Kyosho and Ssangyong products.

Konika Plane Tree Crescent, Feltham, Middx TW13 7HD.
0181 751 6121
Fax 0181 755 0681.

Korting Some spares available from Telefaults, St Michael's Road, Pitts Hill, Turnstall, Stoke-on-Trent ST6 6LG. Spares for other brands also available.
01782 813 757

Fax 01782 835 762.

Kuro Made in India models see BPL.

Kyosho Spares available from Key Electronics.

LG Electronics UK Ltd., LG House, 264 Bath Road, Slough, Berks SL1 4DT.
01753 500 400
Fax 01753 517 445.
See also CPC and Willow Vale.

Loytron Electronics Ltd., Service Dept., Laltex House, Matthews Street, Ardwick, Manchester M12 5DT.
0161 272 8833
Fax 0161 272 8844.

Logik Brand name used by Dixons. Spares available from Mastercare, CPC, HRS.

Loewe-Opta Spares available from Wizard.

Longreach Marketing Ltd., Riverside Business Park, Lower Bristol Road, Bath, Avon BA2 3DW.
01225 444 894
Fax 01225 448 676.
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Luxor Spares available from Genserve Ltd., CPC and Willow Vale.

Manhattan Eurosaf Distribution Ltd., Oxgate Lane, London NW2 7JA.
0181 452 6699
Fax 0181 452 6777.

Maplin Electronics (NEI Spares Division) Unit 11, Valley Court, Station Road, Wombwell, Barnsley, S.Yorkshire. S73 OBS.
0113 277 4310
Fax 0113 277 4312

Marantz Hi Fi UK Ltd., Kingsbridge House, Padbury Oaks, 575/583 Bath Road, Longford, Middx UB7 0EH.
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US8519 (2), US8535 (82), US8578 (182).....

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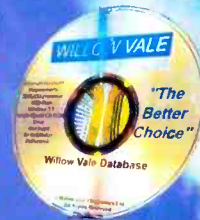
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Spares for Dixons/Currys ranges – Matsui, Link, Logik, Prinz, Saisho, Sanyo.

Matsui Brand name used by Currys and Dixons. Spares available from Mastercare. Also CPC, Chas Hyde, SEME and Wizard.

Metz No UK source of spares. Manufacturers address: Metz Werke GmbH 2 Co., D8510, Furth, Germany.

Mitsubishi Electric Europe B.V. Travellers Lane, Hatfield, Herts AL10 8XB.
01707 276 100
Fax 01707 278 859.
See also CPC, Willow Vale and Wizard.

Morphy Richards Spares available from R and M Technical Services.

Murphy Spares available from Diamond Television for TV sets beginning with CTV and VCR 7101. Some sets fitted with Fidelity chassis. Older sets fitted with Rediffusion chassis. Earlier sets fitted with Rank chassis.

National, National Panasonic
See Panasonic.

NCS See Genserve (GTS) Ltd.

NEC Spares available from SEME and CPC.

NEI, See Maplin.

Nikkai See Maplin. Also CPC, HRS, SEME, Willow Vale and Wizard.

Nokia Spares available from Genserve Ltd. and Willow Vale.

NordMende Spares available from Thomson Multimedia and Blairs Electrical Services.

Onwa Electronics Simonside East Industrial Park, Newcastle Road, South Shields, Tyne and Wear NE34 9AA.
01914 271 888
Fax 01914 276 888.

Orion See CPC.

Osaki Brand name used by Rumbelows. Spares for models VCR31/32/33, also mechanical parts for VCR35 available from Diamond Television.

Osume See CPC.

Pace Micro Technology plc, Victoria Road, Saltaire, Shipley, West Yorkshire, BD18 3LF.
01274 532 000
Fax 01274 537 128.
Spares also available from Eurosat, HRS, CPC and Willow Vale.

Panasonic (UK) Ltd., Panasonic House, Willoughby Road, Bracknell, Berks RG12 8FP.
01344 860 133
Fax 01344 861 598.
Account holders only.
Non-dealer orders handled by SEME Ltd., School Lane, Buckingham, Bucks. MK18 1HD.
01280 823 523
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Prinz Brand name used by Dixons. See Mastercare.

Proline Brand name used by Comet Group plc.

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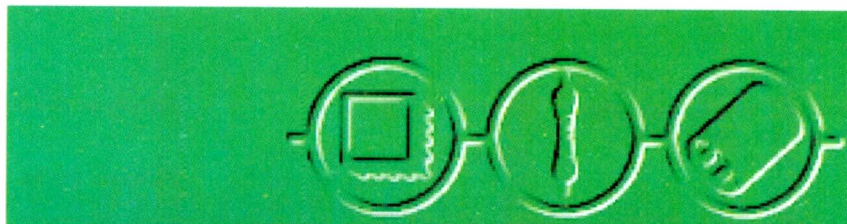
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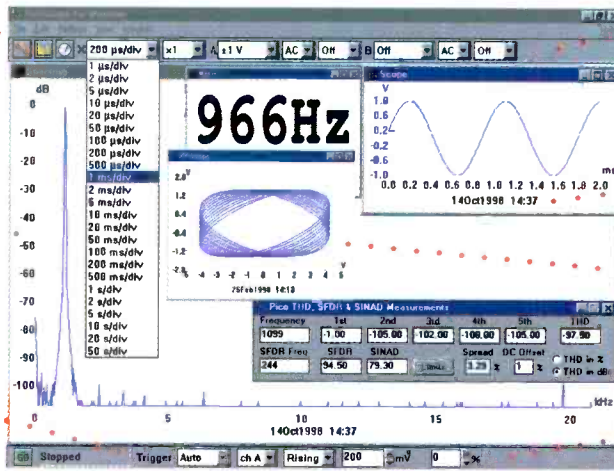
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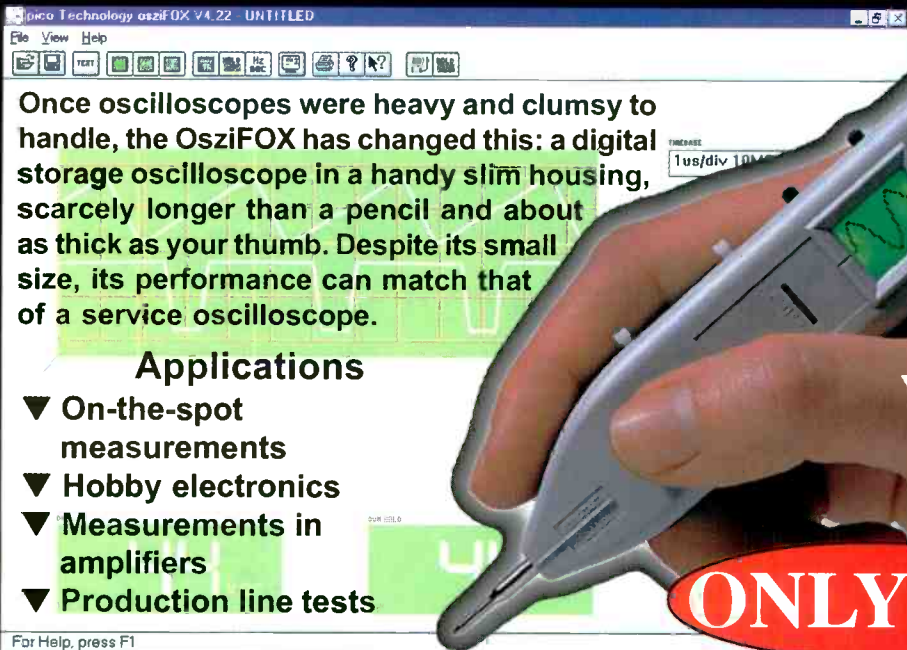
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0.63A	FUSE65	30p
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1A	FUSE67	30p
1.25A	FUSE68	30p
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680 pF	2000v	CAP04	95p	2200 pF	2000v	CAP11	130p
820 pF	3000v	CAP05	150p	3300 pF	2000v	CAP12	145p
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100 µF	6.3v	CAP16	130p	2.2 µF	50v	CAP24	110p
10 µF	16v	CAP17	110p	4.7 µF	50v	CAP25	110p
22 µF	16v	CAP18	110p	10 µF	50v	CAP26	130p
47 µF	16v	CAP19	130p	22 µF	50v	CAP27	180p
470 µF	16v	CAP20	320p	47 µF	50v	CAP28	300p
33 µF	25v	CAP21	130p				

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- * DC CURRENT A: 2mA/20mA/200mA/20A
- * AC CURRENT A: 200mA/20A
- * RESISTANCE Ω: 200Ω/2kΩ/200kΩ/2MΩ/20MΩ/200MΩ
- * CAPACITANCE: 2nF/20nF/200nF/2*F/20*F

**ORDER CODE: CM3920
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continued from page 404

So, with renewed confidence, I ordered the transformer.

When it arrived I soon had it installed, along with the final BS208. I drew a deep breath and switched on. There was a picture with correct geometry, and the BS208 was running cool. I could hardly believe it. Then, just as before, the sides caved in and the transistor blew out a small puff of smoke and died.

Without further ado I switched off, rolled the mains lead up and refitted the back cover. Then I phoned the owner, told him it had beaten me, and asked him to come and take it away. As I sat on my stool, I wondered whether my days as a TV engineer were numbered. I was brought back to reality by the phone. This time it was a nice, simple job. With luck it might pay for some of the Hitachi set's components – and perhaps renew my confidence for a while.

Is there anyone out there who has the faintest idea about what might have been the cause of the Hitachi set's EW fault? I'd dearly love to know.

John Edwards,
Welling, Kent.

Security System

In a letter in the November issue Laurie Watkinson suggested using an old piano-key VCR for recording purposes with a security system. This thought had also crossed my mind, but such videos have become something of a collectors' item of late.

Instead, I decided to modify a relative youngster, a Matsui VX820, using the simple circuit shown in Fig. 1. It should work with most single record button machines. My first step was to black out the PIR photocell and fit it with a 240V AC activated DP relay, RLY1 in Fig. 1. RLY2 is a miniature 12V DC relay. The timer circuit was set to minimum, which in this case is four seconds. A single 556 timer chip could be used instead of the two 555s.

Phil Barry,
Bedale, N. Yorkshire.

Stepper Motors

I was interested to read about Quintin Blane's problem with a stepper motor and his success in dealing with it (February, page 244). It seems to me to have been a torque problem. My experience is that while such motors (known colloquially as Fuji motors) can develop considerable torque when 'plod-

ding', the torque in the 'sprint' mode is much less. This is because the current in the windings reaches its V/R value in the plod mode but never does in the sprint mode, because of the inductance of the windings.

I learnt about this many years ago while working on numerically-controlled crankshaft grinders in the Midlands. These machines are awesome. The wheelhead (spindle) is about a foot thick, and typically carries five grinding wheels (about three feet in diameter) so that all five journals can be ground at once. The wheelhead is driven by a 30 h.p. variable-speed drive.

In operation a robot arm loads the crankshaft into the machine. As the crankshaft is rotated, the wheelhead is hurtled towards it by hydraulic rams but is arrested by a stop. At this point the Fuji motor takes control, giving first a coarse feed, then a medium feed and finally a fine feed. The wheels then retract, and the robot unloads the crank. After twenty cycles the grinding wheels are trued with water-cooled diamond picks, and the NC feed memory is incremented by the same dimension that the picks took off the grinding wheels, typically two thousandths of an inch.

A strange fault developed with one particular machine. The first few cranks after a wheel dress would be oversize. Once four or five cranks had been done the machine would somehow correct itself. As a result it produced about fifteen good cranks out of twenty. The electronics section was called in first. Boards were changed, then the entire NC cabinet and the Fuji motor, all to no avail. The works fitters were, let's say, unhelpful, and there could have been a strike had the electronics section tried to carry out a mechanical investigation. So the makers of the machine were called in.

The manufacturer's engineer was also baffled. He eventually removed a cover and applied a huge torque wrench to the lead screw. Being unable to turn it, he

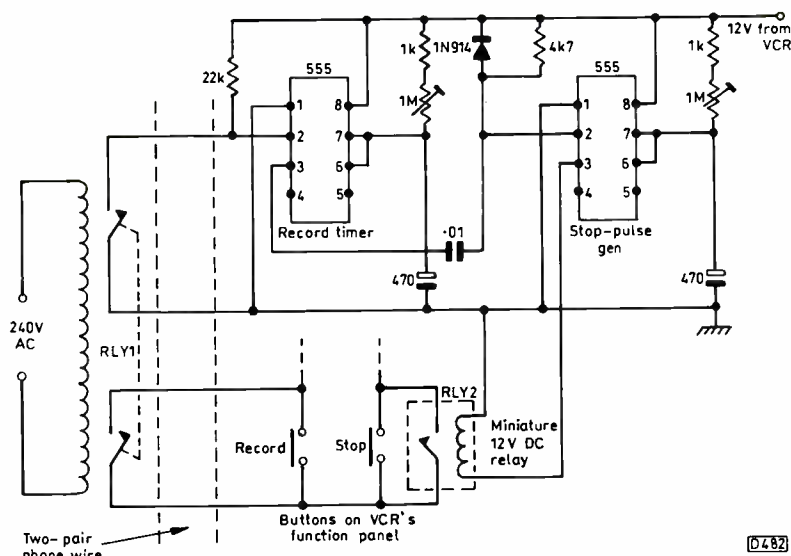


Fig. 1: Record start/timer/stop circuit for security-system use with a single record button VCR.

declared the screw bent. But this wasn't the case either. In the end the repair tools required consisted of a wheelbarrow, shovel, crowbar, large hammer, grease gun and oil-can. These were used to remove thick slabs of 'concrete', made of rusted iron dust, that had accumulated under the machine slides.

Apparently when the Fuji motor was sprinting (catching up after a wheel dress) it was unable to compress the rust. When plodding on its fine feed it could make some headway.

I might add that such errors are caught by automatic gauging. This may be a closed-loop system or, alternatively, 'after gauging' can be used. Zero defects can be achieved by using both systems.

One last point about stepper drives: watch out for multi-voltage supplies that are sometimes used to get more torque in the sprint mode.
D. Benyon,
Bude, Cornwall.

Corrections

A further correction to the Pace PRD series modification article in the February issue (pages 238/9). The added 1kΩ resistor should be connected between the cathode of the added 1N4148 diode and pin 15 of U3.

Two resistors should be deleted in Fig. 9, page 256 of the February issue (Low-power Standby Operation). There is no feedback resistor between the output of the second op-amp and its non-inverting input, and there is no link between the output of the second op-amp and the bias applied to pin 2 of the UC3842/4 series IC.

Servicing the

Hitachi 46TN Series

John Coombes provides a fault-finding guide for these sets, which first appeared in 1995

The Hitachi 46TN series includes Models C2146TN, C2546TN and C2846TN. There are one or two differences between the 21in. model and the 25 and 28in. ones. In particular the HT is higher in the large-screen models, which also incorporate an EW modulator circuit. The two versions use a different line output transistor and have different chopper and line output transformers.

Power Supply Circuit

The chassis uses a discrete-component chopper power-supply circuit, see Fig. 1, which also shows the excess-current trip arrangement. This is based on thyristor Q704, which is fired in the event of a short-circuit/excess current condition, switching the receiver to standby. Q704 is fired by Q955 in the event of a heavy load on one of the LT rails, by Q4452 in the audio circuit in the event of excess current demand here, or by Q703 should the line output stage be drawing excess current. Q703 monitors the voltage across R705 in the feed to the line output transformer. In addition Q704 will be fired if there is an over-voltage condition in the line output stage: ZD701 monitors the 200V supply that's used by the RGB output stages and the tuning circuit.

Q903 is the chopper transistor, which receives a start-up supply at its base via R901 and R902. The circuit is a self-oscillating arrangement, with feedback from the transformer to the base of Q903 via R903/C911/D906/L903. For regulation purposes, Q902/Q901 set the DC conditions at the base of Q903. The base of Q902 is controlled by the optocoupler IC901, whose LED section is driven by Q954. This transistor monitors the HT voltage via the potential divider network connected to its base. VR950 sets the HT, which is 110V for 21in. sets and 152V for larger-screen sets. Zener diode D951 conducts in the event of excessive HT voltage because of incorrect regulation. Standby switching in the power supply is carried out by transistors Q952 and Q953.

No Results

No results with the mains fuse F901 blown should lead to a check on the mains bridge rectifier diodes D901-4 and the chopper transistor Q903 for shorts. If Q903 has gone short-circuit, check the power supply outputs after fitting a replacement to ensure that there are no overloads. It is advisable to replace the optocoupler IC901 and ZD951 when Q903 has failed. If diodes D907 and D908 have gone short-circuit as well as Q903, Q901 and Q902 should also be replaced.

No results with the mains fuse intact could mean that the start-up feed is missing. Check resistors R901 and R902 in this event. One or the other could be open-circuit or high in value.

No results with ZD951 short-circuit indicates that an excess voltage condition has occurred. The cause could be R950 going high in value or IC901 faulty – check the latter by replacement. If there is no regulation, check Q901 and Q902 which could be open- or short-circuit.

The cause of failure of the power supply to work normally could be a line output stage fault (see later), an overload on one of the LT rails, a trip circuit fault or no on command from the microcontroller chip IC001. If the power supply is pulsing, check for shorts at the cathodes of the rectifier diodes on the secondary side of the circuit, D950, D951 and D952. A line output stage fault will produce this symptom.

The protection system may be in operation because of a fault in the trip circuit. Q703, Q955, Q704 or Q4452 (BC556B) in the audio circuit could be faulty. Q704 and/or Q955 can be disconnected as a check. Note that when Q704 is on Q952 will be switched off and there will be no 12V, 8V and 5V supplies. The receiver is then in the standby lock-out mode. Once a fault of this type has been cleared, the on/off switch must be operated to remove the lock-up. An IC data bus lock-up is another possibility: ensure that the microcontroller chip IC001 is resetting correctly at pin 19.

If there is intermittent operation or the set cuts out altogether, check for dry-joints at the 8V and 5V regulators

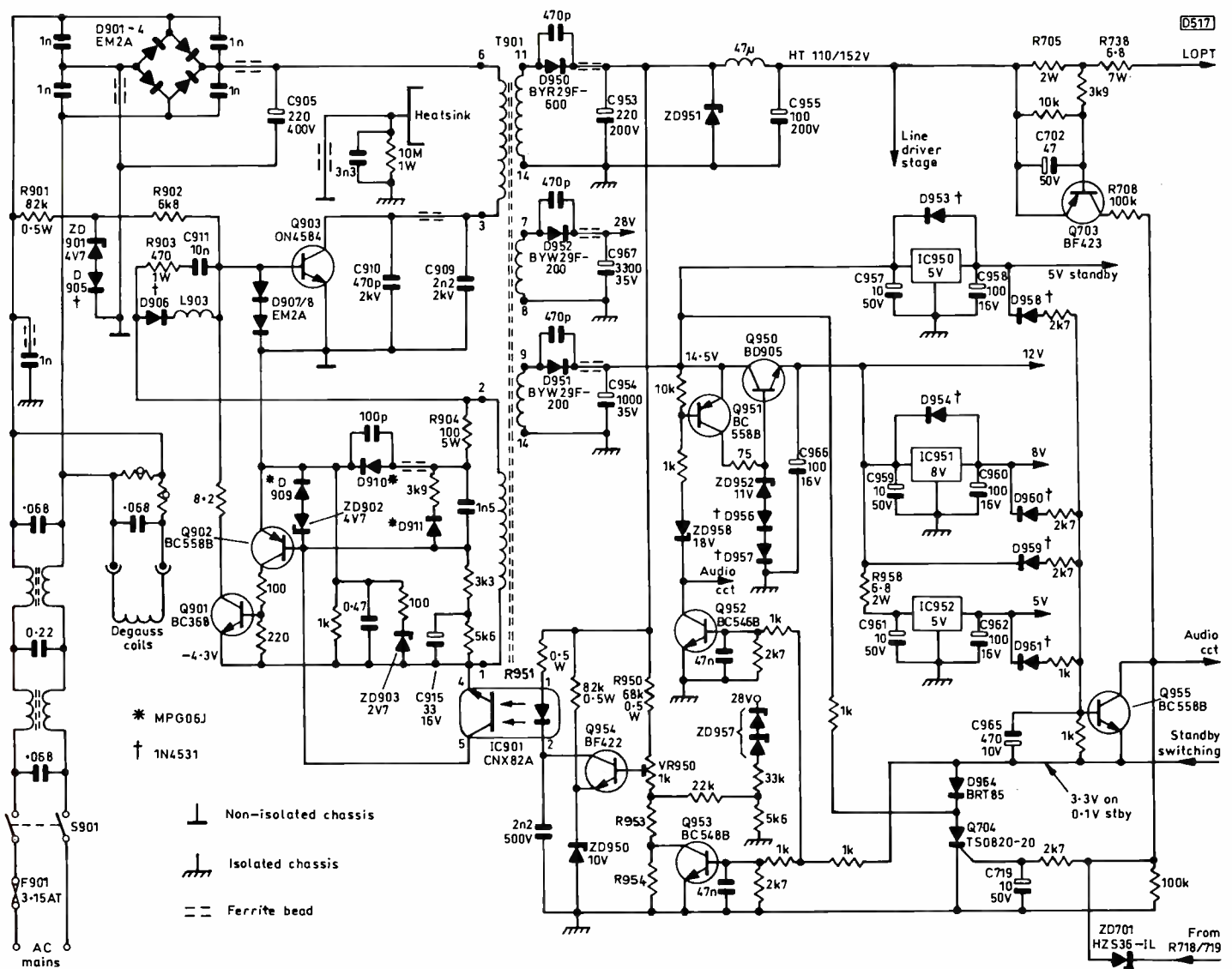


Fig. 1: Circuit diagram of the chopper power supply and the excess-current trip arrangement used in Hitachi 46TN series TV sets. The over-voltage zener diode ZD951 is type PGKE130 in 21in. sets, type PGKE180 in 25 and 28in. models. In the 21in. version ZD957 is two series-connected zener diodes rated at 16V and 6.2V: in larger screen sets a single 22V zener diode is used. In 21in. sets R705 is 1 Ω , R951 8.2k Ω , R953 4.7k Ω and R954 1k Ω . The values in larger-screen sets are 0.5 Ω , 12k Ω , 3.3k Ω and 560 Ω respectively.

IC951 and IC952. Resoldering will usually restore normal operation. The set will go into standby if the 8V supply at pin 37 of IC001 drops to 1.25V

Line Timebase Faults

The first thing to check in the line output stage is that HT is present at pin 9 of the transformer. If not, disconnect the feed and connect a 60W bulb across C953. If it lights, the power supply is OK and there's a problem in the line output stage. The line output transistor Q702 could be short-circuit: it's type BU2508DF in the 21in. model and type BU2508AF in the larger-screen models. In larger-screen sets the EW modulator diodes D706 (BY228) and D707 (BYW96D) are suspect. The transformer could have shorted turns.

If there's no line drive, check for about 27V at the collector of the BF458 line driver transistor Q701. Should this supply be missing, check the transformer T702 which could be dry-jointed or open-circuit, and the feed resistor R732 (4.7k Ω , 7W). If there are no drive pulses at the base of Q701, check at pin 37 of the TDA8361-N4 colour decoder/timebase generator chip IC201. No

line pulses here could mean that the chip is faulty, but before replacing it check zener diode ZD733 (9.1V) which could be short-circuit.

If the line oscillator frequency is incorrect or the output stage tuning capacitor has changed value, zener diode ZD701 will conduct or go short-circuit, operating the trip.

If EHT is present but the tube's heaters don't light up, check for dry-joints at pins 2 and 1 or 3 (depends on CRT size) of the LOPT, at L703 and the tube connector.

No raster could mean that the first anode control is not set up correctly. If this control works intermittently, it may be necessary to replace the LOPT (T701).

Width Faults

The following notes apply to the larger-screen models that incorporate an EW diode modulator and drive circuit. If there is excessive width with no geometry control, check whether D707 (BYW96D), C707 (27nF), Q754 (2SC1983) or C754 (6.8 μ F, 25V) is short-circuit, in that order. If there is excessive width with some control, check whether the HT output from the power supply is excessive.

If there is lack of width with no control check C707 (27nF) and L751, then if necessary check whether there is drive at the base of Q754. No base drive could mean that Q754, R712 or R770 (both are 1kΩ) is faulty. Alternatively the width control VR752 (10kΩ) could have a faulty track, or R774 (8.2kΩ) could have gone high in value.

If there is some control but full width cannot be obtained, check VR752, R774 and R757 (47kΩ).

If there is lack of width with the geometry controls operating, check C712 (2.2nF), C706 (8.2nF) and C708 (470pF). These capacitors are all rated at 2kV.

Field Faults

In the event of field collapse, check that the 27V supply is present at pin 6 of the TA8427K field output chip IC601. If it's missing, check whether R710 or D701 (BYD33J) is open-circuit or C716 (2,200µF, 35V) is short-circuit. R710 is 4.7Ω in 21in. sets, 2Ω in larger-screen sets.

If the 27V supply is correct, IC601 and D601 (1N4002) are suspect, but first check whether there is drive at pin 4 of IC601. This comes from pin 43 of the TDA8361-N4 chip IC201. If it's missing, IC601 or IC201 could be faulty, ZD601 (BZX79C12V) could be short-circuit or there could be a fault associated with pins 42 (field ramp) or 41 (field feedback) of IC201. The ramp capacitor C601A (22nF) is suspect – check it by replacement.

For lack of height check VR601 (200Ω) whose track may have deteriorated and R608 (4.7kΩ) whose value

may have changed. For excessive height check whether R609 and/or R610 (both 2.2Ω, 0.5W) is open-circuit.

Poor field linearity should lead to a check on the values of R605, R606 and R607 (150Ω), also C608 which may have become leaky. The values of R605, R606 and C608 vary with CRT size as follows:

	21in.	25/28in.
R605	27kΩ	10kΩ
R606	18kΩ	12kΩ
C608	2.2µF	4.7µF

Colour Faults

If there's no colour, check that the sandcastle pulses are present at pin 38 of the TDA8361-N4 colour decoder/timebase generator chip IC201. Check that the 4.43MHz crystal X501 is working at the correct frequency and is not dry-jointed. IC201 is suspect, but first check the DC conditions at its pins.

Tuner Faults

The tuner unit can be the cause of a number of faults, from a snowy picture with noisy sound to low gain on one channel or tuning drift. It can be replaced, but repair by MCES is cheaper.

Before condemning the tuner, check that its supplies are present. There should be 5V at pin 6, 33V at pin 7 and 12V at pin 8. If the 12V supply is missing, check zener diode ZD101 (BZX79C18V) and C106 (100µF, 16V). If the 5V supply is missing check C101 (100µF, 16V). If the 33V supply is missing check whether R104 (1.8kΩ) or R741 is open-circuit or ZD102 (33V) is short-circuit. The value of R741 is 82kΩ or 120kΩ (0.5W) depending on model.

ZD102 can be the cause of tuning drift when it's leaky.

Audio Faults

The stereo audio output chip is IC4450, type TDA7263. If there's no audio, check that the chip's 28V supply is present at pin 9. Zener diode ZD4451 (BZX79V36) and C4469 (1,000µF, 35V) are suspect if the supply is missing. It comes via muting transistor Q4454 (BD438) and the 1Ω, 2W current sensing resistor R949. IC4450 can fail.

If the output section is OK, check back to the TDA9860 audio processor chip IC402, the SAA7823ZP Nicam chip IC4201 and the TDA9802 sound IF chip IC4051 as necessary.

IC4201 may be in the wrong mode, giving no sound. It's controlled by data from the 24C04 memory chip IC002. If this chip is faulty, the result can be no sound.

If there is no or poor Nicam sound, check the DC conditions at the pins of IC4201, then the chip itself by replacement if necessary.

On-screen Display Fault

C46TN may be displayed on the screen when the set is switched on or after replacement of the TMP47C1637N microcontroller chip IC001. This means that the receiver is in the factory set-up mode. Press the two remote control VCR record buttons at the same time: when the menu appears, go to standby. When the set is switched back on the OSD information will have been removed.

Remote Control Faults

Remote control faults are rare with these receivers. Poor battery connections or dry-joints at the battery contacts are the usual cause. If necessary check for dry-joints at the crystal and LED.

BACK ISSUES

We have available a limited stock of the following back issues of *Television*:

- 1994** January, February, May, June, July, September, October, November and December
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HELP WANTED

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

Wanted: Cabinet for the Finlux Model 5125S/25S21 Mono. Complete non-working set would do. Please phone John S. Cooper on 01634 847 422 with price etc. South East/Kent area only.

Wanted: The following 1kV commutating capacitors for the thyristor line timebase panel in the Rediffusion Model CU/CV5130 (Mk 3 chassis): 5C4 0.1µF; 5C7 0.15µF; 5C10 0.047µF. W.F. Tunncliffe, 67 Margaret Road, Moxley, Wednesbury, W. Midlands WS10 7QT. 0121 556 4171.

Wanted: Mains transformer for the Panasonic Model AG6200 VCR, or a complete machine for spares. Martin Webster, 1 Thorn View, Luddenden, Halifax, W. Yorks HX2 6QX. 0113 292 3825, 01422 883 197 evenings or fax 0113 392 6305.

Wanted: A Philips test tape to program the EEPROM in VCR Model VR231/05 and for alignment. A good copy or loan of the original OK. Believe the Philips' part no. is 4822 397 30103. John Carter, 147 Maidenway Road, Paignton, Devon TQ3 2PT. 01803 556 243.

Wanted: Soundbox upgrade boards for the Quad 33 control unit. Items required are the SB600 disc board and the two SB797 amplifier boards. Also require a chopper/line output transformer (part no. FM0237) for the Hitachi/Salora Model CPT2650 (J chassis). J. M. Ainscoe, 49 Lon Ceredigion, Pwllheli, Gwynedd LL53 5PP. 01758 613 790.

For disposal: 36 back copies of *Television* from March 1978 to February 1981, also 35 copies of *Rediffusion Engineering* 1970 to 1984 and various circuit diagrams/descriptions from 1970 to the Eighties. Please write to R. Kemp, 100 Sherbourne Road, Hove, Sussex BN3 8BG.

Wanted: Desperately require a text board for the Hitachi Model CPT2188. Please phone Micky

Wilcox in Weston-Super-Mare on 01934 643 962.

Wanted: Circuit diagrams for the Trio solid-state stereo amplifier Model KA2000 and the Korting Transmare stereo tuner Model T600 (photocopies OK). H.G. Huang, 59 Tylney Road, Forest Gate, London E7 0LY.

Wanted: Copies of *Television* from January 1986-December 1993. Complete years if possible. Will collect or pay postage. Mark Cliffe, 76 Hallfields Lane, Gunthorpe, Peterborough, Cambs PE4 7YW. 01733 576 493.

Wanted: Three capstan drive wheels (idler) and one pinch roller for the Ferrograph Series 7 Mk 2 tape recorder. B.A. Greensmith, 113 High Street, Old Waltham, N.E. Lincs DN37 0PN. 01472 822 001.

Wanted: Huntron Tracker 1000. Peter Antcliff, 63 Chester Road, Stevenage, Herts SG1 4JY. 01438 225 602.

Wanted: Any information on an RF/AF signal generator believed to be of US origin. Only identification is Superior Model 1130-S. It also has a leakage tester. W. Walsh, 58 Cowal Place, Dunoon, Argyll, Scotland. 01369 707 995.

Wanted: E421 or equivalent dual-FET, also spares for Metex DMMs. Reg Rookes, 261 Rhuvolt, Kinlochbervie, Sutherland IV27 4RH. 01971 521 353.

Wanted: Grundig V2000 system VCR, remote controls, tapes etc. Please phone Steve Hanley on 0114 268 6058 (Sheffield).

For sale: Many manuals for Amstrad, Blaupunkt, Ferguson, Fidelity, GEC, Hinari, Hitachi, JVC, Panasonic, Philips and Sharp VCR and TV models. David Forfar, 65 Ormskirk Road, Old Skelmersdale, Lancs WN8 8TR. Phone 01695 735 132 for availability and to order.

Wanted: Two TDA1420 audio amplifier ICs or info on a source or

equivalent. D. Hunt, 11 Richmond Road, Skeeby, Richmond, North Yorks DL10 5DR. 01748 824 859.

Wanted: Exploded view (photocopy OK) of the clutch mechanisms used in the Akai Model GX4000D or DS reel-to-reel tape deck. Brian Ecclestone, 10 Stone Road, Norton Bridge, Stone, Staffs ST15 0NS. 01785 760 315.

For disposal: Sony TV Model KV27XRTU (SX chassis) with teletext, Nicam board and service manual (photocopy). £80. Avi Later, 42 Dorchester Way, Kenton, Middx HA3 9RF. 0181 204 2123 after 7p.m.

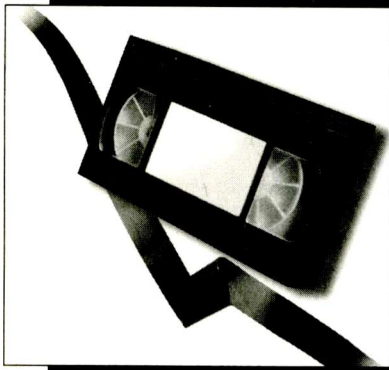
Wanted: Service manual or circuit diagram/information for the Brother BM74L computer monitor. Victor Holbrook, 84 Haddon Street, Derby DE23 6NQ. 01332 768 122.

Wanted: My Sharp VZ3000E 'both-sides play' record deck has finally died. Has anyone a discarded model they are willing to sell, working or for spares, or part no. Sharp IC RH-IX1209AFZZ? Garry Edwards, Highbury College, Portsmouth. 01705 313 287, fax 01705 378 382.

Wanted: Nicam PCB for the Ferguson Model D51ND. Also remote-control handsets for the following VCRs: Hitachi VTM230 (RM252) and VTF860, and the Philips VR502/05. Peter Haida, 259 North Valley Road, Colne, Lancs BB8 9DR. 01282 864 415.

Wanted: Transistor type 2SK244, Sony part no. 8-765-640-10. A. Snow, 45 Knights Way, Tewkesbury, Glos GL20 8DY. 01684 295 189.

Wanted: Second-hand capstan motor for the Hitachi Model VT498EM. Also side panels for a Mk 2 Escort estate from the Eighties: any company but preferably Telefusion or illuminated van signs. Phil Barry, 6 Cowling Road, Burrill, Bedale, North Yorks DL8 1RN. 01677 424 573.



VCR Clinic

Reports from
Pete Gurney, LCGI
Colin J. Guy
Gerald Smith
Ronnie Boag
Adrian Spriddell and
Eugene Trundle

Hitachi VTF350

This machine seemed to have a faulty capstan motor. In the customer's house tapes could just about be played, with a mechanical-sounding screech from the capstan motor, frequent tracking lines and picture break up. When the machine was taken back to the workshop it wouldn't even accept a tape and the motor struggled to move.

Voltage checks around the motor showed that the 5V supply was correct while the 12V capstan supply was at about 11.8V. Then, after about five minutes, the loading problem disappeared and the original fault was present.

At this point I began to suspect the power supply. While the 12V output was correct when checked with a meter, a scope check showed that several volts of AC were present. The cause of the trouble turned out to be C12 (470 μ F, 16V), which was open-circuit. When the other supply lines were checked I found that C16 and C11 had fallen in value. Low-ESR replacements rated at 105°C cured the problem. **P.G.**

Matsui VXA110

This budget-priced machine seemed to have a seized capstan motor. It made more than a few squealing noises at power up. Fortunately the customer hadn't attempted to remove the tape: in view of the low price of these

machines, the damage that this can cause is usually terminal.

Once the tape had been removed, by disconnecting the loading motor and using a battery to power it through eject, access was gained to the deck screws. There are two at the front and one at the rear – don't forget to remove the VCR's metal bottom plate, as this also locates the rear of the deck.

When I lifted the mechanism out I saw that the left-hand clutch assembly had fallen apart and jammed the drive mechanics solid. The clutch consists of a small friction plate, a large spring and a plastic cog that holds the assembly together. The plastic cog had cracked, with the result that the full force of the spring was applied to the split washer that locates the assembly on the spindle. The split washer had eventually given up, then the clutch had disintegrated.

Reassembly with a new clutch and replacement of the washer cured the fault. I've come across this problem several times recently, which suggests that it might be becoming a stock fault. Clutch assemblies are available from CPC under part nos. MA850A200049 (supply) and MA850A200050 (take-up). **P.G.**

De Graff WHSVC1

This old-timer is based on the **Philips C deck**. The complaint was no operation. At switch on the machine powered up, but when an attempt was made to insert a tape the power supply made a few squealing noises then the machine reverted to standby. A new power supply made no difference.

As the supply lines all dropped together, there seemed to be an excess-current problem. So I checked the loading motor's DC

resistance. The reading was much the same as that obtained with a new motor, but a replacement motor cured the fault.

Although the faulty motor's resistance was almost correct, when a 9V supply was connected the current drawn was in excess of 2.5A. **P.G.**

Sanyo VHR2300

The cause of intermittent stopping in playback and record, but not during rewind or fast forward, was eventually traced to dry-joints on the drum motor PCB, particularly around the connector. **C.J.G.**

Hitachi VTF770

This machine's capstan motor was running amok. The cause turned out to be C622 (0.47 μ F). **C.J.G.**

Ferguson FV62LV

Fast forward and rewind were very sluggish, and would eventually come to a stop. Play was OK. The capstan motor had very little torque in fast forward and rewind. The cause of the problem was RP83 (120 Ω), which was cracked. It's under the power supply PCB, in the capstan motor control circuit. **C.J.G.**

Panasonic NVSD200

This machine would stop after a couple of seconds in play or record. The plastic cover on one of the reel sensors had not been properly pushed home. **C.J.G.**

Ferguson FV62LV

There was no UHF output where I expected it, at around ch. 68. I found it drifting around aimlessly in the ch. 36 area. The cause of the trouble was the fact that the synthesiser for the modulator wasn't locking the oscillator. A check on the 33V supply showed that it was

low at about 12V, because of a cracked surface-mounted link in the feed.

As it was tuned to the low channels the tuner had not been affected, but the modulator couldn't make it to ch. 68 on the reduced supply. **C.J.G.**

Marantz MV762

The customer complained that this machine's clock did not keep correct time. I'm always sceptical about this sort of report. But as the station tuning had also disappeared I replaced the nicad battery, set up the tuning, set the clock to the time shown in the bottom corner of my PC monitor's screen, then left the VCR on soak test.

When I checked an hour or so later the clock had lost about three minutes. The station tuning had also disappeared again. The cause of both faults turned out to be dry-joints at the ribbon cables that connect the front panel to the main PCB.

This machine is a **Philips VR6462** clone. **C.J.G.**

Panasonic NVG40

The cause of erratic capstan speed and intermittent stopping was not the usual electrolytics in the power supply but a fault in the capstan motor's stator. Replacement restored normal operation. **C.J.G.**

Sanyo VHR7700

This machine was dead except for the clock display. The cause was the 12V supply switch Q5402. It's located in the blackened bit right in the centre of the main PCB. **C.J.G.**

Hitachi VTF350

The report that came with this machine said that it had a noisy capstan motor. The motor was OK mechanically however. I then noticed that the E-E picture flickered badly whenever the machine was asked to do anything mechanical. This was caused by poor power supply regulation. Everything was OK once C12 (470µF) had been replaced. **C.J.G.**

Daewoo V200

This machine was totally dead. The switch-mode power supply, which is of Sony manufacture, is well sealed in a tin can and is presumably intended to be replaced as a unit. But in view of the low cost of these machines, a new power supply would hardly be justified. So I opened up the can and replaced several sorry-looking electrolytic

capacitors inside it. The machine then worked as well as ever.

C.J.G.

Tatung TVR933

This machine had a record picture fault that showed as lack of luminance and picture tearing. The E-E picture was OK. IC4001 carries out the record picture processing. A replacement chip cured the fault. **G.S.**

Panasonic NVD80

This older machine was dead with no clock display and no functions. When I checked the power supply I found that the primary side wasn't running. Normal operation was restored once C1045 (47µF, 10V) on the power supply sub-PCB had been replaced. **G.S.**

JVC HRDX22EK

This machine was dead with no clock display and no functions. I replaced CP1 (ICPN20) which was open-circuit, but the switched 5V supply was still missing. L959 had gone open-circuit. This item is not shown in the circuit diagram – it supplies CP801 and the 12V switch regulator. Once L959 had been replaced the machine worked normally. **G.S.**

Sharp VCHM64

The fault report said that there was intermittent loss of the hi-fi sound when recording. When I checked the machine I found that this was partially correct: as the right channel was missing in the E-E mode, the recording was faulty. The machine was OK once the Nicam chip had been replaced. **G.S.**

Sanyo VHR286

This machine would power up, go dead (no display) then pulse on and off. The cure was to replace PR512 in the power supply. Its part number is 645-014-2529. **R.B.**

Daewoo DVF522

There was no E-E sound. The BA7790LS chip IC201 had an input at pin 16 but no output at pin 21. A replacement chip cured the fault. **R.B.**

GoldStar GHV1290I

The E-E output had a hum bar and there was patterning in the playback and record modes. The cause of the trouble could be seen as HF interference on all rails. Various electrolytic capacitors in the power supply had fallen in value. Check in particular C118, C112, C108,

C107, C155, C120, C122 (all 47µF), C121 and C123 (both 100µF). I replaced the 12V regulator as a precaution. **A.S.**

Saisho VR1200/Matsui VX800A etc

Check for dry-joints on the luminance sub-modules and/or luminance PCB connectors if there is intermittent or no picture recording. **A.S.**

Ferguson 3V56

If the machine is permanently or intermittently dead with the switch-mode power supply inoperative, apparently in the over-current mode, unplug its output leads and bring up the mains input slowly using a variac. The machine may then work, even with low-value capacitors.

The following voltages should be present at the power supply plug: pin 1 SW5V; pin 2 SW12V; pins 3-6 0V; pin 7 SW5V; pin 8 AT12V; pin 9 AT13.8V; pin 10 power-on 12V (0V in standby). C24, C23 and C35 on the primary side of the power supply dry out and cause no or intermittent power-up or alternatively intermittent shut-down with no current load. Replace with low-ESR 105°C types. **A.S.**

Goodmans TX1200

If the drum is rotating too fast, resolder the 104kΩ chip resistor R525 near the servo IC. **A.S.**

Ferguson 3V56

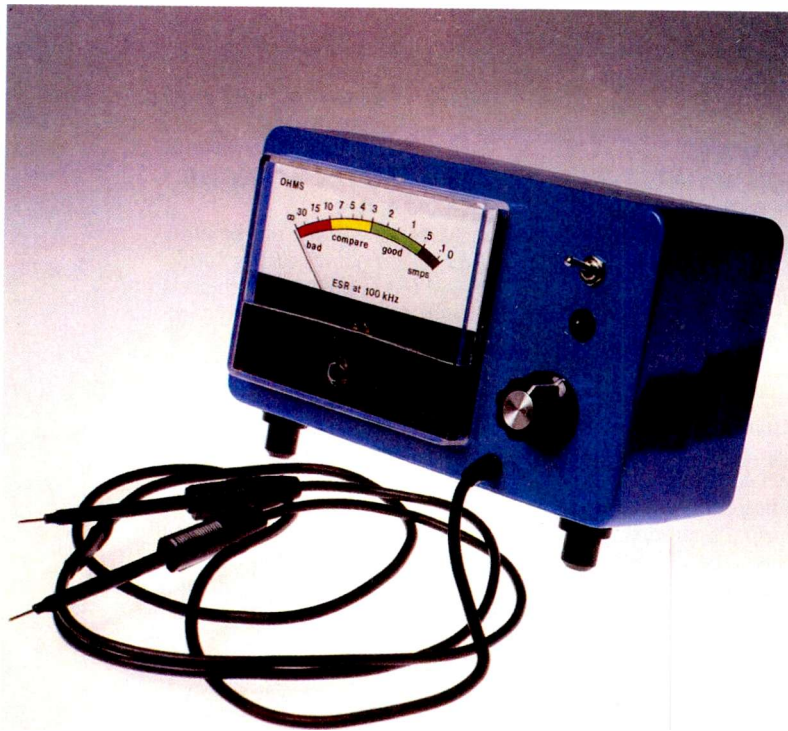
If there's no mechanism control with the micro confused, the drum and capstan running and the loading motor turning even when unloaded, check the 12V supply to the loading cam optos. If it's missing, check protector F10 at the rear centre of the top PCB, by some rework with an inductor across cut print. We've used a 500mA Wickman fuse as a replacement, though this might be frowned upon by Thorn. **A.S.**

Tatung TVR6122

There was no tuning voltage. I found that R5 (100kΩ) in the power supply had gone high in value. **A.S.**

Toshiba V804

We've now had three inoperative machines because the deck mechanism has jammed. In each case the cam lever beneath the main loading cam at the rear right-hand side of the deck had broken. Its part number is 70363446A. **E.T.**



In this second part Alan Willcox deals with construction and setting up of the meter, upgrades and use, and provides additional background information

Design of an ESR Meter

In part 1 last month the design criteria were specified and a full description of the operation of the circuit was provided. The meter is simple to build and the effort required is well worthwhile.

Construction

Fig. 8 shows the board layout. For convenience, 0.1-in. matrix stripboard is used. The most common problem concerns the print cuts. If these are made by twisting a drill bit by hand, as I do, instead of using the correct tool, it's all too easy for the cut to be incomplete or for some of the print to spread over to an adjacent track.

If a double-pole on/off switch is used, this is a convenient point for the connection of an on/off indicator. A flashing LED with a 10k Ω series resistor does the job well: although it takes only a couple of mA, the flashing light does catch your eye.

It is best to use screened cable for the test leads, in order to avoid pick-up of unwanted radiation from any

working TV line output stage in the vicinity. Rather than use plugs and sockets, solder the test leads to the PCB: we are often concerned with ESR values of less than 0.1 Ω , and it doesn't take long for a plug-and-socket connection to deteriorate and produce resistance values greater than this. The length of the leads is not at all critical. I use a 24in. length of screened audio lead terminated by two 8in. lengths of flexible wire.

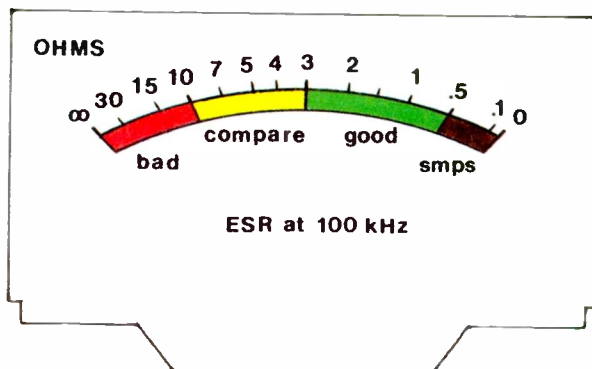
On a cold, frosty morning, before the workshop has reached its normal comfortable, cosy (?) temperature, the meter's readings may increase slightly. Although this increase may amount to the equivalent of less than 0.1 Ω , the fact that accurate low-resistance readings are often required justifies the use of an off-the-board set-zero control rather than a preset type as used in the Wizard ESR meter.

This control also comes in handy if you want to squeeze the last ounce out of the batteries, but the buzzer can't be relied on when the batteries produce less than 5V and the output from the oscillator begins to fall. Also useful in this respect is the ability to alter the pointer position easily at maximum output, to be able to observe the operation of the bulb and the correct functioning of the oscillator. This is covered in the set-up notes later.

Probe clips were used for the all-important probes. The hooks were cut off, the internal springs were removed, then the plastic was cut back to expose more of the probes. They have proved to be ideal in practice, and are small enough to often be able to get under the capacitor on the component side of the PCB. The probes are not polarity conscious, and it doesn't matter which connection is used for the screen of the test lead.

The suggested board size (3 x 2in.) is slightly larger

Fig. 7: Suitable meter scale, reproduced full size.



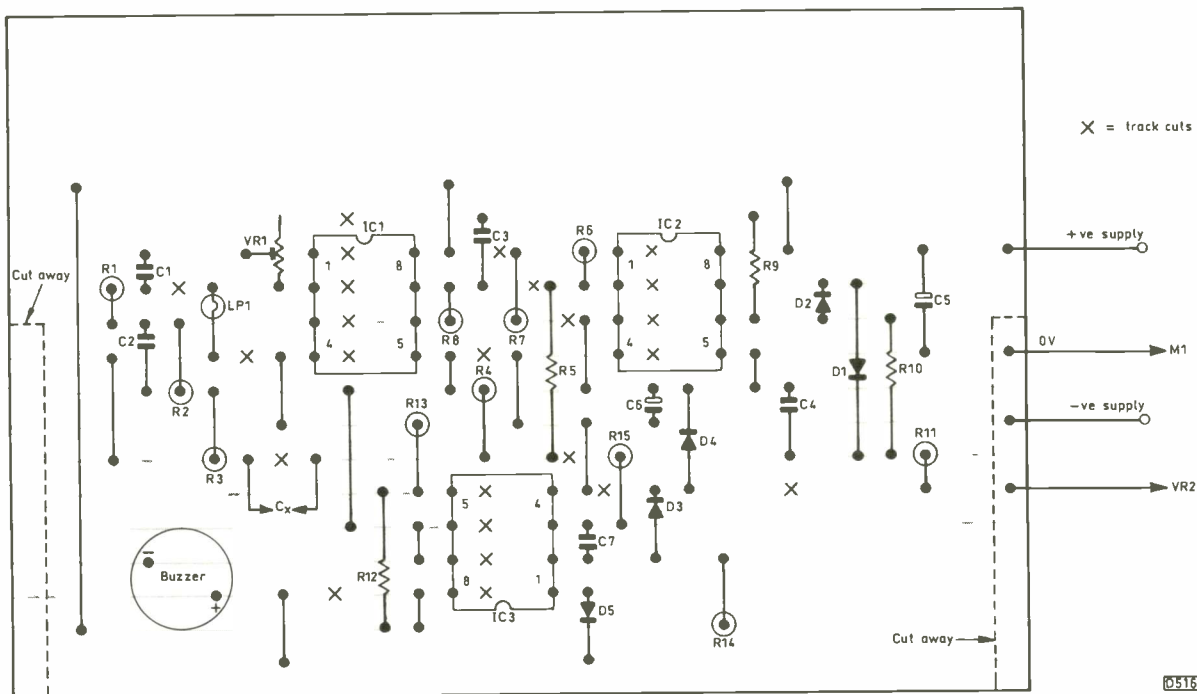


Fig. 8: Meter circuit layout on stripboard. Board size is 3 x 2in. to allow for upgrades. See text.

than it needs to be to accommodate the components. There are two reasons for this. First, so that it will slot into the case that was selected, and secondly to allow space for future upgrades. With this in mind the set-zero control is offset to the right, allowing space for a modular preset shaft.

The batteries are secured with self-adhesive Velcro. It's a simple solution, and the Velcro will transfer several times.

Upgrades

The first upgrade, which will be described in a following issue of the magazine, arose from feedback within the trade. In common with the Wizard this meter does not differentiate between a short-circuit capacitor and a really good one (with an ESR around 0.05Ω). Now although we all know that a short-circuit electrolytic capacitor is quite rare, it can occur and has caught me and others out. A lot of time can be wasted when it occurs and is missed. So I've been testing an addition that gives an audible indication when a short-circuit is present. A further refinement is an auto power-off facility.

I've not included these extras at present because I feel it best to present as simple and economic a project as possible initially. But space has been left for these additions.

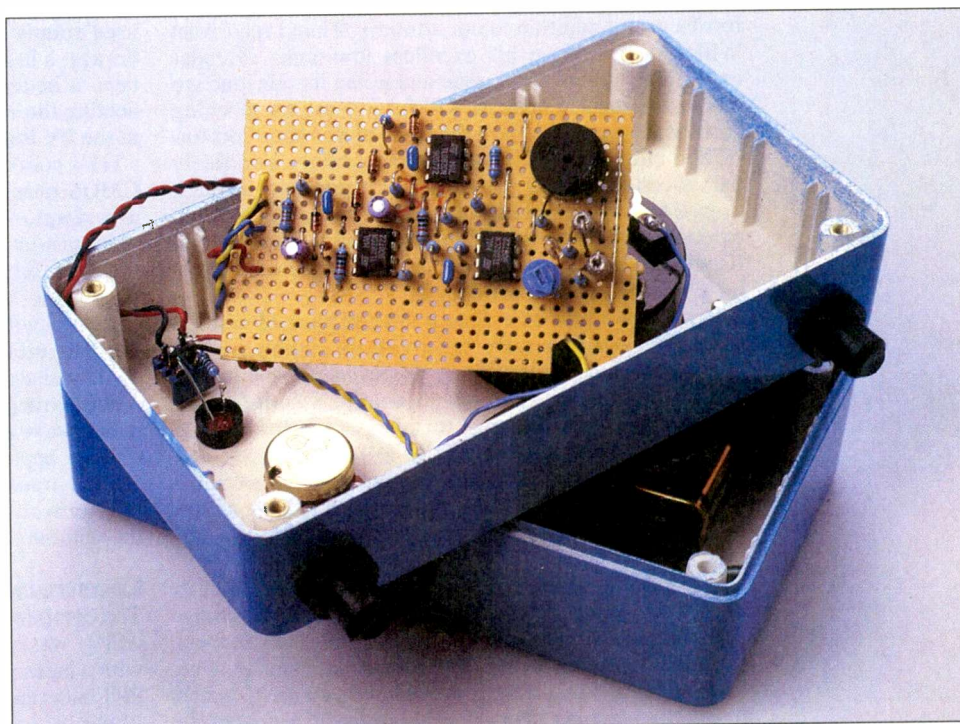
Component Sources

I obtained most of the parts used in the prototype from Maplin Electronics and have included this company's part numbers in the components list. The buzzer and meter movement were obtained from CPC. For correct operation of the oscillator it's vital that C1 and C2 are good-quality polystyrene capacitors.

Apart from the bulb, the specification of the other components is not critical.

The Meter Scale

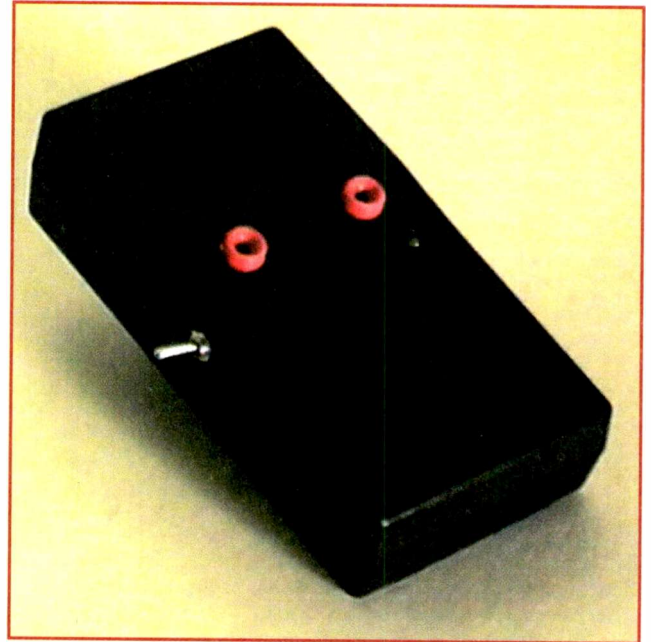
The geometry of the meter's scale (see Fig. 7) is dictated by the relative values of R3 and R4. If the value of R4 was increased to say 10Ω, this would be the mid-scale reading and R3, being low in comparison, would have less effect. Say a capacitor with an ESR of 10Ω is connected. Half the signal across R3 will be passed on, and little of its current will be diverted to reduce R3's voltage, which is the result of the current through the



Internal view of the meter.

continued on page 436

Short Locator



Adrian Spriddell presents an electronics short locator unit that's particularly useful for tracing faults on data bus lines

Because of the nature of much of the equipment we service, we probably have to contend with a greater than normal number of bus-connected IC failures. I had long felt that to help speed up our fault-finding procedures a short locator of some sort would form a useful addition to our armoury. Then I read Alan Willcox's article on his excellent low-ohms extender unit in the August 1998 issue and noted its relevance to our requirement. I hope he will forgive me for pinching most of his design to form the basis of this short locator.

The ability to read low resistance values accurately would certainly be of use to us, but it might be difficult to justify the time needed to build the original low-ohm extender unit. A device that enabled us to locate a dud IC without having to chop out umpteen good ones could be given top priority however.

Alan's low-ohms extender circuit can be used to drive some additional circuitry to provide an audible indication of resistance – the lower the resistance the higher the pitch. This enables you to continue fault-finding without constantly having to take your eyes off the board being checked in order to refer to a digital display. The ear's sensitivity to changes of pitch would, I decided, enable me to find shorts much more quickly than by using actual resistance readings, however accurate.

So my design and assembly wizard Janet was asked to build a low-ohms extender without the range switching. Substitutions could be made wherever necessary to meet the needs of our Ordering Department: Janet again, who holds the belief that if most of the letters on an IC match it will do – we can alter the design later if necessary to make it work!

Circuit Description

The circuit diagram of the unit is shown in Fig.1. A TL082 dual op-amp chip (IC1) is used in the same way as in Alan's design, but the output at pin 7 is taken to Tr1 to provide inversion and buffering. A BC182 was used simply because we have hundreds of them in the drawer: a low-noise device such as a BC550 might have been a better choice. It's biased for 0V input by connecting the emitter to the negative rail via R11 with D3 to the 0V line.

Tr1's collector is taken to the control pin (9) of a 4046 CMOS phase-locked loop IC (IC2) which is here used as a simple voltage-controlled oscillator. Only a couple of extra components are required to enable it to perform this task, R12 and C1, which set the basic frequency. I aimed for an output at around 2-10kHz, which is achieved with R12 = 100k Ω and C1 = 4.7nF. If you want to offset the frequency range, try connecting a 1M Ω resistor between pin 12 and the 0V rail.

This arrangement provides at pin 4 of IC2 a rough squarewave output whose frequency depends on the DC voltage applied to pin 9. The output is fed to another BC182 transistor, Tr2, which drives a piezo-ceramic tweeter with coupling via C3 – R15 is included to lower the volume to a more acceptable level.

Construction

The components were mounted on a small tri-pad PCB which was popped into a hand-held instrument case with a battery compartment large enough to take the two PP3 batteries required.

Lead resistance is of no consequence, as long as it remains constant, so 4mm banana sockets were fitted to

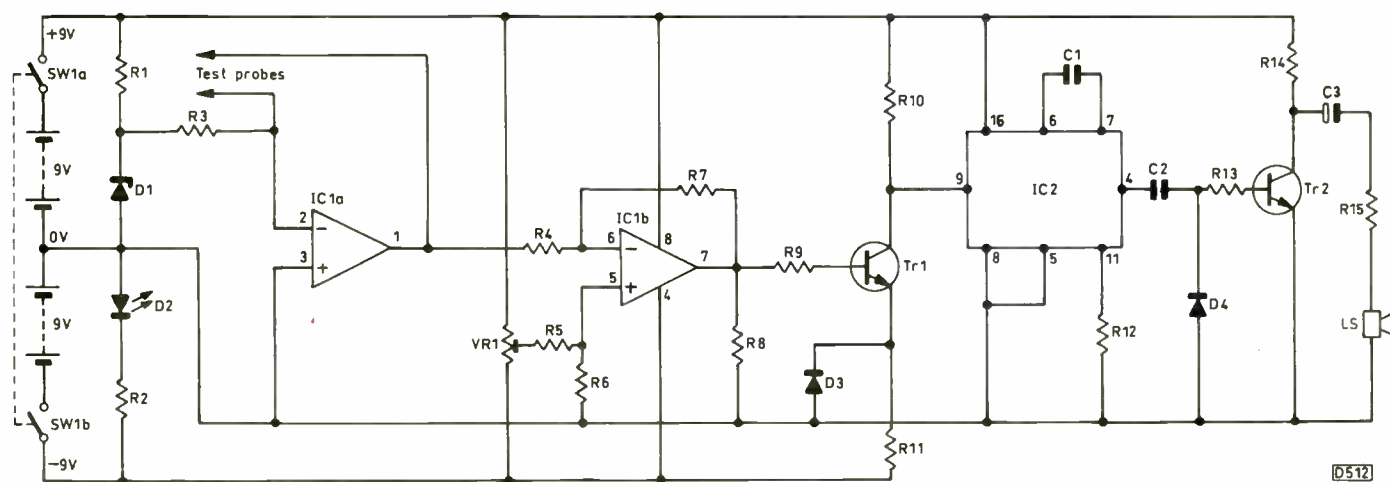


Fig.1: Circuit diagram of the short-circuit locator unit.

the front of the case to enable any one of our sets of test leads to be brought into service.

Use

Use of the unit is more a question of feel than science. If you have a fault condition where for example one data line is being held high, plug in some leads, switch on, jab one sharp test prod on to the positive supply rail and use the other sharp prod to check along the data line concerned, moving from one IC to the next, always in the direction of the higher-pitched signal. The faulty IC is the one that produces the highest frequency sound. Beats cutting print tracks every time.

Status

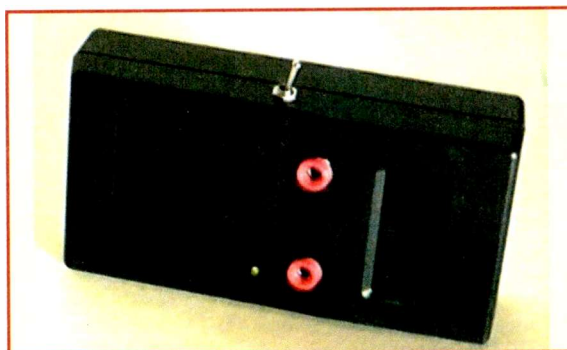
I feel it would be best to describe the unit as a development project. It contains no artificial additives, no animals were harmed in its construction, and no calculators were employed to work out the values of the extra components! The component values listed work, but their selection was quite arbitrary. So a detailed specification is not provided.

C1, which sets the basic oscillator frequency, is a polystyrene capacitor: probably anything other than a

ceramic type would do. A piezo-ceramic tweeter was used because it's cheap and, more importantly, we had one in stock. The type used can be obtained from CPC as part number AR70987. The instrument case is available from CPC as part number EN55046 or from MPS as part number YK24B.

If I ever get around to producing a Mk 2 version I might perhaps make it a little more sensitive, use something more practical than a toggle switch and select component values more carefully.

Feel free to experiment and improve on the Mk 1!

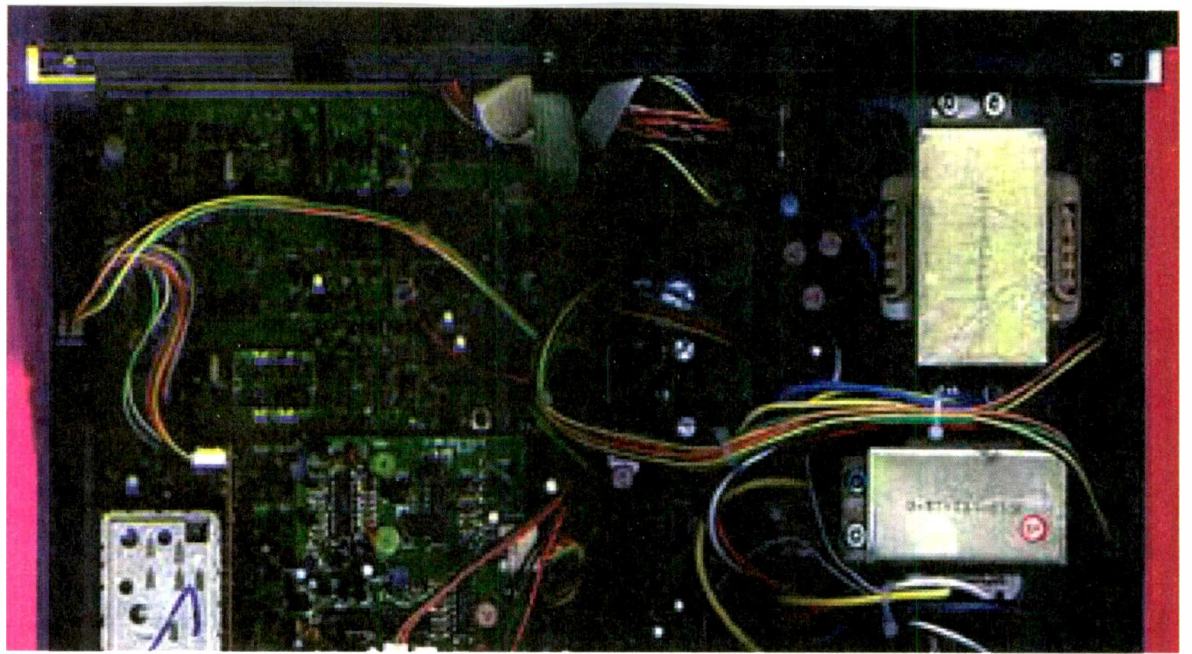


Parts list

R1	3.9k Ω	VR1	47k Ω preset
R2	3.9k Ω	C1	4.7nF polystyrene
R3	1k Ω	C2	220nF polyester
R4	1k Ω	C3	2.2 μ F electrolytic
R5	820k Ω	D1	ZN423
R6	1k Ω	D1	2mA LED
R7	100k Ω	IC1	TL082
R8	1M Ω	IC2	4046
R9	100k Ω	Tr1	BC182
R10	4.7k Ω	Tr2	BC182
R11	4.7k Ω	LS	Piezo-ceramic tweeter
R12	100k Ω		
R13	4.7k Ω		
R14	2.2k Ω		
R15	560 Ω		

All 1%, 0.25W

Case, double-pole on/off switch (SW1), banana sockets, tri-pad PCB and two PP3 batteries with connectors.



Satellite Notebook

Reports from
Christopher Holland,
Pete Gurney, LCGI
and Hugh Cocks

Updating Digibox EPG Software

The SkyDigital electronic programme guide software has been updated at a rapid rate since the launch of the service. To see which version is in the digibox, go to the system set-up menu and press 5, the system details option. The EPG software version is at the bottom of the system details list.

To force the receiver to download the latest version, remove the mains power – also remove the viewing card just in case of a problem here. Hold in the back-up button on the receiver's front panel while reapplying mains power. After a few seconds the front panel LEDs will all light up and you can release the button. It takes a few minutes for the upgrade to be completed. Once done, the receiver reverts to standby. You can then go back into the system details menu to see if a new version is in place. At the time of writing, version 2.1.20.2 is the current one. **C.H.**

Amstrad SRD500

Low audio output was the complaint with this receiver: the TV set's volume control had to be at maximum before anything at all was audible. To narrow the field of search, an initial check was made using the scart output. The result was normal audio, which reduced the search area to one IC.

Audio is taken from the left- and right-hand channels at the scart socket, combined via a resistor network and fed via C771 (10µF, 25V) to the operational amplifier IC307d, which acts as a buffer. Voltage checks around this IC failed to reveal anything amiss, but

a scope check showed that there was no signal input. When tested, C771 was found to have fallen in value to 1µF.

The audio was certainly better when a replacement had been fitted, but was still low. There's a similar coupling capacitor for the output from IC307d, C346 (10µF, 25V). Once this had been replaced there was normal sound. **P.G.**

Low-threshold Reception

An Irish bar along the coast from here was keen to receive the Irish sports channel Setanta via Telecom 2C at 3°E (12.606GHz with vertical polarisation). Unfortunately we are right at the edge of the 2C footprint in southern Portugal. As a result you get beam-edge wobble during the 24-hour period, and reception from morning to early evening is tolerable only when a 2.8m dish is used – reception is non-existent during the night! Over the course of about half an hour in the early evening the signal fades out in front of your eyes.

Fortunately the bar had been aware of the problem before paying its subscription and the arrival of the specially modified VideoCrypt decoder. I connected the decoder to a Pace MSS228/LT low-threshold receiver. Operation of this fairly recent receiver follows normal Pace analogue practice, but threshold extension is adjustable on a per-channel basis by first pressing the level button on the conventional Pace remote control unit. A bar display then appears on the screen, and the receiver can be made more or less sensitive by moving the bars across the screen using the remote-control

buttons to the left and right of the menu button. Once the required picture quality has been achieved, you press the store button. This facility operates independently of the normal blue-screen tuning menus, where the vision IF bandwidth can be switched between 15 and 27MHz to give basic picture improvement alongside the normal tuning parameters.

White dots disappear as if by magic when the sensitivity is increased, but a price has to be paid for this improvement. Captions start to streak badly when too much extension is used. Fortunately the VideoCrypt system is fairly tolerant of weak signals, and the receiver has its first few channels stored with varying degrees of threshold extension at the same frequency.

If the Irish sports channel goes over to MPEG-2 transmission/encryption with the same satellite, reception will no longer be possible here as there is no such thing as digital extension!

I've tried this receiver with weak South American and African C band (4GHz) signals. It works excellently. C-band LNB selection (5.15GHz local oscillator frequency) is carried out via the installation menu. The only disadvantage is that C-band frequencies cannot be keyed in directly via the remote control unit – the receiver will tune up and down the band only manually. **H.C.**

Sky Digibox: Adding Extra Channels

It's not widely known that the digital satellite Astra 2A transmits a couple of free-to-air channels that

do not appear automatically in the Sky electronic programme guide (EPG). Further channels could be added in future. You can include them in the guide, and can also add free-to-air channels transmitted via Astra at 19.2°E or Eutelsat at 13°E, though the digibox will receive only signals that have a symbol rate (SR) of 27,500 or 22,000. The digibox is somewhat touchy when used with other satellites however, so if the customer has a real interest in non-Astra 2A digital channels it's best to use a separate receiver.

The main free-to-air channels not listed in the Sky EPG are Chinese News and Entertainment (CNE), which is transmitted between 9 p.m. and 3 a.m. at 11.758GHz with horizontal polarisation, and Travel, which is at 12.032GHz with horizontal polarisation and is nothing to do with the Sky Travel channel. Another example is CNN radio at 12.051GHz with vertical polarisation. We'll use the CNE channel as an example of how to load channels into the digibox's memory.

Go to the services menu and select option 4, the system setup menu. Again go to option 4, add channels – see photograph 1. The manual tuning menu will then appear. Enter the frequency (11.758) and the polarisation (H). Leave the symbol rate and forward error correction (FEC) as they are, at 27.5 and 2/3 respectively. See photograph 2. Once the frequency and polarisation have been set, go to find channels and let the receiver scan the 11.758GHz digital block. On completion of its scan the following channels should be displayed on the new channels list, see photograph 3: Channel 5, The Box, CNBC, Sky Sports News, Channel 4, CNE and FilmFour. Apart from CNE these channels are already included in the Sky EPG: add CNE by highlighting its name and pressing the yellow store channel button. A tick will then appear alongside CNE, as shown.

To select the channel, press the TV Guide button and press option 8, the other channels menu. See photograph 4. CNE will be listed here and can be viewed by highlighting it and pressing select. Remember that it's only on-air between 9 p.m. and 3 a.m., though a channel identification is present outside these hours.

The above channels are free-to-air and can therefore be loaded into a non-Sky digital STB. Additional

channels that can be stored in this type of receiver are: CNN, Shop! and QVC UK at 12.051GHz vertical; Sky News at 12.070GHz horizontal; and BBC Parliament at 12.148GHz horizontal.

In the Hot Bird position (13°E) you can, for example, add the Italian RAI channels to a digibox EPG. The procedure is as follows. Connect to the digibox a dish aligned to 13°E and enter 11.766GHz, vertical polarisation. Repeat the previously-described scanning procedure. A list of the channels that have been found should then be displayed, in this case RAI1, RAI2, RAI3, RAI Widescreen, RAI Sport Satellite, TEST2RAI and TEST3RAI. Highlight each channel in turn and tick it into the memory, using the yellow button. But, as previously mentioned, if the customer is interested in the Hot Bird channels the Sky digibox is not the ideal receiver to use. A dedicated receiving system with a non-Sky digital STB will give better results.

The Sky digibox can crash if too many channels are added in the extra channels section. It can also be quite stubborn sometimes and be convinced that no 13°E signal is present. At other times it behaves impeccably!

Going between these non-Sky EPG channels can be awkward. You can't just flick through them by using the up and down buttons: you have to revert to the other channels menu and select the required channel from the list. But going back to an EPG channel is easy: just key in the channel number, e.g. 104 for Channel 4, and it will appear.

Two very useful features that are missing with digiboxes are a last channel recall facility and a favourite channel list. One hopes that these facilities will be made available with future models.

When 11.798GHz horizontal is scanned you will find BBC1 Wales and BBC1 Scotland (with the standard digibox SR and FEC, i.e. 27,500 and 2/3). BBC1 England and BBC1 Northern Ireland can be found at 11.720GHz, again with horizontal polarisation. But the Sky viewing card has authorisation for only your local BBC region: it automatically places this on channel 101, ignoring the other BBC1 regions which are not viewable after the extra channel scan though the channel name and programme identification are seen. C.H.

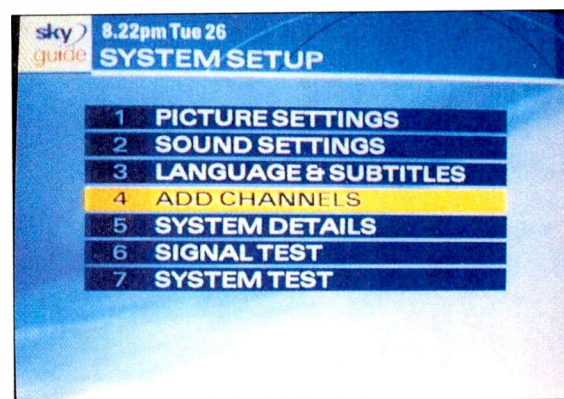


Photo 1: The system setup menu, with add channels highlighted.

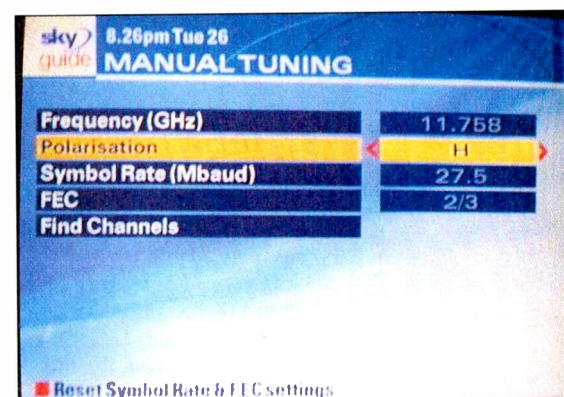


Photo 2: Enter the frequency and polarisation (CNE details shown here). This menu will first appear with the default frequency 11.778GHz, vertical.



Photo 3: After the frequency-block scan, the digibox comes back with the list. CNE can then be stored as described in the text and will be added to the other channels menu.

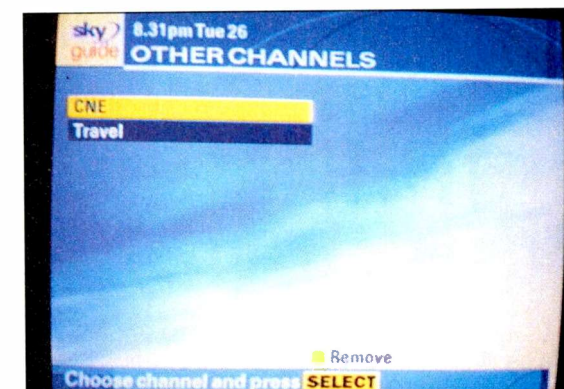
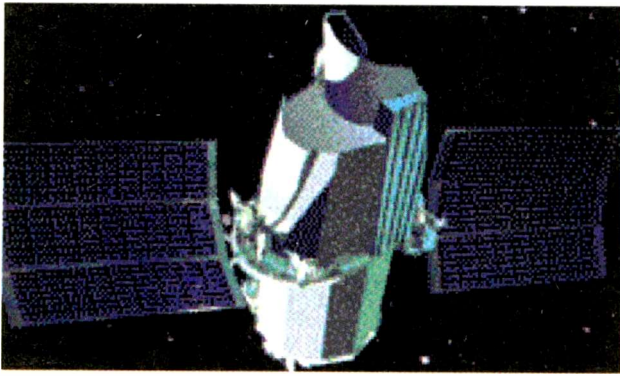


Photo 4: The other channels menu, with CNE added.



DX and Satellite Reception

Terrestrial DX and satellite TV reception. News from abroad and from the satellite belt. A multi-standard receiver from Comet. And some aerial history. Roger Bunney reports

There was very little by way of terrestrial DX reception during January. The only Sporadic E activity occurred at midday on the 6th and 15th, when signals were received on channels R2 and E4 respectively – source unknown, as reception was of unidentified programming. The 21st brought a slight tropospheric lift, with reception of French/Benelux UHF signals in the south east.

F2 Reception

F2 layer activity can be expected to increase as the sunspot count rises. Several people have already reported reception of various communications signals across the 30-45MHz band. To monitor this band you will need either an elderly communications receiver such as an Eddystone 770R plus preamplifier or a modern scanner – one that can

tune quickly across the band to find signals and can switch between AM and narrow FM.

Many North American police and domestic utility signals are audible in the late afternoon. The mornings bring signals from E and SE Europe as the MUF rises. On December 16th ch. R1 video (49.75MHz) was just audible with a scanner. *Skywaves* reports that the local police in Montgomery, Alabama have been heard in Europe at 37.160MHz. There are numerous studio-transmitter links below 30MHz, often used for reverse music feeds to mobile radio station vehicles. So, if you hear a US Medium Wave signal at say 25.870MHz from WFLA, Tampa using narrow-band FM, your scanner isn't faulty: what you are hearing is the studio transmitter output using a modified CB whip aerial to communicate with the traffic spotter plane that inserts observations in the local WFLA news.

Town pagers at 35.22 and 35.58MHz have been heard during previous winter F2 openings, with audio loop idents, but these have largely been superseded by data paging. Signals have been so strong that they would break through at the receiver's IF!

DTT

With digital terrestrial TV now spreading across the UHF bands, interleaved with the standard four/five analogue transmissions per transmitter, so the incidence of DTT interference is increasing. Channels that were once empty are

now filling up with DTT, decreasing the potential for DX-TV reception and also, incidentally, increasing the interference experienced by domestic TV viewers.

The situation will worsen, so greater thought will have to be given to the use of more directional aerials, with sharper beamwidths and reduced side-lobe pickup.

Analogue TV should be around until about 2014. An earlier switch-off, say in 2010, is likely in mainland Europe.

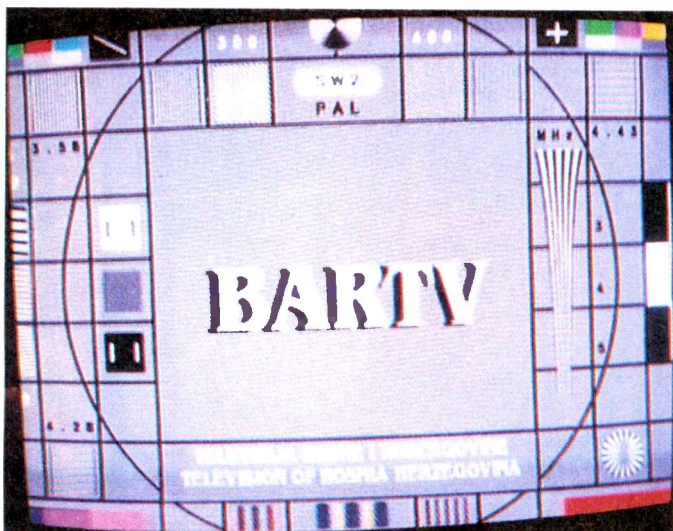
Amateur TV

The British Amateur Television Club has just produced issue number 185 (February) of its magazine *CQ-TV*, marking the fiftieth anniversary of the BATC. The size has gone up from A5 to A4, with a glossy cover. The publication is very impressive: my congratulations to editor Ian Pawson for his courage in taking this dramatic step forward. For details of BATC membership, contact Dave Lawton, G0ANO at Grenehurst, Pinewood Road, High Wycombe, Bucks HP12 4DD, phone no. 01494 528 899 or e-mail

memsec@batc.org.uk

There is concern that the 435MHz ATV band may be lost, as some authorities appear to think it's underused. There is undoubtedly commercial interest in the band. If you are an active ATV operator at 435MHz, contact Graham Shirville, G3VZV with details as soon as possible. It's a question of use it and prove it or lose it – you'll never get it back! Graham's address

The BARTV (Television of Bosnia) pattern resembles a test card of the Sixties. It was received as a digital signal (clear MPEG-2, 27,500 SR, 3/4 FEC) from Eutelsat at 13°E – the 12.520GHz vertical transponder.



is The Hill Farm, Potsgrove, Milton Keynes, Bucks MK17 9HF. Phone 01525 290 343 or e-mail g3vzv@amsat.org

Satellite Reception

Following the mid-December Desert Fox campaign, the Iraqi Space Channel is back on air via NileSat-1 at 7°W, with a digital downlink at 11-823GHz vert (SR 27,500, FEC 3/4). There was a special propaganda event on the evening of January 17th: in view of the sync disturbance/dropouts it must have been a recording.

For mature DXers such as myself, who hanker after the days when summers were always sunny and monoscope test cards prevailed, it was a delight to come across the Television of Bosnia test card via Eutelsat W2 at 16°E. The signal is an analogue one at 11-163GHz hor. You first get an uplink test pattern ident BOS-SAR-3 then, at 2024 GMT, the home-grown test card appears for six minutes prior to the evening programmes.

While checking out the regular transatlantic circuits via New Skies/Intelsat K (21.5°W) on the evening of January 5th I came across, at 11-590GHz vert (Reuters lease, SR 20,145, FEC 3/4), frequency bars with the inlaid caption LONDON VIA 332.5E IS 605 TIERNAN CHA. The time was 2300. Nothing appeared by way of moving pictures. I assume that the reference was to another news circuit, via the 605 craft at 27.5°W, from Tiernan, China.

Cyril Willis tells me that the GMTV SNG truck UKI-149 is still in business at 21.5°W most mornings with analogue transmissions. On January 22nd he received a live news insert from the Hastings police station with an update on the missing girls who were later found at Eastbourne. A favoured spot to find UKI-149 is 11-529GHz.

Check out 48°E: the currently redundant Eutelsat II F3 is being moved there from 16°E and should have arrived by the time you read this.

On January 27th UKI-425 OTRANTO (a naval base) provided coverage of the NATO naval presence in the Adriatic in connection with the Kosovo troubles. This was a new UKI number to me. The signal was digital (SR 5,632, FEC 3/4) via Intelsat K at 11-566GHz hor. That same evening Telefonica, the Spanish telecomms carrier, provided an analogue insert for the

Spanish TVE network from outside an unknown cafe. There was no closedown ident and a rapid switch off, suggesting that the crew departed rapidly. This was at 11-697GHz hor via PAS-3R/6 at 43°W.

On the 28th there was live coverage from rubble-strewn streets in Columbia. This was a digital signal at 11-595GHz, again via Intelsat K. The APTN COLOMBIA EARTHQUAKE SITE caption appeared on colour bars. There were several live reports to US networks: also onwards, over the Atlantic, transcoded to PAL for European use.

I've been logging very high-level 3-448 and 3-623GHz (RHC) C-band carriers at about 40°E using my old 1.5m dish. They are completely noise free. It's definitely not Gorizont at 53°E. Can anyone identify this mystery bird?

Terrestrial News

RSL-TV: The Isle of Wight RSL station TV-12 has applied to the ITC to use increased power, from 1kW to 2kW ERP, at its ch. E54 Rowridge transmitter to improve reception for both island and mainland viewers. A newstext service, in conjunction with local papers, is to start shortly. Response from mainland viewers has been far higher than expected. TV-12 has also applied for the West Sussex RSL-TV licence – an area based around Chichester.

The Southampton RSL-TV licence has been awarded to Solent City Television, which plans to run a 24-hour local-programming service, starting in October, financed by advertising and sponsorship. **France:** A new broadcasting bill is expected to be introduced in late summer, after the European Parliament elections. The government will seek a national poll to gain support for changes that are likely to include reduced advertising revenue for the France 2 and 3 networks.

The Netherlands: SBS was due to open a second network, NET 5, on March 1st. It will be aimed at a largely female audience. SBS is hoping to achieve an 18 per cent market share.

Estonia: TV5+, a commercial channel, is expected to open shortly, increasing the number of commercial channels to four. There may be a reduction when the franchises come up for renewal at the end of August.

New Zealand: Wilson-White has



formed a Y2K group to provide an early warning of millennium problems in the Pacific region on New Year's Day 2000. NZ is twelve hours ahead of the UK and will be the first country to experience any such problems. Wilson-White will run a 'beacon alert system' to spread the word internationally as problems arise in NZ.

Digital reception tends to produce either a good-quality picture or nothing at all. As the signal level becomes marginal, video breakup occurs and the audio cuts in and out. This example of video breakup occurred with the BT Washington feed via Intelsat K at 21.5°E.

Aerial Techniques



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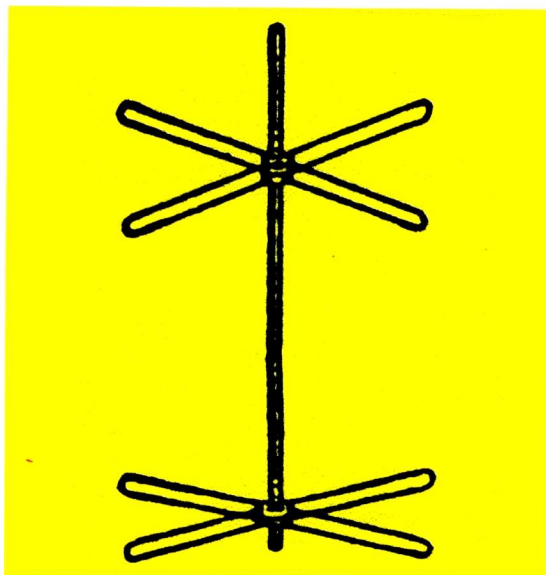


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The Double Dublex aerial, designed to counter heavy ghosting in extreme fringe areas, was featured in Aerialite's 1957 trade catalogue. This version is for horizontal polarisation. Quoted performance figures were: 9.1dB forward gain; 62° acceptance angle; 29dB front-back ratio. With its crossed, folded elements it could have been a forerunner for efficient Band I DXing.

Multi-standard Receiver

Gareth Foster has drawn attention to the Goodmans C520 multi-standard receiver which Comet is selling at £139.95 (January price). The 5.5in. receiver covers the TV bands in the 48-860MHz spectrum, decodes PAL and Secam colour and has system B/G/I/D/K/L capability. At VHF there is automatic switching from the lo to the hi band, also out-of-band (cable channel) coverage. The receiver has baseband audio and video inputs/outputs and operates at 12V DC – a 13A mains power supply is included. Gareth points out that the instruction booklet is none too well written, suggesting that the coverage is less than it actually is.

Satellite News

Hong Kong based Star TV switched off decoder authorisation for Indovision C-band viewers (via Palapa C2 at 113°E), blacking out all 19 channels on December 13th. Problems arose when Indovision failed to pay debts rumoured to be over \$25m. A limited service continues via Cakrawarta at 107°E, but this is in S band (2.6GHz).

The Italian government, concerned about the power of Rupert Murdoch's News Corporation, is considering the introduction of a broadcasting bill that would limit advertising revenues and establish quotas for European-made programming. News Corporation has agreed to buy 80 per cent of the Italian 'Stream' digital service.

Euronews is to go over to digital transmission only from Hot Bird at 13°E from end March.

Several PanAmSat craft developed control processor problems last year and continue in operation

by using standby equipment. The same problem is now understood to have occurred with PAS-4. Galaxy 81 and PAS-4 have also apparently developed battery cell failure, making them vulnerable during solar eclipses/darkness.

According to *SatFACTS* magazine (New Zealand) the Pace-designed Sky digibox Model DSR620 (New Zealand version) manufactured by Dovatron de Mexico radiates a high level of UHF interference when a terrestrial aerial is plugged into the diplexing arrangement at the back.

Apparently chopper power supply shash and digital processor harmonic beats go to the terrestrial aerial as modulated UHF interference which is sufficient to affect neighbouring TV sets.

Aerials of Yesteryear

You would think that domestic VHF TV aerials are a thing of the past, but some stalwart alloy monuments to a bygone TV era are still to be seen adorning chimney stacks. While visiting my daughter at Guildford recently I noticed several combined Band I/III aerials of a type made by C Aerials of Croydon. After maybe thirty years they were still intact.

This is less likely to be the case with the monster Band I Telerection aerials such as the Multimus, which featured a delta matching arrangement on the dipole. A dramatic upward tilt of the aerial by perhaps 15° was claimed to provide enhanced reception in extreme fringe areas. You still see versions for channel 5 (Wenvoe) in Wiltshire and Dorset, often with parts of the elements missing because of metal fatigue collapse – Telerection often filled the elements with sawdust or sash cord to minimise vibration. The company's smaller, stacked Band III systems, with straight dipoles and phasing bar terminations, have stood the test of time – examples that are largely intact are still seen. Telerection eventually became part of the Thorn group: prior to its closure, most of the Weymouth factory's output went to the rental market.

If you pass through the village of Corfe on Purbeck you will see a Dale Parabolic Mk 1 Band III system on a disused building. It has a series of eight reflector elements mounted on a curved boom, with a single dipole at the focal point. These aerials were popular in hilly areas, where ghosting was a problem, and a Mk 2 version with a V-

type corner reflector was subsequently introduced.

When sorting out old catalogues after a recent house move I discovered a lot of interesting material. Fringevision Ltd. of Marlborough made very substantial aerials of largely alloy diecast hardware. The company also sold components for the home constructor. The Fringevision catalogue I found features a dipole and an H aerial for the "new" 90MHz BBC FM transmissions from Wrotham, so it must date from the mid-Fifties. This was a golden era, when Band III was being opened up across the UK.

Fringevision didn't survive, but Maxview Aerials of Norfolk did. Aerialite's trade catalogue for 1957, its silver jubilee year, shows up to four-element Band I arrays and double mounting kits to stack the aerials for extra gain. The company's double Dublex, a stacked horizontal X arrangement, was perhaps a forerunner for wideband, omnidirectional DX-TV systems. The Dublex consisted of folded elements.

I also found an almost mint copy of *The Radio Constructor* dated November 1960. On page 276 there's a report of a visit to a TV dealer in Buckingham, where Ian Beckett was then a TV engineer. Ian confidently announced "there's something coming in now" and, within five minutes, the reporter was astonished to find himself looking at Test Card G from Budapest. Exiting, pioneering times.

Amongst the aerial catalogues I found a mint condition *World Radio Atlas and Gazetteer* for 1933. It lists "The Concerts of Europe". Daventry 5XX for example then radiated the National Programme, and a new station at Droitwich was shortly to open with greatly increased power. Daventry, the home of Empire Services, had seven short-wave transmitters, GSA to GSG, in operation in the 16 and 49m bands. The smaller regional relays, such as Bournemouth 285.7m, relayed the London regional programme. Hamburg 331.9m is listed as "sometimes sending morse letters HA . . . in the interval and often strikes gong before announcing"!

It's always interesting to get a glimpse of earlier periods. If you are moving house or clearing a workshop, please don't throw away any old aerial catalogues. Just let me know what you might have available.

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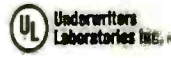
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continued from page 427

bulb. A mid-scale reading of this order may be more appropriate for testing surface-mounted electrolytic capacitors, which seem to have higher ESR values. I have no data on this type of capacitor at the time of writing however.

Anyway, the value of R4 used here, 2.7Ω, does affect the source voltage to an extent that has to be considered. The current that flows through the bulb is controlled by the setting of VR1. R3, being only 1Ω, does not affect the operation of the oscillator.

Scale calibration with an 0-100 dial ideally follows the rule

$$\text{Reading} = (R3 + R4)/(R3 + R4 + \text{ESR}) \times 100.$$

In practice the signal becomes so low at high ESR values that some non-linearity in the circuit is apparent, the result being a slight departure from this formula. Because of this, it's better to use either fixed resistors to calibrate the scale or copy Fig. 7. If a standard 90° movement of a different size is used, it is easy enough to reduce or enlarge the scale by photocopying.

Setting Up

The first consideration is the oscillator's output level. With the specified lamp, the oscillator will work down to 2V peak-to-peak. But bear in mind that the oscillator's output setting is not important in itself – full-scale deflection is simply adjusted by VR2 with the test leads shorted together. Low setting of the oscillator's output provides a longer battery life, reducing the level at which the bulb ceases to function as a regulator. The test signal can however be so low at high ESR values that accuracy suffers. In practice an oscillator output of about 5V peak-to-peak is a good compromise.

If an oscilloscope is not available, the following simple method can be used. Connect a 1Ω resistor between the test leads and turn the set-zero control VR2 (shown incorrectly as a preset in Fig. 5 last month) anticlockwise. Advance the setting of VR1 slowly. Just after the half way point the oscillator will start up and the meter's pointer will deflect. Carry on until the buzzer sounds steadily. At this point the oscillator's output should be close to 5V peak-to-peak. Note that with each adjustment the pointer will twitch briefly as the bulb settles, giving the impression that the potentiometer is noisy.

Table 1: Typical ESR values at 100kHz.

Capacitance value	Voltage rating	Impedance*
1μF	50V	4Ω
2.2μF	50V	2.8Ω
4.7μF	50V	2.4Ω
10μF	63V	1.9Ω
22μF	50V	1.3Ω
47μF	25V	1.3Ω
47μF	50V	0.7Ω
100μF	16V	0.5Ω
100μF	35V	0.25Ω
220μF	16V	0.25Ω
220μF	35V	0.114Ω
470μF	16V	0.114Ω
470μF	35V	0.065Ω
1,000μF	16V	0.065Ω
1,000μF	25V	0.041Ω
2,200μF	25V	0.036Ω
2,200μF	35V	0.034Ω

*When new – low-ESR type.

Leave the set-zero control at minimum and observe the operation of the bulb by switching on with the probes shorted together. You will see the pointer deflect high then almost immediately jump down to the stabilised position.

Once the oscillator's output has been set, adjust VR2 for full-scale deflection with the probes shorted together. Finally, centre the control knob.

Using the Meter

Experience with the meter provides the best guide as to what ESR value to expect of a good capacitor. Some general guidelines can be given however. The reservoir and smoothing capacitors on the secondary side of a chopper power supply should all give readings of less than 0.5Ω. A practical ESR limit is 0.05Ω. With an electrolytic capacitor of 100μF or over value, you should expect a reading close to this and certainly below 0.5Ω.

There are some exceptions however. I'll mention them here as they can cause confusion. A high ESR value is to be expected with 1μF, high-voltage electrolytics: if the meter deflects at all, the capacitor is often OK. This type of capacitor is widely used as a start-up component. Being operated in a DC context, its ESR is less important. As an example a new 450V type may well produce a reading of the order of 30Ω. At the other end of the range you get the 1,000μF, low-voltage type. If one of these doesn't produce a reading of 0.1Ω or less it's duff.

Table 1, from Dubilier, provides a useful guide. In addition, if you are unsure what reading to expect it's easy enough to make a comparison with a similar type from your well-stocked tray of electrolytics.

The meter has good protection against placing the probes across a charged capacitor, but this should of course be avoided. The only real cause for concern is the 'main smoothing block', i.e. a mains bridge rectifier's reservoir capacitor. We all know that this capacitor can deliver a hefty punch when a power supply has failed to start up. If you are of the type with a tendency to such accidents, it would be prudent to wire a couple of beefy diodes back-to-back across the meter's input. This should protect the meter, but it won't help your heart – or your probes – in the event of such a misfortune. It's good practice to discharge this capacitor with a mains-type bulb – it is always reassuring to have a visual indication that little charge remains. See warning note later.

Inductance

As the meter operates at 100kHz, any inductance in the circuit under test becomes significant. The loudspeaker that reads 8Ω on your conventional ohmmeter appears to be nearly open-circuit with the ESR meter.

This property can be quite useful. When testing a line output stage for example you might find that there's a short-circuit across the transistor. In this event there are in general three possibilities, (a) the transistor is short-circuit, (b) the line output transformer has a primary-to-secondary short, or (c) the HT line has a short-circuit across it. If the short-circuit is still present when the ESR meter is used, the transistor is almost certainly the culprit: in the other two cases the ESR meter will give an open-circuit reading because of the inductance of the transformer's primary winding.

Video head testers operate by measuring, in effect, the inductance of the head. Its impedance falls as the gap deteriorates with wear. Although this meter operates at a frequency that's inappropriate for a video head, it can

give a relative indication of the head's condition. I don't have a collection of heads in various states of health to be able to confirm any figures, but it seems that new heads produce a reading of about 2Ω while worn heads produce a reading of about 1Ω .

Inductors with millihenry values, of the type used in EW modulator circuits, normally give an open-circuit reading. But if a shorted turn is present the inductance drops dramatically and the meter's pointer will deflect.

Analogue v Digital

In dealing with the problem of in-circuit ESR measurement I've used traditional analogue technology. But, as is often the case, there's another way of doing things. Bob Parker, an engineer 'down under' who was convinced of the importance of such an instrument, first tried analogue circuitry. After "a few fairly unsuccessful attempts" he opted for a digital approach. His solution is to use a Zilog processor with, instead of a sinewave as a test signal, short current pulses applied to the capacitor being tested. The resultant voltage pulses, which are proportional to the electrolytic's ESR, are compared to the level existing on a ramp generator. Time measurement by the Z86 processor determines the amplitude of the pulses.

As far as the power requirement is concerned, there's a parallel in the form of a remote-control handset. The LED is pulsed with a high current for a short period, the average current drawn being low. The brief high current is supplied by a reservoir of stored power in an electrolytic capacitor that's wired across the battery's connections.

Friendly rivalry between the analogue and digital camps has existed for a long time. This brings to mind an old story that sums it up well. Two male engineers, one specialising in digital design and the other in analogue design, are working together in a lab. A nude female appears at the door, attracting the attention of both men. This vision of beauty announces that every ten seconds she will reduce the distance between herself and the engineers by one half. The digital engineer looks disappointed and cries "that's terrible, she'll never get here". The analogue engineer smiles and then replies "that's OK, she'll get close enough".

More on ESR

Bob Parker (*Electronics Australia*, February 1996) puts it this way.

"The electrolyte has an electrical resistance which, along with the (negligible) resistance of the connecting leads and aluminium foil, forms the capacitor's equivalent series resistance. Normally the ESR has a very low value, which stays that way for many years unless the rubber seal is defective. Then the electrolyte's water gradually dries out and the ESR creeps up with time. The electro gradually comes to act like a capacitor with its own internal series resistor . . . Heat makes it worse. If an electro is subjected to high temperatures, especially from heat generated internally as a result of large ripple currents, the electrolyte will start to decompose and the dielectric may deteriorate – the ESR will then increase far more rapidly. To make things worse, as the ESR increases so does the internal heating produced by the ripple current. This can lead to an upward spiral in the capacitor's core temperature, followed by complete failure – sometimes even explosive . . ."

Both Bob (Dick Smith Electronics) and Ray Porter, in an article on ESR meter design in this magazine a few years back, mention the use of fixed resistors to assist with meter calibration. Armed with this information,

and considering the fact that ESR is an in-phase component, I have made the assumption in my calculations that ESR amounts to the same thing as an equivalent fixed resistor.

Other uses for the meter emerge the more it is used. For example, non-electrolytic capacitors can be measured and their capacitance estimated. But because of the different types of capacitor construction in use, I can't come up with any hard and fast rule. A lower limit for measurement is about $0.1\mu\text{F}$. There seems to be less and less need these days to measure the actual value of a capacitor. With line output stage tuning capacitors and timing components a conventional capacitance meter is more appropriate.

The ESR meter is one of those things that, once you have one, you wonder how you ever managed without it. Hats off to whoever came up with the idea – it's not mine. I've just taken this opportunity to share with you the course I adopted to end up with the solution presented here. I haven't clapped eyes on the Wizard yet – we can't afford one down here in Wales. I'd like to know how the Wizard designer approached the problem, but no information has come my way.

The idea for my meter was triggered off by the Wizard. When I first read about it I was impressed. It would test that most troublesome of all components, the electrolytic capacitor. Not only that but it would do so in-circuit, ignoring associated components. I liked the idea of a conventional meter movement with its easy-to-interpret scale, also the buzzer feature for quick checking. But the meter was shrouded in mystery and its price tag was beyond me. So I decided to have a go myself.

Development

A clear picture formed in my mind as to how to go about it. My idea was to supply a low-value resistor (10Ω) with a constant-current 100kHz sinewave, amplify and rectify the resultant voltage waveform across this resistor and feed it to a meter movement. In this situation the meter is to be set at full-scale deflection. The test leads were to be connected across the resistor. Now if the capacitor being tested has an ESR of say 10Ω , the voltage across the resistor would fall by half. Thus half-scale deflection would correspond to an ESR of 10Ω and so on. A very low ESR (good capacitor) would produce a near-zero reading while a poor capacitor would have little effect, the pointer remaining at near full-scale deflection. The result is a meter scale in opposite sense to that of the Wizard.

Within a couple of months of the start of development work on the project I had a working prototype and decided to write an article about it. Then, at the eleventh hour, I had second thoughts. Something was nagging me. The meter looked OK, did its job, and others were happy with it. But after using it for some time I felt that something was not quite right.

My main concern was that it seemed to be very sensitive to the inductance of the test leads. This impedance meant that even with the test leads shorted the reading could not be brought down to zero. I had introduced measures to offset this, but in this connection a more serious problem emerged after some further use.

When a capacitor with a very low (near zero) ESR was being measured, the pointer would vary about the zero point if the distance between the test leads was altered. If they were close together, their inductance would tend to cancel and the reading would decrease. I was aware how important it was to be able to differentiate between say 0.5Ω and 0.1Ω or between 0.1Ω and

zero. This was a design weakness, and I was not happy.

At this time Bob Parker's K7204 ESR meter became available. I had one with which I could make a comparison, and noticed the same sensitivity to inductance that I was experiencing. Both meters monitor the voltage across the capacitor, whereas the Wizard measures the current through the capacitor – this was clear from its scale.

I went on to build a little circuit to do just that and, lo and behold, this over-sensitivity disappeared. The effective lead impedance dropped dramatically, and that which remained could be simply compensated for by means of the FSD preset. So it seemed that the Wizard way was the right way. All this can be explained using the relevant maths, but I'm not about to brush up on my theory and extend this article longer than it is already.

Reluctantly, I accepted that I had to scrap my original idea and start all over again. This was by now becoming an obsession with me – I had to come up with the best solution, and it had to be the simplest.

Certain things had to go. After some use I realised that plugs and sockets for the test leads were out of the question. Their increasing contact resistance made low-ohms readings unreliable. I had also been determined that the meter should operate with a single PP3 battery.

To this end I had built a DC-DC converter to provide a negative supply line. This provided operation down to 7V. But it used 7mA and greatly increased the circuit

complexity. To do away with it meant that I needed a higher supply voltage. The use of two PP3s in series to obtain this may seem to be a backwards step, but isn't really. The meter now takes half the current used by the first prototype, and will regulate down to less than 5V per battery. In fact the meter reading remains unchanged over the supply range 10-30V with the oscillator set at 5V peak-to-peak.

Now, almost a year after building my first prototype and quite a few versions later, I have presented this – my final (?) solution!

Warning

It seems that forgetting to discharge the main smoothing block or HT reservoir capacitor before measurement is a more frequent occurrence than had been expected. When this happens R4 at least will blow. As replacing components on stripboard is a messy job, I strongly recommend that protection is built in. A small board with two 1N4007 diodes wired back-to-back and a 1A (N25) circuit protector in series with one of the test leads can be mounted on the back of the meter movement.

Thanks

I have to thank Martin Pickering for his constructive comments after testing an earlier, voltage-sensing prototype meter.

Components list

<i>Item</i>	<i>Value/type</i>	<i>Order code</i>
R1, R2	3kΩ, 1%	M3K
R3	1Ω	M1R
R4	2.7Ω	M2R7
R5, R7, R9	10kΩ	M10K
R6, R8, R15	100kΩ	M100K
R10	91kΩ	M91K
R11	5.6kΩ	M5K6
R12, R13, R14	56kΩ	M56K
R16	2.7kΩ or 10kΩ*	M2K7 or M10K
VR1	500Ω cermet preset	WR39
VR2	10kΩ linear potentiometer	JM71
*Value for current economy		
C1, C2	470pF, 1% polystyrene	BX53
C3, C4, C7	0.1μF miniature resin dipped	RA49
C5, C6	22μF, 16V	VH09
IC1, IC2, IC3	TL082CN	RA71
D1, D2, D3, D4, D5	1N4148	QL80
D6	Flashing LED plus clip	QY96 and YY40
LP1	Miniature wire-ended 28V, 24mA lamp	BT44
M1	100μA meter movement	CPC code PM11125
SW1	DPST switch	RD17
Buzzer	Miniature alarm	CPC code LS-M3
Stripboard		JP47
Case	ABS box type BM22	CC83
Knob		YX01
Batteries	Two PP3s plus clips	HF28
Probe clips		HF21

Order codes are Maplin's unless otherwise indicated.

Answer to Test Case 436

- see page 383 -

Even though it can sometimes be the only possible course of action, especially in a case of random mains-fuse blowing like this one, fault diagnosis by trial-and-error replacement of components is very wasteful of time, money and parts. In this particular case, progress might have been made by observing the interior of the TV set in total darkness at switch on, or even perhaps by temporarily fitting extra fuses to establish where the excess current was going.

In this Panasonic set a 2.5A anti-surge fuse added in the AC feed to the mains bridge rectifier D801 would not have blown when the fault occurred, but another such fuse included in the lead to the degaussing system would have ruptured violently. A flash inside the casing of the degaussing posistor would also have been visible, for this is where the cause of the problem lay. At switch on there was sometimes a flashover across the outer edge of one of the posistor's two resistive elements. A scar and burn mark were clearly visible when the device had been broken open.

The problem is in fact not unusual in these sets - and many others of many makes. Yes, Television Ted *would* have known about it. He may even have sent Colin out equipped with a posistor at the outset!

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This simple-to-operate, battery-powered meter has been developed for digital satellite dish alignment. The requirements with a digital signal differ from those with an analogue one. This meter takes the following signal parameters into account: frequency, BER, polarisation, symbol rate and FEC. Eugene Trundle has been trying the meter out.

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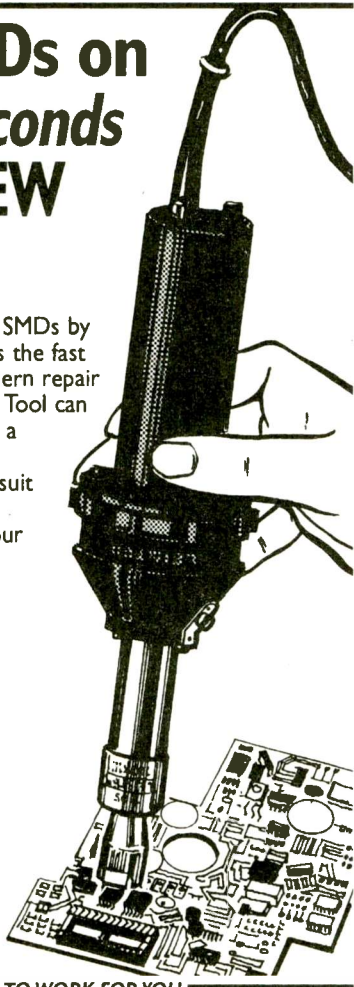
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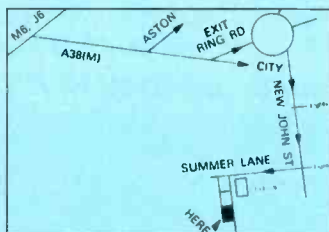
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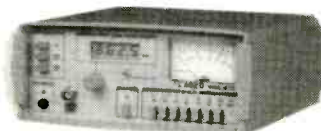
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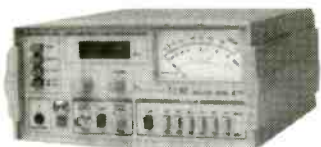
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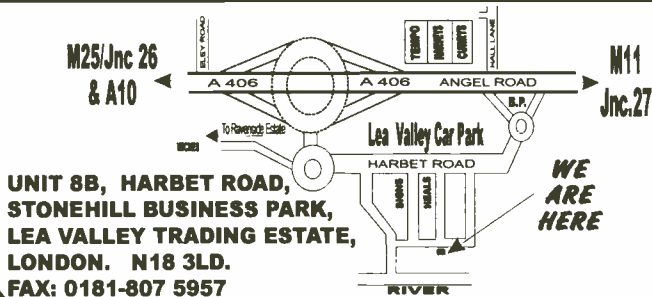
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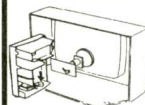
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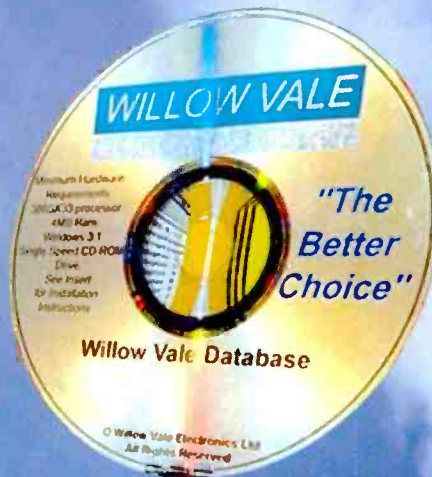
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