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TELEVISION

SERVICING · VIDEO · SATELLITE · DEVELOPMENTS

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Microcomputer systems for TV

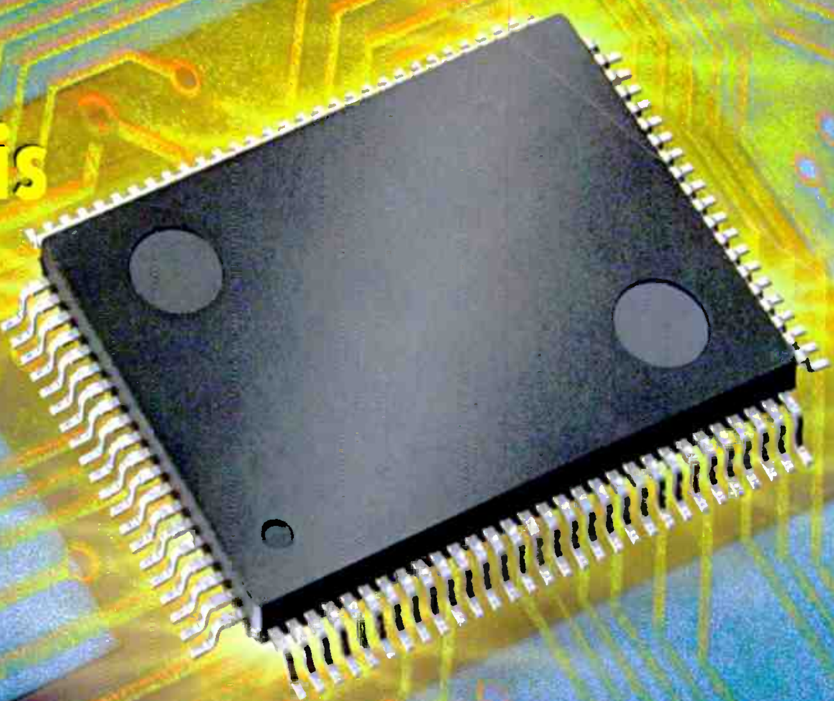
Servicing the Philips L6.1 chassis

All about ADSL

A century of TV

Interactive TV update

Microwave keypad tester



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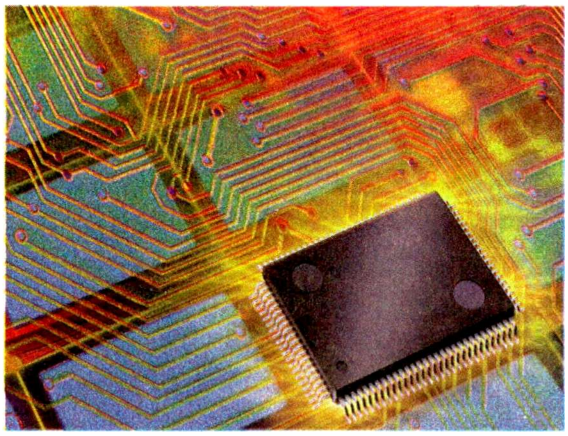

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Note that we are unable to answer technical queries over the telephone and cannot provide information on spares other than that given in our Spares Guide.

January issue on sale December 15th.

Next issue, dated February, on sale January 19th.

A Year of Digital

Digital TV has been with us for just over a year. SkyDigital started it off in June 1998, quietly at first while the system was being tested. There was then a build up as extra channels were added, the first month of full operation being October 1998. ONdigital's services were launched the following month. In the earlier stages a shortage of set-top box held things up, but the public showed a reasonable degree of interest in digital TV. Then, in May 1999, the 'free' STB offers started. Both broadcasters were desperate to establish a healthy viewer base, in particular before the cable companies started to go digital – this is only just beginning to happen.

The subsidised boxes have been a great success. They would be. The public is not slow to see a bargain and go for it. As a result the digital broadcasters have achieved their viewer projections, though at huge cost. Was that necessary? Probably not. But it did have a fearsome effect on our business, the repair trade – for analogue receivers in particular. What's the point in having a repair carried out if you can get the latest technology for the price of a subscription? Inessential repairs – say to all those bedroom and kitchen portable TVs – were put off while viewers worked out for themselves what to do about digital, or simply waited to see how things would develop. The low cost of much new TV and video equipment hasn't helped the repair trade either.

Lack of business has prompted many to change jobs. The situation is unlikely to improve much while the public is stocking up on new equipment. But there's a good chance that repair work will eventually increase again. After all TV sets remain basically the same whether digital or not, they simply have a different front-end. A power supply, scanning, tube drive and audio power circuitry are all still required, and these are the areas where the vast majority of faults occur. A micro-based control system is also required. Though far less troublesome than power circuitry, this can be the cause of a fair amount of servicing work.

As long as there are power supplies and suchlike, the work will keep coming in. Will non-CRT displays make a difference? They will remove the need for scanning in the traditional sense, but any changeover to plasma-type displays seems a long time off. They are still very expensive and, worse, the life span is limited. In addition tube developments continue and the CRT can provide really excellent pictures. The problem for the repair trade is that an increase in its work load will take some time to develop. And the problem for viewers is that once the new equipment is out of guarantee and beginning to play up there could be few service personnel left to carry out repairs. In particular we are seeing an alarming decrease in the number of new entrants to the trade. They see better opportunities elsewhere.

Those who can stick it out will see a gradual increase in their workload. Meanwhile the shops will be doing well. An interesting aspect of new receiver trading was highlighted at a recent conference held by the Digital TV Group. Steve Dowdle of Sony summed it up cogently in asking whether the emphasis on extra channels had been overdone. There are many viewers who are perfectly happy with a limited selection of channels – provided programme quality is maintained. They are not particularly interested in becoming pay-TV customers. But they will have to be persuaded to change to digital if the analogue switch-off is to take place say in 2010 – or at least equip themselves with decoder boxes. Steve suggested that, in particular, the lack of conditional-access modules is holding back the move to digital. But the broadcasters are, understandably, not all that interested in encouraging open-standard TV equipment that can be used to receive their competitors' services. The ITC is bringing pressure to bear to force the pace of side-car module development and production, and the move by the BBC, Channel 4 and Channel 5 to set up a viewing card service (see Teletopics last month) should help.

At some stage the demand for repair work will increase. Electrolytic capacitors, which are essentially 'compromise' components, don't seem to improve, nor does the quality of setmakers' soldering. Transformers will continue to break down, and for some reason surface-mounted transistors have proved to be prone to failure. Someone will have to continue to wield the soldering iron. At the end of he day it could turn out to be similar to the 405/625-line changeover, though rather more dramatic.

The advent of interactive services will be another source of increased work for the trade, certainly on the installation side. They might also give rise to a lot of extra user problems, making the life of field engineers interesting to say the least.

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REED BUSINESS INFORMATION

What a Life!

A collection of TV sets this time, with weird and wonderful faults and owners. Donald Bullock's servicing commentary

A shady-looking customer came in with a 10in.Bush CTV100. He placed it on the counter and tapped it with his finger.

"This set. It's very annoying. When it is going it's stopping, and when it is stopping it's going. My wife is upset too. She is getting very tired of it. And I am in agony with my brother."

"Right" Paul said, "what name is it?"

"Mustafa Norange" the man replied.

Paul made a note and the chap departed.

"Funny sort of name, funny sort of fellow" Paul said when he'd left. Paul tried the set, which seemed to be all right. He tapped about, but it continued to work. So he took the back off and had a good look at the chassis. As there were no obvious dry-joints or poor connections, he put it together again and left it on test.

More Nutters

Then Mr Beezer staggered in with a 25in. Goodmans set, Model 2575 (F11 chassis). He bumped it on to the counter, just missing my hand as I whipped it away.

"Phew" he exclaimed, "en't as young as I was. These things be heavy. And hard to keep a grip on. Like trying to carry a giant greased pumpkin they be."

"What's the trouble?" I asked.

"Well, it's like you can't hold 'em properly. They keep slipping see."

"The set" Paul broke in patiently.

"Oh, the set. Keeps going off. And when it does, all we hear is whining."

"Not surprised" said Paul, "must be very upsetting." He plugged the set in and it worked all right.

As Beezer left, Paul looked from one set to the other. "Just fine!" he exclaimed, "two sets brought in and there's nothing wrong with either of them."

At that an odd-looking fellow strode in. There was a sort of grin on his face.

Paul smiled back. "Can I help you?" he asked.

"Name's Weatherspoon. Maddening it is. Brought my set in a month ago. It was cutting out. You fiddled about with the mains plug while I waited. Said it was a wire nearly off and that there was nothing wrong with the set."

He smiled but was beginning to sound rather hysterical. Paul looked a bit frayed. "I don't see a job card here" he said, "what did we charge you?"

"Nothing" Weatherspoon said. "Now I've had to bring it back. It's totally maddening. You must have put a different fault on it. Picture's too short."

He strode back out to his car and returned with a 21in. Toshiba set, Model 2100TB.

Paul plugged it in. The picture that appeared was a couple of inches short at the bottom, and there was a liney gap at the top. "You've a frame fault here" he said, "nothing to do with the plugtop."

"Funny it happened after you'd fiddled with it though. Gets my goat, this sort of thing."

As he strode off he almost knocked over little Mrs Pugh, who was bringing in a Matsui colour portable.

Grundig CUC7301 Chassis

"So you've had old Weatherspoon in" she said. "Troublesome man if ever there was one."

"Oh, I don't know about that" Paul replied, "he seemed a bit sharp but said it all with a grin."

"That was no grin" said Mrs Pugh, "he tripped over his cat a year ago and damaged a nerve in his face. It's left him looking like that."

I asked her what the problem was with her set – a 14V1R (Grundig CUC7301 chassis).

"Dead as a doornail" she replied, "except for the standby light flickering. But if you leave it plugged in and switched on for half an hour it starts up."

I seemed to remember having had this problem before. After removing the back I made for C667 (100μF, 35V), which is the reservoir capacitor for the UC3842A chopper control chip's supply. The voltage across it was low at only 3V. I applied heat to it from a hairdryer for a minute or two, then the set started up. The voltage across the capacitor was now about right. Clearly its value was temperature dependent. A replacement restored normal operation.

Servicing Session

Meanwhile Paul had taken the back off the Toshiba 2100TB and was checking around in the field output stage. It didn't take him long to find that C317 (2·2μF) in the feedback circuit was leaking. He fitted a replacement and tried again. There was now full field scanning.

"Weatherspoon's set done anyway" he said, "we might see a grin on a grin when he comes back for it."

Then the Bush CTV100 started to crackle a bit. Before long it was going off and on. Paul removed the back and tapped around. He found that there was a gap between the 3·15A DC fuse FU651 and its holder. "Wonder is that it worked at all" he said. After tightening the fuseholder he left the set on soak test.

Shortly afterwards the Goodmans 2575 clicked off and started to whine. When Paul removed the back it came on and stopped whining. He tapped about a bit but couldn't instigate the fault. So he boxed the set up again. Just as he finished, it started to play tricks again. This time he left it. Eventually it died and stayed like that, whining away.

Steven came in and saw it. "Had a couple of them last week" he said, "both whining and intermittent at first, then dying altogether."

In one set the cause had been the TDA4601 chopper control chip IC14. In the other it had been the resistors in the start-up circuit, the associated 100µF capacitor C102, and the chopper transistor's base drive coupling capacitor C103, also 100µF. He'd decided to replace all these items in both sets. Paul set about the same routine, and before long the set was working a treat.

The soak-testing Bush CTV100 then started to play up. It crackled and blinked, then died.

Paul looked surprised. "Thought I'd fixed that fuseholder well enough" he commented. He opened the set up and had another look around. There's a second fuse, FU631 (1A), in the AC feed to the mains transformer T631. Its fuseholder also had a wide gap and a loose fuse. The set was OK once this fuseholder had been tightened.

Steven had been ordering spares. He looked up. "Had several of those Bush sets with fuseholder problems" he said. "They're cheaply made and seem to give a lot of trouble. I'll look about for better replacements that fit the panel. We'll probably be needing them."

Strange

"Joo mend tellys?" asked an unusual, deep voice. I turned around and saw a strange apparition. Bristly chin, skirt and high heels. With a cigarette on the go.

"We try" I smiled. All I got was a scowl.

"This 'un's dead" was the reply.

It was a 14in. Sharp set, Model 37AT25H. "Name?" I ventured.

"Strange. Mr Strange – Nancie."

The set's owner minced off. I couldn't work out the customer, but soon sussed out the set. It was the usual trouble – the start-up resistors R704 and R705. They are both 560kΩ, rated at 0·5W. Both were high in value. In fact R704 was almost open-circuit.

A Philips G90

All we saw of our next customer was a small face in the centre of a huge, bushy black beard. He was carrying a 21in. Philips colour set, Model 21GR2550 (G90AE chassis), which he placed on the counter. He then pulled his face into a smile and beamed intensely at me.

"It is being faulty" he said.

"Right, name?" I replied.

"I am being Abdul Ahmed, and I am delightful to be here. This set is being dead."

I took a note of his name and he departed. Steven looked at the set and found that someone had tried to repair it with the Philips kit. This is quite complex and includes a number of surface-mounted devices. Whoever had attempted the repair had made mistakes but had gone ahead and switched on. The BUT11AF chopper transistor had exploded, and the mains fuse was a charcoal tube. There was terrible soldering.

Steven started by tidying up the soldering, then found that the 6·2V zener diode D6617 in the chopper drive stage was short-circuit. This was replaced, along with the other parts in the kit. The set was then gingerly started up, applying the mains supply via our variac. A raster appeared when the AC input was 60V, but at 100V or so the set began to trip, with the 95V HT supply pulsing between 30 and 40V. The cause was traced to R3668 (150Ω), a surface-mounted resistor in the overload protection stage that shuts down the chopper circuit. It was badly dry-jointed.

When Abdul returned we gently suggested to him that his set had perhaps been got at. He switched his grin on. "No, no. That is not being so at all" he said softly, "as soon as it was failing I was bringing it straight to you gentlemen."

We left it at that.

Murky Picture

A couple of huge chaps in gumboots carried in a 28in. Goodmans set, Model 2875. Another F11 chassis.

"Picture's sorta dark, murky red" said one.

"Bit like thee" the other one said to him. As we were raising a job card, he looked at me then at his friend, as though I'd reminded him of something. "Good beer at the Rose and Crown" he said, "'ad about fourteen pints the other lunchtime, and knew I'd 'ad 'em."

I looked at him sternly.

The set's picture was certainly very dark and red. Steven soon found out why. There was no blue gun output, and the green gun hardly worked either. The chassis uses a TEA5101A RGB output chip, with an external 68kΩ, 0·5W feedback resistor in each channel – R26, R28 and R29. One had gone high in value, one had gone very high and one was open-circuit. Steven replaced them all, fitting 1W resistors. He also noticed that the Nicam sound was crackling. The cause was traced to some bad dry-joints at the connectors on the Nicam board.

Paul looked a bit frayed . . .

A Tripping Ferguson

Paul decided to tackle one more set before taking a break. It was a 24in. Ferguson Model 59P7A (ICC5 chassis). The card said it tripped three times at start up. On test it did just that. After checking whether the HT was high he moved over to the line output transistor, which was short-circuit. As usual the cause was spikes created by dry-joints in the line output stage, particularly at the driver and output transformers.

Having fitted a new transistor and attended to the dry-joints Paul switched the set on. There was a bright screen with flyback lines. The cause was RV82 (10Ω) on the tube base panel. It's in series with the HT feed to the RGB output stages and seems to fail whenever there's a line output stage fault.

TELETOPICS

Mergers

The number of separate ITV companies has steadily decreased over the past decade, to the point where there are just three principal ones, Granada, Carlton and United. There is likely to be further consolidation with the announcement by Carlton Communications and United News & Media that they intend to merge. This would bring together Carlton's franchises in London, the Midlands and the South West and United's franchises in the South, East Anglia and the West Country. All in all the merged company would cover 65 per cent of UK households, leaving just two main players, Central/ United and Granada. In recent years Granada has acquired London Weekend TV and Yorkshire Tyne-Tees (a previous merger). In addition Carlton owns half of ONdigital while United has a 29 per cent stake in Channel 5.

Might the merger be stopped? At present, no single ITV company is allowed to control more than 25 per cent of national TV advertising revenue, nor is any single media company supposed to have a greater than 15 per cent share of TV viewers. The merged enterprise would quite likely breach both these conditions. But would the competition authorities step in? The Office of Fair Trading has already announced that it is to review the rules.

The proposed merger raises tricky questions and would involve a major clash of interests in the digital broadcasting field. BSkyB is unlikely to be happy at the prospect of all the major ITV companies being involved with ONdigital.

Meanwhile in the cable TV field the Department of Trade and Industry has referred NTL's bid for CWC to the Competition Commission. Stephen Byers, Secretary of State for Trade and Industry, decided to overrule advice from the Office of Fair Trading, saying that a reduction in the number of major cable companies from three to two could affect the pay-TV market. Will he be happy with the prospect of a similar reduction in the number of ITV companies?

In the satellite broadcasting field the French utility company Vivendi's acquisition of a 25 per cent holding in BSkyB has also been referred to the Competition Commission, because it raises concerns about film and sports rights and conditional access technology.

Consolidation in the broadcasting field in the UK has been justified on the grounds that most UK companies are small in comparison with many international media organisations. Somehow this doesn't sound all that convincing.

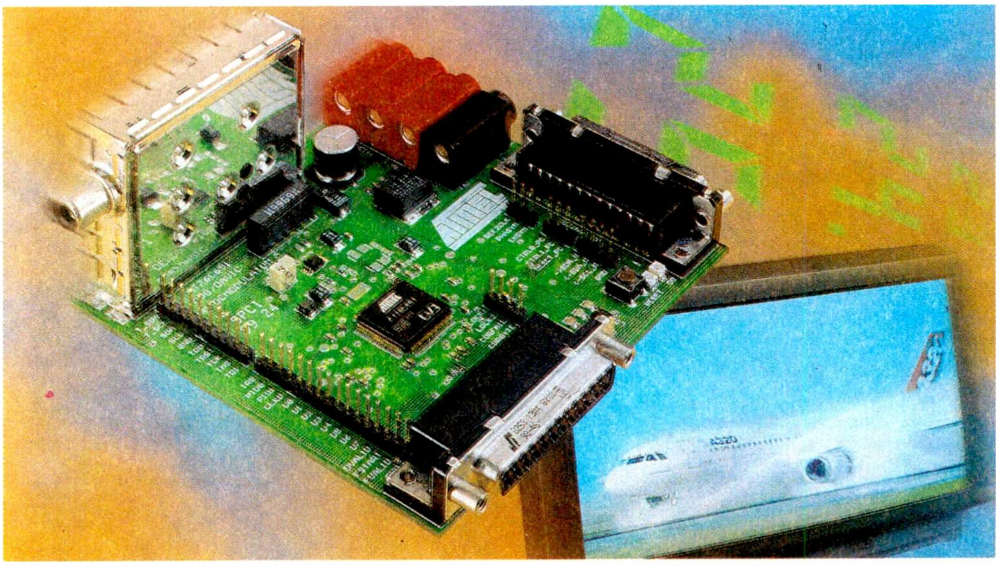
DVB selects Java

The Digital Video Broadcasting (DVB) project, which sets digital TV standards in Europe, has selected Java software technology for its interactive TV standard. This decision will enable the DVB Multimedia Home Platform (MHP) specification to be completed in early 2000. The software will link the worlds of broadcasting, telecommunications and the internet.

CWC Expands Digital Cable Operations

Cable & Wireless Communications has extended its contract with Pace Micro Technology for the supply of digital set-top boxes, bringing the total order to 300,000 units. The boxes will be used in the continued roll-out of CWC's digital services, which were launched in the North West earlier in 1999.

The boxes being supplied to CWC are the world's first to incorporate a DOCSIS (Data Over Cable System Interface Specification) compliant cable modem. The modem, developed by Cisco Systems, enables cable operators to provide a new generation of interactive services such as e-mail, e-commerce and home shopping, gaming and internet access. CWC has already launched a range of features that include e-mail via the TV set and an initial selection of internet-based interactive sites: others such as interactive games are due shortly. In addition viewers can connect the set-top box to a PC, using the cable modem for access to high-speed internet services. RAC and Carlton Online are working with CWC to develop on-line entertainment and travel services. CWC's digital cable service has already attracted over 46,000 customers. The company says it is on target to make digital cable available to 3·1m homes by March, two thirds of those in its franchise areas.



Atmel has introduced the AT76C651 QAM demodulator chip for use in TV set-top box front ends. It can be used for satellite TV, cable or MMDS reception, providing an MPEG-2 bit-stream output for decoding. With less than 0·5dB degradation in the 256-QAM mode and a locking time of less than 10µsec, up to four additional TV programmes per channel can be used. An advantage for the viewer is very fast channel switching.

News from Pace

Several developments have been announced by Pace Micro Technology, including a set-top box with a built-in hard-disk drive and a hand-held scanner that can be used with an STB, TV set and modem to order groceries. The scanner, called the Shopping Mate, should be available in about eighteen months time. It will have a touch-sensitive screen and a bar-code scanner to record items ordered, sending the order by e-mail.

The STB, which has been developed in conjunction with News Corporation subsidiary NDS, is currently code-named XTV. It can record up to twenty hours of programming on the hard disc. Future versions could store vast numbers of video games or shopping catalogues to avoid having to resort to the internet. The XTV could learn viewer's habits, so that it would automatically record say the final instalment of a four-part series.

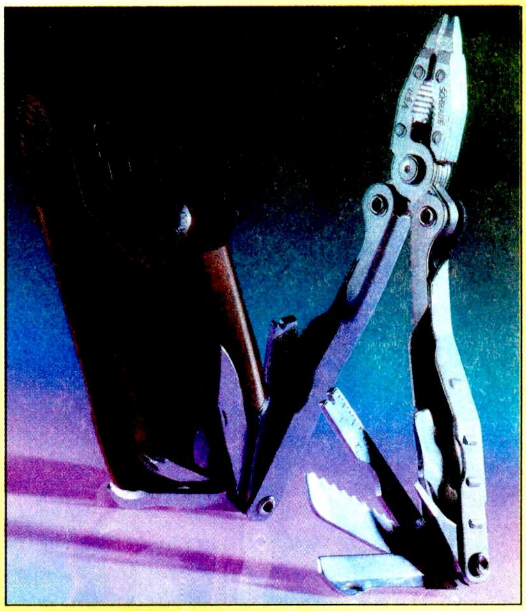
Pace has been awarded a contract to supply a minimum of 750,000 STBs over a three-year period to Time Warner, which will use them to provide digital services to its US cable subscribers. This is Pace's largest order to date, and marks a breakthrough in the USA. Time Warner has 13m US cable subscribers, and is upgrading its networks.

Consumer Products

Currys has introduced a Matsui-brand IDTV receiver with a 28in. widescreen CRT, Dolby Pro-Logic surround sound and Fastext at £599 including an ONdigital subscription. It enables viewers to receive the current nine free-to-view digital channels: purchase of an additional smart card provides ONdigital pay-TV channels.

A new digital camera, Model PDR-M5, from Toshiba can record up to 16 minutes of standard video in addition to still pictures. It has 2·14m pixel resolution and can provide 3x optical and 2x digital zoom. The new digital processor chip used has a boot-up/between shots time of less than 4secs. Battery life is increased, enabling users to take up to 240 shots before recharging. The camera comes with an 8Mb SmartMedia storage card and a high-speed USB interface for use with Macs or PCs. The camera can be linked to a TV set or VCR, providing a PAL video output. Cost is about £650.

Imerge Ltd. is to present a range of hard-disk based audio and video products at the January CES in Las Vegas. The Imerge SoundServer for example can store thousands of tracks of music, with playback to suit your mood (one button push can provide a personal music channel, with music selected randomly to a chosen theme in terms of artists, genre etc.). The same VirtualDJ software enables VisionServer to record programmes to your choice, providing a virtual TV channel. Imerge Ltd. is based at Harston, Cambridge CB2 5NH. It can reached on 01223 875 265 or e-mail info@imerge.co.uk or check at www.imerge.co.uk



Farnell is distributing this Schrade Multi-tool, which is made of 100 per cent stainless steel and has twenty one different implements and functions. There's a variety of blades for a wide range of cutting operations, and the plier jaws have riveted interlocking construction for maximum strength. It is listed in the Hand Tools section of Farnell's Industrial catalogue. For further information phone 0113 213 2828.

ARD Extends Range

Since its launch in March 1999, electronic components distributor A.R.D. has extended its already huge range. The company now supplies manufacturers' original components for products from Toshiba, Pace and LG (GoldStar). A.R.D. operates from a new custom-built 28,000 sq.ft warehouse at Accrington, Lancashire. A 600-page, easy-to-use trade catalogue is available free to registered customers. Delivery is free on orders over £30, and there's same-day despatch.

Trade customers can easily register via A.R.D.'s web site at www.ard-plc.co.uk

New account customers have £250 credit from day one and ten per cent off their first order. Payment can be by cheque, cash or most credit cards. A trade counter is open daily, including Saturday mornings. A.R.D. can be reached on 01282 683 000 – or fax 01282 683 010.

ITC orders IDTV upgrade

ONdigital has been told by the ITC that the commission expects it, in accordance with the terms of its licence, to ensure that plug-in conditional access modules for upgrading free-to-view integrated digital TV receivers are made available by May 2000.

ONdigital has already developed an integrated CA module with one TV manufacturer, but the ITC wants consumers to be able to use open-standard sets, also interoperability with satellite services.

The ITC recently extended the timetable for ONdigital to start audio description services.

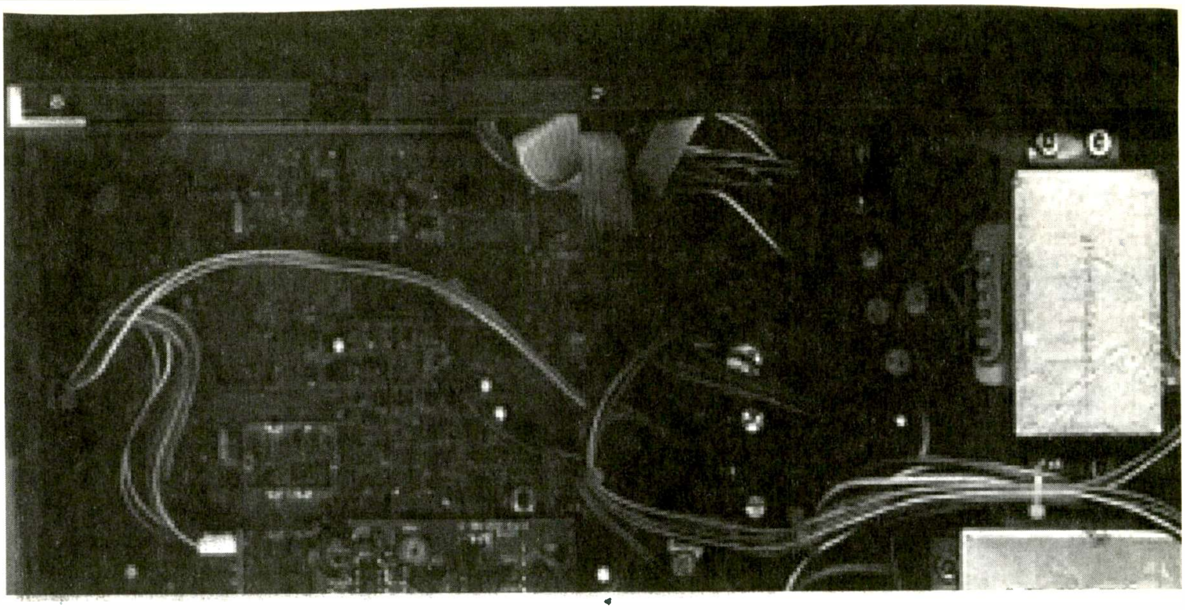
Interactive TV

Flextech Interactive has announced a partnership with Open, creating five new shops for TV viewers. The first will be UKTV Shop, featuring BBC books and merchandise, and ScreenOne, offering CDs, books, videos and ticketing. The agreement includes an option to provide Screenshop for domestic and household items and TV Travel Shop.

Gameplay has joined forces with Open to create Europe's first TV-based specialist games shopping service. Viewers can choose from a selection of eighty games titles.

CAI Directory

The Confederation of Aerial Industries Ltd. has redesigned its list of members as a ring-bound, hard-wearing directory which will be issued twice yearly, in April and October. Cost to members is £6 plus VAT, to non-members £20 plus VAT. The CAI is located at Fulton House Business Centre, Fulton House, Wembley Park, Middx HA9 0TF, phone 0181 902 8998, fax 0181 903 8719.



Satellite Notebook

Reports from Hugh Cocks and Christopher Holland

Digibox Software Problems

One of our customers had been out of the country for several months and had left his digibox switched off while he was away. Fortunately he hadn't signed an interactive discount contract, which requires the digibox to be on at all times. He'd had problems in the past with electronic equipment being damaged by lightning via the telephone line, and didn't want his digibox to suffer the same fate – even though it involved paying extra for the installation.

The digibox started to boot up when it was reconnected to the mains supply and the dish, but before a signal could be received the menu broke into random squares and there was no response to remote-control commands. Unfortunately there had been several over-the-air software upgrades in the owner's absence. The box needed a forced upgrade before normal operation could be restored – it was living in some sort of electronic limbo land!

To be sure that there were no other problems, I wanted to see a normal working TV channel prior to the upgrade. This can be done by going to the 'add channels' menu, finding Sky News at 12,070GHz H, and storing it as an extra channel. But the box crashed as soon as it received a live signal from Astra 2A, so devious means had to be adopted to store the channel.

With the IF input disconnected, I entered the frequency and polarisation in the 'add channels' menu then started the search by highlighting 'find channels' and pressing 'select' on the remote control handset. Once the search had started I quickly reconnected the IF input – if you are too slow about this, 'no signals found' will be seen. Sky Cinema, Sky News and Cartoon Network + were found, but it was only necessary to store Sky News.

Once the channel had been stored, to be on the safe side I disconnected the IF feed again, went to the 'other channels' menu and found Sky News. The receiver said that no signal was being received: when the IF input was reconnected there was a good Sky News picture. But the box still wouldn't respond to any remote-control commands.

Safe in the knowledge that the digibox was basically operational, I disconnected it from the mains supply. To force a software upgrade, hold in the 'backup' button on the front panel and apply the mains voltage. After a few seconds the LEDs on the front panel will all light up. If the digibox is connected to the TV set via a scart lead, there will be a rather stern message warning you not to disconnect it from the mains supply or satellite dish during the approximately ten-minute upgrade period. No message will be seen if the receiver is connected to the TV set via only its UHF output.

Once the upgrade had been completed the receiver behaved impeccably. Next time its owner goes away for some time, which he does fairly frequently, he will leave it connected to the mains supply! **C.H.**

Pace Menu Problem

A Pace MSS100 receiver was brought to us by a local dealer who rents TV sets and the odd satellite system to tourists during the summer months. Not having much experience of satellite equipment, he was confused by the fact that the signals seemed to have disappeared though another receiver worked perfectly well with the same dish and LNB.

I soon found the cause of the trouble: universal LNB had been selected as normal in the installation menu, and most of the channels had been set to high band with a 22kHz tone on the LNB's supply. The LNB thus moved to the 11·7-12·75GHz digital band and all the analogue receiver did was to display the familiar blue "no signal" message.

To save time I reprogrammed the receiver via the Pacelink PC reprogramming system, then locked the menus with a pin number so that a tourist would find it much harder to get to the menus and fiddle with the settings! **H.C.**

Dead Pace MSS200

This MSS200 receiver had a power supply fault: there was no front panel display, and a vague 'pinging' could be heard.

As the chopper transistor measured OK I replaced the mains bridge rectifier's 47μF reservoir capacitor together with the two 10μF and one 22μF capacitor on the primary side of the power supply, also the large electrolytics on the secondary side – they were originals and looked rather the worse for wear. Unfortunately this made no difference! Checks on the usual resistors and diodes on the primary side of the power supply revealed nothing amiss, and there were no short-circuits on the secondary side. When an external supply was used to power the receiver it sprang to life.

Whilst turning the PCB upside down I heard a vague 'clunk'. On inspection I found that the lower section of the mains transformer's ferrite core was loose and had moved off the bottom of the PCB, hitting the upper section – this would have been its normal position. When the receiver was powered up with the board in the upside down position there was normal operation. But, with the two core sections separated, the transformer wouldn't have been very efficient at the operating frequency. Hence the pinging when the power supply tried to start up.

The two halves of the core are normally glued together, but little glue seemed to have been used when the transformer had been assembled. Why the core took some four years to separate is another question: maybe the receiver had been knocked by something.

I removed the transformer from the PCB and applied a small amount of glue to the ferrite core sections to hold them together. This restored normal operation. **H.C.**

SkyDigital Package Additions

The analogue test pattern at 12·324GHz has been removed – there is currently no analogue signal to serve as a tuning guide. Two channels have been added, TCM Films at 12·051GHz V and Adventure One at 12·324GHz V, EPG numbers 327 and 540 respectively.

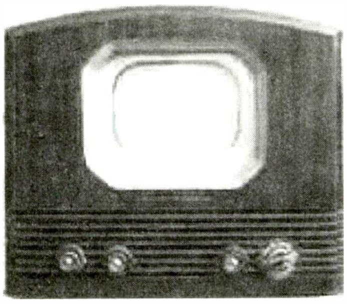
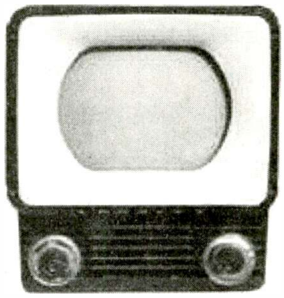
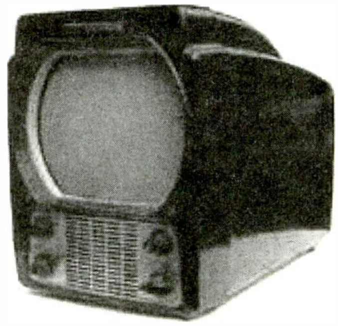
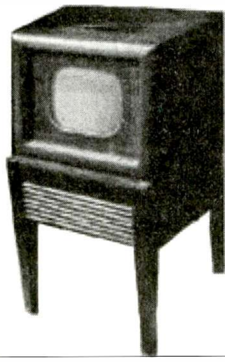
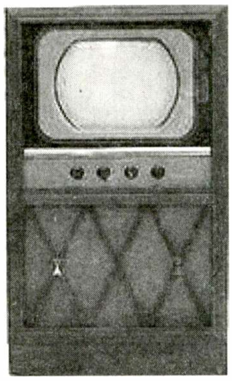
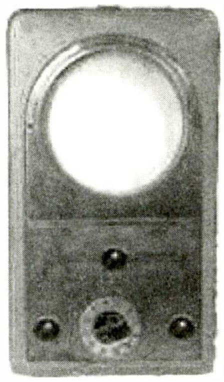
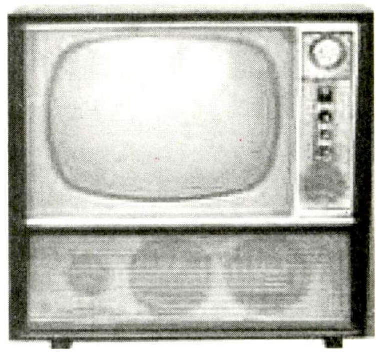
Virgin Radio, XFM Radio, Capital Gold Radio and Talk Radio are being tested at 12·324GHz V. Talk Radio is encrypted but the other services are currently in the clear, so any MPEG-2 digital receiver will pick them up. BBC Radio 1, 2, 3, 4 (longwave and FM variations), 5, Radio Wales, Radio Ulster and World Service are being tested at 11·798GHz H. The radio stations are expected to be added to the EPG on channels 901 upwards, starting about November 20th.

A newly activated transponder at 12·382GHz H is in operation with transmissions of some channels already in the Sky Package plus Eurosport (ch. 419) and Fox Kids (ch. 610), which have been moved from 12·246GHz V. Music Choice at 12·188GHz V is to transmit a Christmas Music channel again this year, expected to be on ch. 850. **C.H.**

Faulty Diplexer

I was recently called to a three-year old Pace MSS100 receiver that displayed the 'LNB short-circuit' message. Not surprisingly the co-axial feed from the dish produced a very low-resistance reading when I checked it with my multimeter. The LNB was not to blame however, the short-circuit being somewhere else along the cable route. I found that there were two UHF/satellite IF diplexers, one upstairs to feed a bedroom TV set that was adjacent to the dish site. The upstairs diplexer was in the bedroom, out of the way of the elements.

There was no difference to the short-circuit when the downstairs diplexer was disconnected: the culprit was the one upstairs. Both units were of far eastern origin. The cause of the problem turned out to be a Phillips screw that held the diplexer PCB to the metal case. It was just touching a printed-circuit coil that was in series with the LNB supply. As the two units were poorly constructed I decided to replace them both to avoid a repeat performance. It's strange how the short took several years to show up, especially as the LNB's supply voltage be would either 13V or 17V for vertical/horizontal polarisation. **H.C.**

As we greet the new millennium, it seems appropriate to take a look at one of the most noteworthy features of the Twentieth century, the development of TV. Alastair Carruthers tells the story, from the earliest days to digital TV via satellite

A Century of TV

Television means seeing at a distance. It is something we take for granted, a part of almost everyone's daily life. When did it start? This is not as easy a question as you might think, since many people carried out research and development work over several decades before TV became a practical proposition. And it depends on what you mean by seeing at a distance: this varies from primitive forms of fax to today's high-definition, full-colour displays transmitted in digital form via satellite, terrestrial broadcasting networks and cable. The antecedents go back a long way in time, to well before the start of the twentieth century. Nevertheless TV as we know it has been a result of twentieth century innovation.

Antecedents

Photography dates from around 1839, with the work of Fox-Talbot, Daguerre and others. It had become well-established by 1850. Telegraphy had been proposed in 1837, by Wheatstone and Cooke, and was a practical reality by the middle of the century. It's not surprising that some people started to think about putting the two together: why not send pictures by telegraph? To do so, two things were required: a method of converting light values into an electrical signal, and a way of scanning the picture to convert it into a series of light signals. Some sort of display could be devised by reversing the scanning process and modulating a light source.

The first requirement was met with the discovery by John May, in 1873, that the electrical resistance of selenium was light-sensitive. He had been carrying out work on cable transmission, and noticed that the readings obtained with his measuring equipment, which compared the resistance of copper cable with a length of selenium, became erratic in the presence of strong sunlight. That was to lead to the photoelectric cell.

An early form of fax scanning had been devised by Alexander Bain in 1842. He used a row of metal brushes to scan some raised metal type, their output being linked by wires to a second set of brushes in contact with a moving roll of light-sensitive paper. In this way letters were successfully transmitted. In 1862 the Abbé Caselli successfully transmitted a picture by wire between Amiens and Paris: he used a tiny light bulb fixed to a moving carriage to scan the picture, the reflected light being directed to a photocell. Shelford Bidwell in 1881 used a box with a small hole at the front and a selenium plate at the rear to scan a photographic slide. His equipment was widely demonstrated.

These forms of scanning were suitable for use with still pictures, but would be hopelessly inadequate if a moving picture was to be transmitted. In 1880 Maurice Leblanc proposed a method of scanning that used two oscillating mirrors, mounted at right-angles, to scan an object. This was made to work, but was extremely difficult to implement. As a simpler alternative, in 1882 Atkinson came up with the rotating mirror drum.

A more promising system for mechanical TV however was the scanning disc, thought up by the Russian engineer Paul Nipkow, who took out a German patent for a "television machine" in 1884. It was to be the basis of Baird's work in the Twenties and early Thirties.

Others, including Dieckmann in Germany, experimented with the use of scanning discs. The Nipkow disc had a series of small holes in it in the form of a single spiral. As it rotated, these holes scanned the image behind the disc – from top to bottom. At the receiving end the viewer's eye integrated the scanned samples. This relies on a phenomenon known as the persistence of vision. The eye retains an image for about a fifteenth of a second: if the picture is changed at a higher rate, a moving picture is seen. This is of course the basis of all television.

One other item that plays a vital role in TV had been devised by the start of the twentieth century. This was the cathode-ray tube, developed by Karl Ferdinand Braun in 1879 as a cold-cathode device for research purposes – it could scan out patterns, using electrostatic deflection. Work on the CRT continued, and by 1906 Braun had devised a tube with a hot cathode and an electrode whose voltage could be varied to alter the brightness of the display. It had, in fact, become a possible means of providing a TV display.

Early Proposals

Although the theory behind TV as we know it was emerging by the turn of the century, the technology required was still far off. After all, the thermionic diode detector was patented only in 1904, by Ambrose Fleming, and the triode valve in 1906, by Lee De Forest. Ideas were nevertheless forthcoming.

Boris Rosing, a lecturer at the St. Petersburg Technical Institute, published a proposal in 1907 and obtained a British patent for it. The camera end was mechanical, using two mirror drums for vertical and horizontal scanning, with a selenium cell to generate the video signal. The significant feature however was the use of a modulated CRT to provide the picture at the viewing end. Deflection was to be electromagnetic. In every respect this was far in advance of Baird's ideas almost two decades later. Rosing is reputed to have demonstrated his system in the laboratory: he also developed a more sensitive form of photocell.

It seems that at about this time Dieckmann in Germany had devised and built a system with a scanning disc at the transmitter end and a CRT to provide the picture. Little is known about his apparatus, though a picture of it is in existence.

In 1908 A.A. Campbell Swinton expressed the opinion, in a letter to *Nature*, that to be a practical proposition television would have to be electronic at both the transmitting and receiving ends. In 1911 he presented proposals in greater detail in a lecture to the Röntgen Society. Fig. 1 shows the scheme. He is reputed to have done some work on it, but didn't succeed in getting the system to work. Basically two things were missing: a light-sensitive camera tube target, and a method of providing sufficient amplification to drive the display tube.

Things seem to have come to a temporary halt at about this time. World War I was hardly the time to be pursuing a technology that didn't have any immediate practical application. All effort went into radio communication, which led to the start of regular broadcasting in the early Twenties. Television was just something that might be feasible, with transmission via cable.

The Twenties

The name most closely associated with TV in the Twenties is John Logie Baird. He was an electrical engineer by training, and as a student at Glasgow University had been fascinated by the work of Nipkow and others on mechanical TV. After various business ventures that

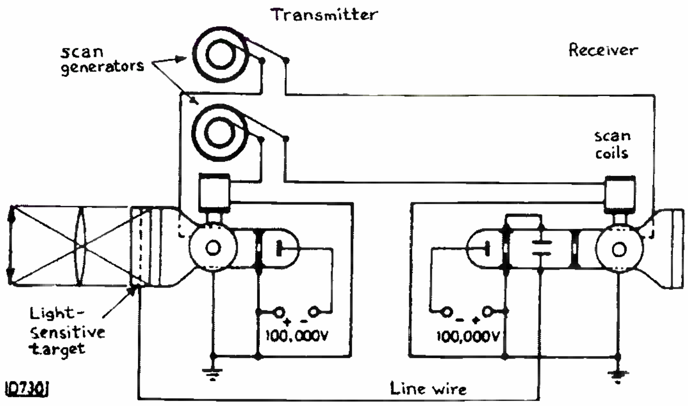


Fig.1: A.A. Campbell Swinton's 1911 proposal for an all-electronic TV system.

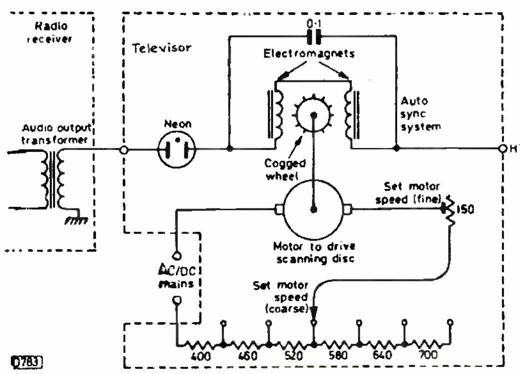


Fig.2: Circuit diagram of the Baird Televisor Produced by Plessey in the early Thirties.

seemed to bring him little success, he settled in Hastings in 1923 and resumed experiments with mechanical TV. He had little money with which to finance his research, but plenty of flair and determination. He got a mechanical system going, and in 1925 gave some public demonstrations at Selfridges in Oxford Street – Gordon Selfridge considered it good publicity for his store, and provided some backing. What did the public see? The picture was strictly black and white, roughly 2in. by 1·5in. in size, had 16 lines and a repetition rate of five frames per second. Transmission was achieved over a few feet of cable. The demonstrations were of still, not moving, pictures. Later that year Baird further developed his system and achieved a grey scale. He had to raise further funds if his work was to continue, and could do so only by demonstrating progress publicly. In 1926 he invited members of the Royal Institution to a demonstration at his Soho laboratory. A report in *The Times* the following day gave him a much-needed publicity boost.

Baird went on to refine his systems. There are few technical details, because he was much concerned about commercial confidentiality and let little out. But he went on to increase the number of lines, to adopt flying-spot scanning (mirror-drums), and to use MW radio for transmission. A demonstration radio transmission between London and Glasgow was achieved in 1927, and from London to New York in the following year. In 1928 he patented a sequential colour TV system. In 1930 his company started to sell televisors, which were made by Plessey, and the BBC was persuaded to provide experimental transmissions of his 30-line system. In all about 1,000 Baird televisors were manufactured and sold. Sound was transmitted separately. Receivers

Fig.3: An off-screen photo of Baird 30-line mechanical TV.

were also sold by various companies in kit form – how many, no one knows. But mechanical TV was severely limited: in 1934 the 30-line transmissions came to an end – there had never been anything approaching a regular, scheduled service.

Fig. 2 shows the circuit of the Televisor. There's not a valve in sight, unless you count the neon tube, which was simply connected to the MW radio receiver's audio output transformer. The modulated output from the neon bulb, of a brownish hue, was scanned by the Nipkow disc and viewed through a magnifying lens. There was an auto-sync system, which worked after a fashion – the 30-line transmissions didn't include sync pulses. Fig. 3 gives an idea of reception quality. You had to set the motor speed and framing each time the televisor was switched on.

More important developments were in progress in the USA, though industrial secrecy again makes it difficult to ascertain precisely what was happening. The important point is that Philo T. Farnsworth, who filed an application for an all-electronic TV system in 1927 and provided a laboratory demonstration in 1929, and Vladimir Zworykin, who had been a student of Boris Rosing, both carried out development work on electronic camera tubes. The Farnsworth tube came to be known as the Image Dissector, the Zworykin tube as the Iconoscope.

The Image Dissector made use of a photocathode, which emitted electrons when light was focused on it (the phenomenon of photoemission had first been noted by Heinrich Hertz in 1886). The electrons were attracted to the far end of the tube, where a plate with a small hole in the centre was placed. This very wide beam of electrons was made to scan the plate by electromagnetic means. The small sample of electrons that passed though the hole provided the video signal. The problem with this device was its lack of sensitivity – the signal output was minute. To overcome the problem, Farnsworth subsequently added an electron multiplier.

Zworykin applied for a patent for what was eventually to become the Iconoscope in 1923 – because of legal difficulties, the patent wasn't granted until 1938. He was at the time working for Westinghouse Research Laboratories, and subsequently continued his work at RCA. The advantage of the Iconoscope over the Image Dissector was its much greater sensitivity, because of the use of electron storage. The scene was focused on to a target layer, which was scanned by an electron beam. Charges were thus stored between each scan, hence the increased sensitivity. A connection to the target layer provided a serial video output as the scanning progressed.

The strange thing is that, again under great secrecy, a camera tube that was almost identical to the Iconoscope was being developed by a team at EMI in the UK. It became known as the Emitron, and was developed between 1929 and 1932: production of a successful tube seems to have been achieved just ahead of the Iconoscope.

Development of the Iconoscope/Emitron was a considerable feat: the target layer in particular was a problem – how to make it, what to make it of, and how it actually worked!

The Image Dissector and the Iconoscope-type tube were both successful devices. But whereas the Iconoscope/Emitron type tube came to be widely used in the early days of TV, the Image Dissector was used mainly as a high-quality scanner for still pictures.

The Thirties

The Thirties were when TV really began to happen, which in practice meant the advent of electronic camera tubes. All-electronic TV was being developed in the UK, the USA, Germany, France and other countries. The first regular, scheduled TV service anywhere was started in the UK by the BBC in August 1936. By then EMI had developed a complete system with 405-line, 50Hz interlaced field scanning; Baird had continued his work and had an alternative 240-line system. Which one to use? The government couldn't decide, and set up the Selsdon Committee in May 1934 to decide. The Committee couldn't decide either! As a result, when broadcasting started it was dual-standard, with the EMI and Baird systems in use alternately. It didn't take long for the superiority of the EMI system to be proved: Baird's system was dropped in February 1937. The EMI system was more flexible. Baird still didn't have an electronic camera. To overcome the problem, he came up with the idea of the Intermediate Film Camera. The output from a cine camera went via the processing bath to be scanned by a mechanical television camera – this clumsy system had to be bolted to the floor, and didn't produce particularly good pictures. Although his system was dropped, Baird continued to carry out development work. Amongst other things he came up with a two-colour camera tube, the Telechome, in 1940.

The work of the Marconi company in developing VHF transmitters for TV was also vital in getting TV broadcasting started in the UK.

A fully-electronic 180-line system had been developed by Telefunken in Germany by the mid-thirties. It was used only for closed-circuit work, because the Nazi government wouldn't permit over the air TV broadcasting. By the end of the Thirties Germany was using 441 lines and France had started a 455-line system.

Why didn't TV broadcasting in the USA start until 1941? During early 1933 RCA demonstrated the first successful all-electronic TV system. The transmitter, W2XBS, was atop the Empire State building in New York. The system used 240 lines with sequential frame scanning at 24 frames per second. The video carrier was at approximately 45MHz, and the channel bandwidth was 2MHz. Much other work was being done, but RCA was out in front. This was the time of the great depression however. The radio industry wasn't making any money, and few potential viewers could afford sets.

RCA began regular broadcasts as part of a large-scale field test in June 1936, again from W2XBS but this time with 343 lines and 30 interlaced frames per second. The bandwidth was now 5·75MHz.

In June 1936 the Federal Communications Commission (FCC), which had been set up in 1934, began hearings on the use of the radio spectrum above 30MHz. There followed several years of dispute about TV standards. At the June 1936 FCC hearings the Radio Manufactures Association (RMA) proposed a 441-line standard with 30 interlaced frames per second and a 6MHz bandwidth. But at that stage no one had achieved 441-line TV! It wasn't until February 1937 that Philco was able to provide a convincing demonstration of 441-line TV. In 1938 the RMA revised its standard, the significant change being to recommend vestigial sideband transmission (a full upper sideband and a partial lower sideband), something that wasn't adopted in the UK until the immediate post-war period. The FCC still couldn't come to a decision on whether to accept the standard however.

In October 1938 RCA decided to bring pressure by announcing that it would start regular TV transmissions as a public service in April 1939, to coincide with the New York World's Fair. Several manufacturers produced sets, but sales were poor. By the end of 1939 fewer than 400 sets had been sold in the New York area.

Further FCC hearings were held in January 1940. There was disagreement at these on the RMA standard: Philco proposed a 605-line, 24 frames/sec system, while DuMont advocated 625 lines with 15 frames per second. The FCC procrastinated, and RCA continued its pressure. In the end, in mid 1940, the FCC said it would approve a standard provided the industry could agree on what it should be. This led to the NTSC (National TV Standards Committee) being set up. It re-examined the standards question thoroughly, and decided to back the RMA 441-line system with one alteration – FM was to be used for the sound channel. The FCC felt that 441 lines was inadequate, and in March 1941 the NTSC proposed an increase to 525 lines. This standard was finally approved in April 1941, and broadcasting started later that year.

By this time TV broadcasting in Europe had ended with the advent of World War II – though there were some limited services in Continental Europe during the war. After the war a 625-line system became gradually accepted throughout Europe, though France had an 819-line system for a time. It required a huge bandwidth, but the pictures were superb.

Colour

The next major development was colour. This takes us back to the USA again where, in 1948, CBS introduced an experimental sequential system and started to sell sets. Fields were transmitted in RGB sequence, a colour-filter wheel being used at the receiver in conjunction with a standard CRT. This was a failure. Because of the filter wheel the sets were bulky, the picture quality was poor, and worst of all the system was not compatible – those with monochrome sets couldn't receive the transmissions.

The NTSC was once more brought into action to adjudicate. It set a specification that work already done by RCA met. In effect a system devised by RCA became the NTSC system, which was approved by the FCC in 1952. Compatibility was achieved by using separate luminance and colour-difference signals (two), the latter being used to modulate a subcarrier in quadrature (the third colour could be obtained at the receiver by matrixing the luminance and two colour-difference signals). Monochrome receivers simply ignored the subcarrier and its modulation. Colour receivers decoded the modulation and derived three colour signals to drive the tube. The latter had by this time been developed by RCA, using ideas of its own and others. Its important feature was the shadowmask, which enabled the three beams to strike only screen phosphors of the appropriate primary colour – red, green or blue.

The system had one significant disadvantage. Because of the quadrature/phase modulation used for the colour subcarrier, phase shifts that occurred anywhere in the system caused a colour change at the receiver. Viewers were provided with a hue control to compensate for this. When the time came for Europe to decide on a colour system, modifications were introduced to overcome this deficiency. Hence the PAL and SECAM systems. Colour broadcasting started in the UK in 1967, and by that time UHF was being used for TV transmissions.

Recent Years

There is much that we have had to leave out in this brief look at the progress of TV, for example significant camera tube developments with, first, the Image Orthicon and subsequently the Plumbicon tube – not to forget the vidicon for CCTV applications – and the development of standards converters by the BBC and the IBA. The converters did much to lay the foundations of digital TV, by establishing how a video signal can be successfully converted to digital form and back again (to drive the tube), and be processed while in digital form. We can mention more recent developments only briefly.

During the late Sixties UK broadcasters started to make use of a few lines in the field flyback period for test and identification signals. They were called VITS – Vision Insertion Test Signals. Could the field flyback period be used for anything else? The answer was yes, and the service that emerged was teletext. This is a digital signal that can be stored in a TV set, decoded and used to produce screen displays of news and other information. The service started in the autumn of 1976, and the technique was subsequently adopted by many overseas broadcasters.

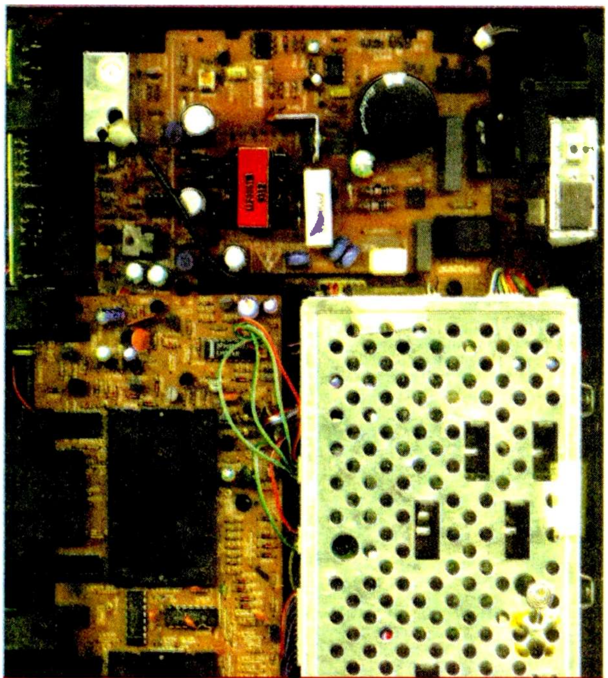
Engineers were also considering how to add stereo sound to TV transmissions. Several systems were devised, the UK opting for a digital approach, Nicam. The signal is modulated on to a subcarrier just above the mono sound one. Nicam transmissions started in 1990.

The first TV use of satellites was for distribution to broadcasters and cable operators. Experiments with DTH (Direct To Home) transmissions started at an early stage however, in particular with the ATS-6 satellite in 1975. The technology was soon proved, and in the UK regular broadcasting to TV viewers (Sky TV and BSB originally, then merging to form BSkyB) started in 1989/90. This took domestic TV into the SHF region, with dishes and LNBs. FM was adopted for the video signal.

Why not transmit the signal in digital form? This would have been unthinkable as recently as the Eighties, because of the wide bandwidth that would have been required. Rapid developments in signal compression in the early Nineties overcame the problem, by removing spatial and temporal redundancy (repetitive signal values, such as large areas with no detail repeated for a number of frames). Once the MPEG-2 standard had been developed and adopted it remained only to find spectrum space. That was not a problem with satellite transmission, rather more of a problem with terrestrial TV.

Then there's video, but this is a subject in its own right. For another time perhaps.

Satellite WORKSHOP



Jack Armstrong

BT SVS260

This model is almost identical to the better known SVS250, the only obvious difference being that it can store a few more channels. Copying the EEPROM's contents into a blank one and soldering this into an SVS250 gives an instant upgrade – pre-programmed EEPROMs are stocked by SatCure (01270 753 311).

The tall, grey-suited gentleman who brought this receiver in for repair wasn't interested in upgrades – and didn't even seem to mind about cost! "Sentimental value" he explained, "it was left to me in a will. Was never used but now won't work. Just dots on the front." He pointed to the front panel, which displayed three horizontal LED segments when I connected mains power to the unit.

When I pressed the up button repeatedly the channel numbers changed in the normal manner, but the three LED segments remained lit and there was no picture or sound – just snow on the monitor's screen. This was hardly surprising, as my meter showed that there was no LNB supply. "Leave it with me" I said, with what I hoped was a reassuring grin.

The man in the grey suit looked very sorrowful, and trudged out towards his tiny foreign car. It never ceases to amaze me that a six-foot tall man will chose to drive a tiny 500cc vehicle – or perhaps he had borrowed his wife's car while his Mundaneo was in for service?

The SVS260's cover screws were loose – worryingly so for a receiver that had "never been touched". Inspection inside revealed that the heatsink's screws were extremely loose and that the tuner's F connector was held in place only by virtue of its plastic base moulding. I was relieved to find that, despite the obvious hammer work, there was no sign that soldering had been undertaken. All the original components were present, correct and 'done to a turn'.

The tuner module looked as if it could be salvaged but, to save time, I fitted a working tuner from a scrap receiver that some cowboy had 'repaired' in the past. The three LED segments indicated that there was a problem with the 24C08 memory chip, so I put a new one in my Crownhill Associates Ltd. EEPROM programmer and loaded the contents from my PC. (Whenever I have a working receiver of a type I've not had before in the workshop I copy its EEPROM contents on to my PC's hard drive for future use. I'd be interested to know if anyone has a similar library of TV EEPROM files?)

Once the tuner and EEPROM had been replaced the receiver worked nicely, but the Sky programmes remained scrambled and there were no decoder messages. Another twenty minutes fitting the capacitors from Relkit 17 sorted out that problem.

When the tall gentleman in the grey suit returned next day in his little car I told him the good news. On hearing the cost he didn't, as most customers do, scream "*how much?!*" Instead, he reached for his wallet and commented on the weather.

"Bet you'll be glad when your own car is fixed" I said.

"Nothing wrong with it" he replied, looking a little bemused. "Served me well enough these past ten years. Does fifty miles to the gallon. Just as well really, otherwise I couldn't afford your hefty charges!"

He was out of the door before I could reply, folding himself back into his little vehicle. I'm sure the roof bulged upwards. "Putt putt putt grrk" it went crossly, looking for a gear – any gear.

Pace SS9200

I'd not seen one of these receivers for months. Then two arrived on the same day! The first one had "dead" and "intermittent scrambling" written on the note that accompanied it. It wasn't dead, but the timer and on LEDs were both permanently lit and no amount of button pushing would alter this. At first I thought that the 2,200μF electrolytic capacitor in the 5V supply might have failed. But it was new, having been replaced along with the other items in Relkit 2 some months previously. I replaced the EEPROM, but that made no difference. It *had* to be something that prevented the microcontroller chip from working. So I checked the 5·625MHz crystal X10, which was fine. Finally I replaced the chip itself. That cured the "dead" fault.

The picture was still intermittent however. It would appear and disappear when the unit was tapped. I traced the cause of this fault to broken solder joints at the ten-pin decoder board connector.

The second receiver had a similar fault, but this time the timer and standby LEDs were lit. When I checked X10 there was no sign of oscillation. So I fitted a replacement. The receiver then worked, but the decoded pictures were very streaky. This was cured by fitting the rest of the components in Relkit 2, which contains several capacitors and a couple of transistors. The pictures were then perfect.

BT SVS250

I'd repaired this receiver on a previous occasion when the symptom had been no decoder messages.

Fitting Relkit 17 had cleared the fault. This time the note that accompanied the receiver said "won't lock and gives strange messages". Occasionally the fault reports I get make the mind boggle. Mine was now boggling. When I connected the receiver up on the test bench it produced audio with hum and a picture with a hum bar that repeatedly travelled up the screen. Diodes I thought cheerfully, as I began to remove the screws. Two minutes later I was less cheerful.

It seems that I had already replaced the two rectifier diodes (D405/6) at the rear right corner. They are notorious for failure, and I had fitted BYV95A diodes as a precaution. There was no difference when I replaced the remaining diodes here. Nor did replacing the large electrolytic capacitors make any difference. Feeling somewhat desperate, I replaced the 6V regulator U403. Aha! That eliminated the hum on sound, but the horizontal bar still scrolled up the screen.

I won't tell you how many parts I replaced before I came to the conclusion that the cause of the fault wasn't in the power supply. The bar was much more pronounced when the decoder board was removed. It was very odd, and I decided that the fault was in the early video amplifier stages. Heat made the symptom worse, suggesting that the culprit was a semiconductor device rather than a capacitor. Freezer spray seemed to narrow the cause to Q106 which, controlled by pin 39 of the microcontroller chip U201, adjusts the video level. But I was not convinced, and a new 2SC1815 transistor in this position again made no difference. Freezing it made the fault disappear however. As I'd already spent far more time on this repair than the receiver warranted, I tried soldering a 1kΩ resistor between the transistor's collector and emitter. The 'hum bar' then disappeared, and I screwed the receiver back together with a sigh of relief. I know that this bodge simply masked the fault, which was caused by something else, but it was 11pm and I had had enough!

A week later the receiver bounced back with a cryptic note that said "no Sky Sports 2 or Discovery". When I tested the receiver the channels were there but most of the ones with horizontal polarisation produced a "no decoder" message. Now one of the many items I'd replaced was the 2kΩ video gain potentiometer VR101. I had fitted a 1kΩ potentiometer in this position, as there hadn't been any 2kΩ ones in stock. It seemed to work fine, and was certainly better than the mangled thing left by a previous owner, but the video level was a fraction too low for the decoder's liking. I fitted a 4·7kΩ potentiometer and made a mental note to order some 2·2kΩ ones.

Decoder operation was now fine, but the original 'hum bar' had returned in the form of a faint row of dots that floated up the screen twice a second. I decided to fix it properly this time. So the 1kΩ resistor came out and I went in with a scope. The cause of the symptom was then immediately apparent – I could see a pulse coming from pin 39 of the microcontroller chip U201. It should not do that! Fitting a microcontroller chip from a scrap receiver finally cured this fault. Strange that a microcontroller chip should apparently be the cause of a hum bar!

Jack Armstrong is willing to try to sort out readers' satellite TV receiver problems by e-mail. You can reach him via the internet web site at:

http://www.ukstay.com/jack

If you have no internet access you can write to him c/o Television, Room L302, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Please enclose two first-class stamps.

E-mail blues!

Readers will have noticed that my contact address in the box is no longer an e-mail one but a web page URL. The reason I often switch off one address and use another is to reduce junk mail. Unfortunately doing this means that some readers can't easily contact me. To get round the problem, type the URL

http://www.ukstay.com/jack

into the address line of your internet browser. Press return and my page will appear on your screen. You can then read the latest instructions for contacting me. You will also find online "frequently asked questions" and answers about satellite faults, so you might not need to contact me at all. If you don't have a problem you might like to look at my web site and peruse the information about Hobby Electronics, Audio, Satellite TV etc. – everything from a crystal set design to Chris Muriel's explanation of digital satellite TV.

Test Case 445

The last Test Case of this decade, this century – and this millennium! To celebrate, we're going to do something a little different. The following series of mini-puzzles goes back as far as anyone in the Test Case workshop can remember – to the late Fifties. See how many of them you can answer correctly!

(1) In the Fifties TV tubes (all black-and-white) had bent electron guns that fired the beam at the glass wall of the neck of the tube. Why was this done?

(2) Colour TV came to the UK in the late Sixties. A feature of some of the earliest TV receivers was a monster valve, type PD500. What did it do, and why could it be dangerous?

(3) Transistors and ICs gradually took over from valves during the Seventies. Some line output stages used two switching transistors that were connected in series with the primary winding of the LOPT. Why was this necessary?

(4) The Eighties saw the start of, amongst a number of other developments, direct-to-home satellite TV transmissions. PAL continued to be used for the video signal, but the type of modulation was changed. Why? And why is the PAL system basically unsuitable?

(5) The most significant development during the Nineties was the advent of digital TV – for video storage on discs and tape, and for broadcasting both terrestrially and via satellite. What made it possible to start transmitting digital video? How much video memory does an MPEG-2 decoder require for current standards, and how is it used?

To check that you got the answers right, turn to page 184.

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: Do you have spare copies of the March and April 1999 issues of *Television*? We've completely run out and require a couple of each for reference purposes. If you can help, please phone the *Television* editorial office on 0181 652 8120.

Wanted: Working remote control unit (type RMTV131) for use with the Sony VCR Model SLV-E8UV. Brian Coppings, Lee Television, 5 Odeon Parade, Well Hall Road, Eltham, London SE9 6SU. 0181 850 2290.

Wanted: On/off switch and knob for the Bush AM-FM stereo radio/colour TV Model 1006. M. Till, 6 Oakwood Close, Walsall Wood, Walsall, W. Midlands WS9 9BP. 01543 371 383.

Wanted/for disposal: Require operating instructions for the Sony Model SLV315; a 12V lead for the Toshiba TV Model B1201; and a ribbon cartridge (type SBC3720) for the Philips VideoWriter Model PG7716. Have for disposal radio, TV, electronics, TR mags. Ken Domminney, 7 Chestnut Close, Eastbourne, E. Sussex BN22 0SZ. 01323 500 174.

Wanted: Chopper transformer for the Philips CP110 chassis. One from a scrap chassis would do if known to be OK. R. Padgett, 23 Woodside Avenue, Kinmel Bay, Rhyl, N. Wales LL18 5ND. 01745 342 448.

Wanted: Regulator transformer T701 for the Sharp CTV Model C3705. P. McKeever, 4 Castleview Park, Derry BT48 8DL. 01504 353 613.

For sale: Thandar PFM200A digital frequency meter, battery model, range 20Hz-200MHz, very good condition. £40 plus postage. Paul Byrne, 99 Bro Deg, Ruthin, Denbighshire LL15 1XY. 01824 705 810.

Wanted: Help with repairing 16:9 widescreen 28 and 33in. Nokia Eurodigi TV sets. I have manuals and can obtain spares. John Haines, Redtiles, 70 Friars Street, Sudbury, Suffolk. 01787 373 181 daytime, 01787 373 363 evenings.

Wanted: 10-20MHz oscilloscope. Must be in good condition. Marwan, 15 Grange Road, London NW10 2RA. 0181 451 6499.

Wanted: User handbook for the Betacom table phone Model Caravelle no. 3325. To purchase, borrow or photocopy. L. Symons, 14 Maidenwell Road, Plympton, Plymouth PL7 1RB. 01752 343 074.

Wanted: LOPT, two if possible, type TBC70172 for the Vega 5in. mono TV Model 342. Also a TDA2655 (not TDA2655B) field IC for a Saba CTV. Oliver H. Tynan, Leitrim, Ballinalee, Co. Longford, Ireland. Phone 00 353 43 23448.

For sale: Because the business is closing down, we have the following for disposal: *Radio and Television Servicing* books dated from about 1957 to 1967, in excellent condition – offers please. Crotech 3132 dual-beam 20MHz scope; U-View books TV 87-93, VCR 91-93, Satellite Vols. 1 and 2; *Television* magazine 1983 to date; Visions training tapes, Ferguson ICC5, Akai, GoldStar D16 deck, Pace 800/900 as well as the Philips Charlie Deck and Pioneer CD; various service manuals and spares. Contact Jim on 01870 602 110 or e-mail jlynch1033@aol.com

Wanted: Circuit diagrams or service manuals for the Akai VSF200EK and Sanyo VHR315E VCRs and the Binatone Model 01/9014 portable CTV, photocopies OK. M.P.Quinn, 21 Hawarden Way, Mancot, Deeside, Flintshire CH5 2EL. 01244 531 639.

Wanted: LOPTs for the following models: Panasonic TX2231 and TC2232, Sanyo CBP1747. A. Topping, 97 Ploughmans Court, Droitwich WR9 9DX. 01905 775 680.

Wanted: Sony Betamax Model SLC9UB VCR for spares or repair. Must be cheap. Mr Griffin, 89 The Ridgeway, Sedgley, W. Midlands DY3 3UN. 01902 880 063.

Wanted: UPD8048 CPU, part no. 4822 209 10241, for the Philips Model VR2023 VCR (V2000 system). The IC is mounted on panel U23, which is part no. 4822 214 30659. I am willing to pay for the chip, the U23 PCB or a complete machine. Tony Stevens, 2 Lambourne Road, Mote Park Estate, Maidstone, Kent ME15 8NB. 01622 858 539 or 01622 736 755.

Wanted: A dropped/damaged Philips widescreen TV Model CTV8916 with a serviceable chassis. Condition of the case and tube unimportant. Paul Crosskill, 87 Trimpley Drive, Kidderminster, Worcs DY11 5LA. 01384 567 755 (day). E-mail paul.crosskill@cwnet.com

Wanted: Plug-in deflection PCB (usually part no. 29504-007, with a stick-on label on the printed circuit side of the board) for the Grundig Model A7400 (CUC220 chassis), or the TDA2655B IC (preferably two) used on this board, or an A7400 TV set complete with all plug-in PCBs, working or not. Also a service manual. I will arrange for collection and payment. Phone George Frewin on 01264 354 949 any time or fax 01264 334 949.

Wanted: Cossor FM alignment generator Model 1324 or similar, working or not. Service data for the 1324 and the Cossor Telecheck 1322 B1-3 sweep/marker generator, photocopies OK. Fifties' valve gear. R. Ballerdie, 6 Crofton Avenue, Timperley, Cheshire WA15 6DA. 0161 962 8826.

For disposal: Amstrad PC1512 with slight fault and PC-MM monochrome monitor, free to collector. Also an Apple 14in. colour monitor with composite input. US model, so 120V mains and 60Hz field rate etc. Very good condition, believed working, again free. Nicholas Arnold, 30 Mere Road, Upper Wolvercote, Oxford OX2 8AN. 01865 556 991.

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MSS500 , MSS1000	SATPSU10
MRD920 , SS9000 , SS9010 , SS9200 , SS9210 , SS9220	SATP-SU2
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SAT301	SATPSU10
THOMSON	
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SRD7/8 , SRS3 , SRS4	SATPSU2
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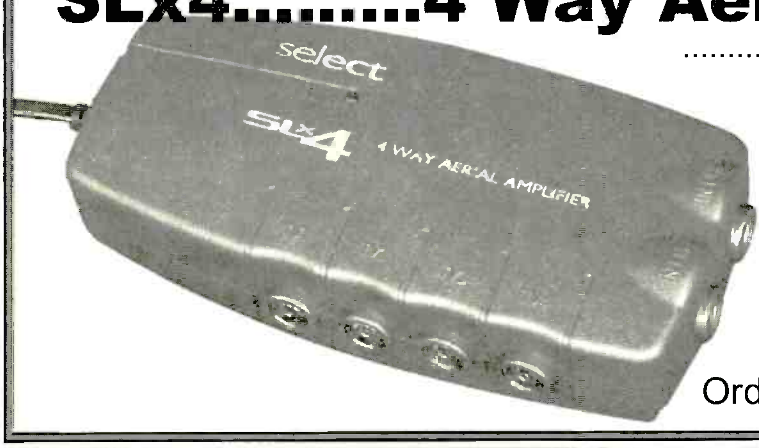

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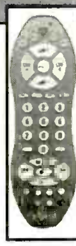

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An inexpensive but invaluable aid for microwave oven servicing

Keyboard Tester for Microwave Ovens

Rapid fault diagnosis is essential when you provide free repair estimates. There are several possible reasons for failure of a microwave oven to operate when the start button is pressed: there may be a fault on the electronic control PCB; a door switch may be defective; or the keypad could be faulty.

Keypad Damage

Wiping the keypad with an over-damp cloth will damage it: water gets inside the keypad by capillary action. This can lead to shorted buttons or can damage the silvered contacts. Either way the keypad is rendered useless. The simple project described in this article enables a keypad to be quickly tested.

Tester Arrangement

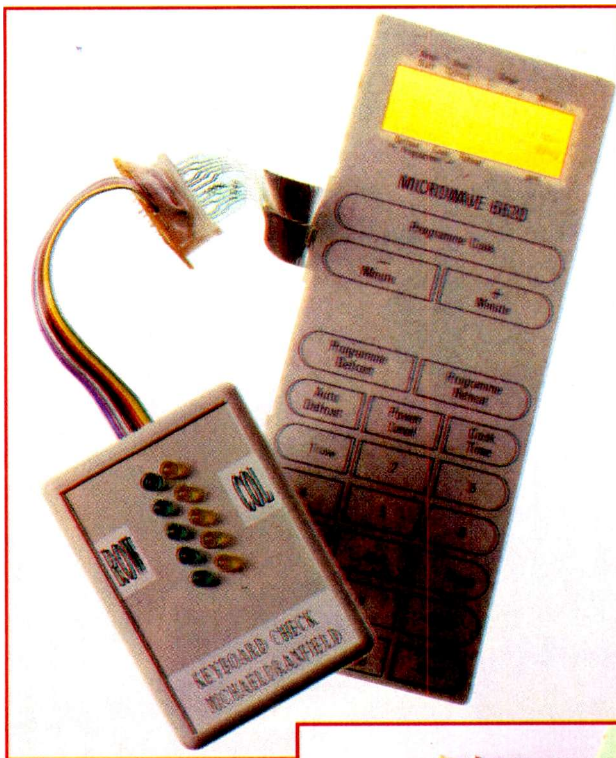
We've found that the most common keypad arrangement, used with Matsui, Saisho, Hotpoint and GoldStar ovens, is a five-by-five row/column array. A tester could be built for other arrangements, such as six-by-four or seven-by-three. The one shown in Fig. 1 has ten LEDs, five to indicate row and five to indicate column. You could use just five LEDs, but I decided on ten so that a diagram of the keypad could be drawn up in the absence of the service manual. In this way a faulty oven can be tested without its keypad.

If there's a stuck down or leaky key, some LEDs will glow though no key has been pressed. The forward current through the LEDs is limited by the 470Ω resistor. I used low-current 5mm LEDs to increase battery life – the power source is a single PP3 battery. The specified case has a PP3 battery compartment.

The ribbon cable used was taken from some old computer equipment. The keyboard connector came from a scrap microwave oven.

Cost

The prototype unit cost less than £6 to build. It has proved to be invaluable in the workshop.



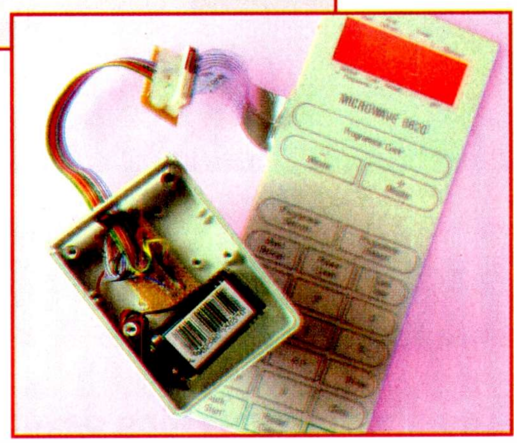
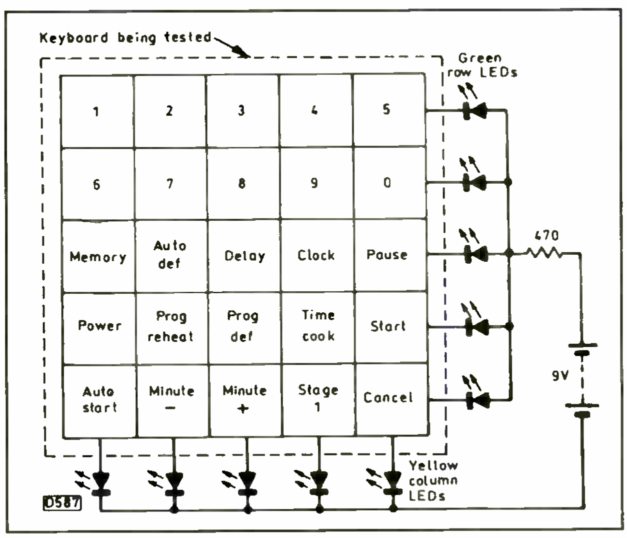


Fig. 1: Microwave oven keyboard tester circuit.



Parts list
5 yellow LEDs, Farnell order code 323-147
5 green LEDs, Farnell order code 323-159
470W, 0◊4W resistor
Case – Farnell order code 930-192
PP3 battery clip

Interactive TV Up date

A number of interesting developments in the interactive TV field have been launched during the past few months, including the start of Open on SkyDigital and two VOD services that use ADSL technology. George Cole reports

Until recently TV was a one-way, non-interactive service with viewer activity limited to selecting a channel or teletext page. Interactive TV gives viewers a much more active role. One of the benefits of digital TV is that the transmission of data makes it easier to offer PC-like services via a TV set.

The essential components of an interactive TV service are a broadcaster/service provider, a transmission link to the viewer, and a return (back) channel to the broadcaster/service provider. The latter may be via telephone or cable, to enable the viewer to call up a specific programme or service. Various types of interactive services are now available, such as home shopping and banking, information-on-demand (weather information when you want it etc.) and pay-per-view ordering.

Open

Open is the name of the interactive service developed by British Interactive Broadcasting, which is owned by BSkyB, BT, HSBC and Matsushita. The service had been under development for several years prior to its launch in October 1999, and at the time of writing has a potential audience of some 1·2 million households. The Open service is 'closed', in the sense that users have access only to information and services provided by Open: there's no access to the internet.

Content is sent to the viewer's set-top box via satellite and phone line, the system relying on a TV rather than a PC screen for display. User-operation is by means of a remote control handset. The public switched telephone network is currently used as the return path and as a data link: the SkyDigital set-top box has a built-in modem for transmitting and receiving data. Transactional data, book ordering for example, is sent to the relevant supplier.

The content supplied by firms or service providers who use Open is assembled at Open's headquarters in north London. Services are developed using an SCE (Service Creation Environment) package that consists of hardware and software including Open TV's proprietary tool Open Author – incidentally Open TV is an interactive TV software company, not to be confused with Open. Coded information produced in this way goes to the Service Delivery Platform, where it's checked then split between the Broadcast Server, which sends it on to Astra 2A, and the Online Server for delivery via telephone line. Two Astra transponders are used, providing a transmission capacity of 68Mbits/sec. At present Open receives video, audio etc. from companies and does all the programming and packaging in-house. This will change as more development tools become available and firms develop their own production services.

Open has computers at three key sites: the broadcasting platform at BT Tower, an online platform in central London and the commissioning and operational centre at Open's HQ. The uplink site is at The Docklands, while the customer management centre is at Livingston. BT provides the dial-in network.

Open's service has been developed for TV, offering a mix of high-quality sound, video, still images, text and animation. Video and sound are delivered via satellite; text and pictures that change frequently or are specific to an individual firm can be delivered via the telephone line; frequently-used items such as company logos can be stored temporarily in the set-top box.

The Open STB

The on-screen display is created by the set-top box in response to a viewer's request: data is collected from the satellite or by dialling Open's computers, assembled inside the box and then displayed. An Open screen typically consists of video and background taken from the satellite, with text and images that come via the telephone connection.

The set-top box carries out both MPEG-2 and JPEG decoding, and handles audio and the communication protocols used for online connection. There are three layers in a typical Open screen display: a background MPEG layer, a second video layer, and an on-screen display/graphics layer that's used primarily to overlay text.

The STB has roughly the same processing power as a fast 486 PC but no disk drive – the operating system (OS) is stored in flash memory. This means that the OS is instantly available when the box is switched on. As a backup to the upgrade process, the box keeps a copy of the last working OS.

Using the Open service

Open was designed as a family service and is thus simple to use. When the SkyDigital remote control unit's interactive button is pressed the main menu appears. This provides a numbered list of services: shopping, entertainment, money, information, e-mail, how to use and special offers. Press the corresponding handset number and you get a specific service, for example 4 takes you to the information service which includes the latest weather reports. Each section may have submenus that provide selection in the same way – the shopping service has submenus for entertainment and leisure, sportswear and fashion, and home and electrical goods for example.

The handset's red button is used for navigation and offers a go-to feature, for example to take the user back to the main menu and enable services to be bookmarked. The green button is for the 'organiser', which enables the user to enter credit card details and/or PIN numbers for faster transactions – users no longer have to enter credit card details every time they make a purchase. The backup button takes you back to the previous screen. The scroll buttons are used to read menus and hidden text information.

The e-mail service had not been launched at the time of writing this. It will enable TV viewers to send and receive e-mail from other Open users and PC owners. An optional wireless keyboard is being developed for this service. Payment will be made by entering a PIN code and credit or debit card details. Data is encrypted during transmission.

The STB has a smart-card slot for a Mondex-style electronic cash system. Open is negotiating with a number of companies on the use of this feature.

What's on Offer?

Open currently provides a mix of services. They include home banking with HSBC; financial services from the Woolwich; shopping with companies such as Woolworths, Somerfields and Dixons; games; film reviews; and fast-food delivery from Dominos Pizza. There's no subscription fee, and most calls are charged at the local rate – whenever you go online, a small telephone logo appears at the bottom left of the screen.

The Open service has good presentation (video and graphics are broadcast quality rather than the low-resolution images provided by internet-based services), is secure so that users can safely send credit card details and personal information, and parents needn't worry about their children wandering around the internet. Users can call up interactive services from an armchair, without need to go to and fire up a PC. On the downside the service is slower than broadcast TV, where a touch on a button takes you instantly to the next channel: there's a time delay between selecting Open and the relevant service or page appearing on the screen. Open is keen to use platforms other than SkyDigital, for example cable and even ADSL digital telephone services.

Video-on-demand

The idea of video-on-demand (VOD) is to provide access to a virtual video store in your living room, movies and other programming being selected by use of a remote-control handset. The selected programme should appear on the TV screen within seconds. Furthermore the programme can be stopped, paused, rewound or fast-forwarded like a video tape, though the programme is actually at a server computer some distance away.

VOD is an appealing feature. For various reasons – technical, economic and strategic – it has failed to take off as quickly as some had expected. A number of major VOD trials were carried out during the early Nineties,

The main Open menu.

most notably Time Warner's Full Service Network trial which involved 4,000 homes in Orlando, Florida. The results were positive, but the high cost of delivering the service made it unviable: the user's STB was a powerful Silicon Graphics workstation, and the giant server computers needed to store the video material were prohibitively expensive.

In recent years however the technology used to deliver VOD has been refined and, more importantly, become more affordable. Developments such as MPEG video compression make it easier to store and transmit moving digital video to homes, while the cost of mass-storage systems like hard disks has plunged. In fact the prospects for VOD are now so good that Time Warner is about to start a new trial in Austin, Texas.

Some digital TV systems are better suited to VOD than others. Because VOD requires a fast return channel from the customer to the broadcaster/service provider – for ordering programmes and controlling the video stream – satellite broadcasting is currently not suited to this type of application. For this reason some digital satellite broadcasters, such as TPS in France, are planning to offer near-VOD, downloading movies to a hard disk in the user's STB. Digital terrestrial TV lacks sufficient bandwidth to be able to offer a large number of VOD channels.

Cable is well-suited to VOD however, having a broadband network with a high-speed return channel. NTL has announced plans to launch a commercial VOD service in the UK before long (see below), and Telewest is to run a VOD trial involving 20,000 customers. Recently two telephone-based VOD services have been launched, by Kingston Interactive Television (KIT) and Videonet.

Kingston Interactive TV

Kingston Interactive Television, a subsidiary of Kingston Communications, launched a VOD service in Hull last October using the ordinary public switched telephone network (PSTN). As PSTN was originally designed to deliver voice traffic over a narrowband network, it may seem an odd choice for transmitting video programmes. But the PSTN has proved to be highly adaptable. Analogue modems are already in use to send data via the PSTN system, and a high-speed data technology known as Digital Subscriber Line (DSL) enables video to be sent via ordinary telephone lines (twisted copper pairs) between the local exchange and homes.

KIT logo and set-top box.

Today's telephone-based VOD systems use Asymmetric Digital Subscriber Line (ADSL) technology. The name arises because the downstream data speed (to the customer) is faster than the upstream (return) rate. ADSL provides a downstream data rate of up to 8Mbits/sec and an upstream rate of 1Mbits/sec, though the speed depends on a number of factors. These include the distance between the customer's home and the local exchange (a data rate of 6Mbits/sec can be achieved at a distance of about 1·5km, but only about 2Mbits/sec when the distance is some 3km), the quality and gauge of the copper wire, and the number of bridge taps in the local loop – the part of the telephone system that lies between the exchange and the individual customer. Many telephone companies that offer ADSL technology provide data speeds of about 2Mbits/sec downstream and 512kbits/sec upstream. This provides better-than-VHS picture quality.

ADSL works by transmitting video and sound as data signals modulated on to carriers at frequencies above those used for the standard PSTN service. In this way far higher data speeds than that offered by a 4kHz voice channel are achieved. Because of the frequency band difference, the phone line can be used in the normal way while providing an ADSL link. The user requires a digital STB with an ADSL modem and a copper-wire connection known as a digital subscriber line access multiplexer (DSLAM). More information on ADSL technology is provided in another article in this issue of *Television*.

KIT is currently offering an ADSL service to 1,500 customers, with digital TV prices that start at £9.99 a month; VOD movies, TV programmes, music videos and educational programmes from £4-£8 a month; and fast-internet and e-mail services at £14.99 a month. There is also a free interactive service that provides shopping, local information and news. The Pace-manufactured STB is provided on free rent, the installation charge being £60. The company aims to make the service available to Kingston's 155,000 telephone subscribers during the present year.

Videonet

The Hertfordshire-based company Video Networks (Videonet) launched an ADSL VOD service in a part of London last October. It uses BT's ADSL network, which is being extended across the country. The service, known as Home Choice, offers users a mix of films, music videos and TV programmes – Videonet recently signed an agreement with the BBC for 600 hours of programming. Prices range from £6.99-£13.99 a month, with a £40 installation charge. Films are rented on a 24-hour basis, during which time they can be watched as often as the viewer likes.

Programme material is stored in giant server computers, about 1Gbyte of data being required for each hour of programming. The servers are in London, but as Videonet's service expands a network of local servers will be set up around the country.

The Videonet STB has a range of AV connectors, including RF and scart (RGB, S and composite video) and phono audio. Videonet says that the picture quality offered by MPEG-1 is nowadays impressive, and that viewer test panels have reported much satisfaction.

One of the benefits of ADSL over a cable-TV based service is that there's a dedicated leased circuit from the modem back to the exchange, which means that the data rate is unaffected by the number of homes using the system at the same time. But there's a cost involved in having a large number of ADSL units in place, so Videonet has set up a 3:1 overbooking system. This enables the network to cater for up to a third of Videonet's customers at any one time, i.e. if Videonet has 30,000 customers, up to 10,000 can use the service at the same time. This is purely a marketing decision and is nothing to do with the technology, which could be scaled up to meet the needs of as many customers as required. If the overbooking limit is breached, those customers above the threshold are bounced off the service. Overbooking is not unique to ADSL: cable companies and Internet Service Providers (ISPs) use the same system when launching their services.

Videonet plans to introduce new services, including interactive TV ones like home shopping and banking and fast-internet access.

NTL

In late September NTL announced that it had signed a deal with the US company Diva Systems to launch a cable-TV based VOD service during 2000. Diva's VOD systems are currently used by six US cable companies over seven networks. The system being developed by Diva for NTL will include a Diva System Manager to control functions such as billing and subscriber management, a video server with 2·3Tbyte storage capacity (enough for 600 movies), and a Diva Digital Link that handles MPEG multiplexing, modulation and the various video streams.

For VOD each film is stored at different locations in a number of hard drives to provide fast, random access. Each server is designed for high reliability and has a dual power supply. Every fifth disc is a spare that can be hot-swapped if a problem occurs.

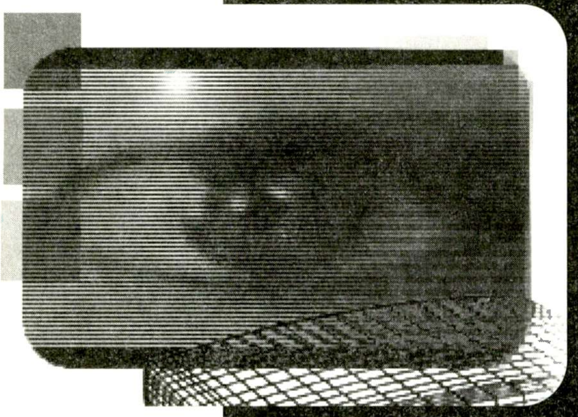
NTL says that its VOD service will offer data speeds of 4Mbits/sec, and thus better picture quality than an ADSL-based service. But the speed of the service will be affected by the number of customers using it.

iSee

Retail technology group Media Logic has developed an interactive TV service, called iSee, that aims to dispense with remote-control handsets, keyboards, mice and suchlike. It enables the viewer to talk to a sales assistant on the telephone and see the assistant live on the TV screen at the same time. The service, planned for launch on Telewest's digital cable network later this year, works as follows.

The customer phones a home shopping firm as usual, then the call centre agent asks him/her to tune to a particular channel to receive a dedicated video feed to the STB. Once the channel has been set, the customer sees a full-screen image of the agent (called a personal sales assistant) who sits in front of a video camera and a PC that contains relevant sales material. For example someone booking a holiday could see video clips or price charts while speaking to the assistant. When the viewer has selected the required item/service, it can be booked with a credit card. Alternatively the viewer can record the sales presentation and play it back before making a decision.

Media Logic says that iSee doesn't introduce any technological barriers, as it works on the same principle as a pay-per-view system. The service is to be launched in the autumn and will initially involve some 200,000 homes.



TV Fault Finding

Reports from Colin J. Guy, Michael Dranfield, Pete Gurney, LCGI, David Smith, Kevin J. Green, TMIIE, Michael Maurice, Glyn Dickinson, John Hepworth, Gerry Mumford and Paul Hardy

Ferguson D68N (ICC9 chassis)

Poor picture was the complaint with this set. In fact there was no luminance, as happens with the ICC5 chassis when the luminance delay line goes open-circuit. Easy I thought – but I couldn't find a delay line. A check with the circuit diagram revealed that the luminance delay line is within the TDA4671 video processing chip IC02, which is expensive. The cause of the fault turned out to be TC02 however. It's a surface-mounted BC848 transistor in the circuit between IC02 and IV01, where matrixing is carried out, and was short-circuit emitter-to-base. These little blighters seem to be about as reliable as those brown Panasonic capacitors. **C.J.G.**

Hitachi C2166TN

The cause of intermittent tripping turned out to be the 5V regulator IC952. I initially thought that dry-joints at its pins were responsible, but in the end a replacement 7805 had to be fitted. **C.J.G.**

Hitachi CPT2598 (G8Q chassis)

This set had been in several times because its EEPROM had become corrupted. Each time I'd fitted a replacement and set it up. The cause of the problem turned out to be the degaussing posistor, which arced internally when tapped. **C.J.G.**

Hitachi C21-P918 (GQ8 chassis)

This set was dead with a blackened mains fuse. The cause was found to be melted PVC insulating tape on the degaussing coil. It was resting on the audio amplifier's heatsink. This presented a considerable safety hazard. **C.J.G.**

Panasonic TX25W2 (Alpha 3 chassis)

The complaint with this set was poor focus. When the focus control was adjusted the picture brightness altered considerably. I suspected the LOPT, but when the first anode lead was disconnected from the tube base PCB the focus voltage was found to be leaking to the CRT's first anode pin. A new CRT was required. Fortunately Express TV had some at bargain prices, so the repair was economic. **C.J.G.**

Hitachi G7P Mk 2 Chassis

This set had been brought in because it was dead. Replacement of the electrolytic capacitors on the primary side of the chopper circuit restored normal operation. But it was back next day: the customer said that it would start in the morning, but if he switched it off it wouldn't come on again unless it was left off for several hours. He was right. The cause turned out to be R913 (100Ω) which is connected between the base and the emitter of the BUT11AF chopper transistor. It was open-circuit. **C.J.G.**

Mitsubishi CT2154TX (Euro 4 chassis)

Our installer had called to move the VCR channel to avoid digital interference. He found that the set would tune but wouldn't store channels – those already tuned in were OK. The cause of the problem was loss of the –30V supply to the EEPROM. It comes from the standby supply transformer T951, which was sitting in a blob of blackened glue. When the transformer had been removed and the glue cleaned off, the broken winding could be seen. It was successfully repaired. **C.J.G.**

Hitachi CPT2174 (G6P chassis)

This set produced a bright picture with flyback lines even when the first anode preset was turned to minimum. The cause of the trouble turned out to be zener diode ZD301 (12V) which was leaky. It's across the luminance feed to the CRT base panel. **C.J.G.**

Matsui 2096

This set was dead with the 6·8Ω surge-limiter resistor R101 open-circuit. The cause was traced to a short-circuit between the primary and feedback windings on the chopper transformer. I was able to get the transformer direct from Mastercare (0870 909 0444) at a reasonable price with same-day despatch using a credit card number.

It's also advisable to replace R108 (220kΩ) and R109 (330kΩ) in these sets, using 0·75W metal-film resistors. They are connected to pins 3 and 2 respectively of the TDA4605 chopper control chip IC104. **M.Dr.**

Sharp 59CS03H

I am not impressed with this chassis. The set was sold brand new just eighteen months ago and here it was back in the workshop, dead and full of dry-joints and scorch marks on the PCB. The power supply was whistling, and it didn't take me long to discover that the surface-mounted 2SA1797Q power transistor Q305 in the class D audio output stage was short-circuit. As a precaution I also replaced Q306, D301 and D302.

At switch on the set failed straight away. This time D305 (1N4933) was short-circuit – I'd checked it previously and it had read OK.

Whenever one of these sets comes in for repair, always check for dry-joints at the back of the scan coils PCB. A burn-up here can cause mass destruction in both the power and the line output sections of the receiver. **M.Dr.**

Nokia 6364UK SFN (Euro Stereo 2 chassis)

Intermittent reversion to standby, width problems, change of line frequency or failure of the line output transistor can all be caused by a faulty BC337-25 line driver transistor (T507). It will appear to be OK on test, but replace it nevertheless. For good measure also replace C507 (220μF) which decouples the supply to the line driver transformer TR510. **M.Dr.**

Tatung B series Chassis

If there's no line or field sync and you find that a video signal is present at pin 5 of the TDA2579A timebase generator chip IC401, the cause of the problem is most likely to be a crashed X2402P EEPROM chip (IC703). It's not necessary to replace this chip: just reprogram it.

If the set lives in a smoky or dusty atmosphere, clean the tube base. Sparking around the focus pin will crash the EEPROM. **M.Dr.**

Sharp 51DS02H

This set wouldn't come out of standby. Eventually, after fiddling about, I managed to get it to come on. But the front buttons – volume up/down and channel up/down – didn't work. The cause turned out to be simple. R705 (68kΩ), which feeds the standby microcontroller, was open-circuit. **M.Dr.**

Bush 2063NTX (Vestel 11AK10 chassis)

Field collapse was the problem with this set. There was a vertical ramp at pin 43 of IC401 (TDA8362A) but nothing else. The cause of no input at pin 1 of the TDA3653B field output chip IC701 was C701 (4·7nF), which was leaky. It's not the first time I've come across leaky disc ceramic capacitors in this area with various brands that use the chassis. **M.Dr.**

Crown 2894

The chassis in this set was familiar: it's used in most 28in. Bush sets. The customer had complained that the field scanning was unstable after half an hour. After replacing the usual capacitors in the primary side of the chopper power supply I put the set on soak test. About thirty minutes later the height decreased, the linearity altered and there was intermittent field bouncing.

My first move was to check the 12V supply, which is derived from the line output stage, used to power the line/field generator IC. The voltage at ZD402 is quite critical. It should be 12V but had fallen to 10·4V. Tracing back to source, I found that the 25V supply was also somewhat low. The cause of the trouble was R435 (0·68Ω) in the feed to the 25V rectifier. It measured 4·3Ω out of circuit and the correct 0·68Ω when it had cooled. A replacement cured the fault. **P.G.**

Alba CTV842

This 14in. portable was dead. When I checked it I found that the power supply was working but there was no line drive. The cause was quickly traced to the line driver transformer, whose primary winding was open-circuit. When the transformer was removed it was clear that the transformer had been damaged by the glue which had been applied to the PCB – it was badly discoloured, and had rotted the ends of the wires where they are soldered to the transformer's connection pins.

I've had this problem before. With care and the use of a good magnifying glass you can clean the ends of the wires and reconnect them by adding sufficient extra wire to make a good joint. **P.G.**

Toshiba 3357DB

It was not the first time I'd come across the problem, which had in this case been caused by the owner's dislike of the surround sound speakers. Feeling that they got in the way, he disconnected them. Two weeks later the set died. I found that the 5A fuse link Z889 and the TA8211AH surround sound rear speaker amplifier Q640 had failed.

With another customer's set that suffered from the same problem the above items were faulty, also the TA8256H chip Q870 which drives the front speakers. This additional chip had died when the front speakers had been disconnected with the set switched on in order to vacuum clean the carpet! **P.G.**

Panasonic TX28W3/BK (Euro 1 chassis)

This set had a fairly straightforward fault, field collapse. I checked the voltages around the TDA8175 field output chip IC561 and found that, DC wise, they were all within specification. A new IC restored the picture. Some further checks were then carried out to see whether anything that might have contributed to IC561's failure could be found. C558 (2,200μF, 50V), the reservoir capacitor for the 27V supply, had a domed top and an extremely high ESR reading, and the field flyback boost capacitor C563 (220μF, 50V) was leaky. **P.G.**

Amstrad CTV1400

Intermittent loss of the picture was the complaint with this 14in. portable. On test I found that the loss was extremely intermittent – it put in an appearance only once in two weeks. At first I suspected an intermittent connection to the CRT's heaters, as the brightness slowly decayed then returned, but the fault cleared before the set's back could be removed and I could not see any bad joints.

When the fault did last long enough for some measurements to be carried out I discovered that the first anode voltage had fallen to 6V. A replacement HR line output transformer cured the fault. **P.G.**

Tatung D14RDD64 (Series D chassis)

This set was locked to one channel and the volume was at maximum. I've had the problem before with the D chassis. The cause is usually EEPROM corruption, which a reset will cure.

To load the factory defaults when the set is on, short-circuit pins 1 and 2 of PC701 near the main microcontroller chip and press any one of the front panel controls. The set will then go into standby. Remove the short-circuit and switch the set back on. Factory defaults will be loaded in the EEPROM and retuning should, as in this case, complete the repair. **P.G.**

Bush 2163NTXA

There was intermittent sound: it would sometimes go low, fade off or just cut out. Tapping the Nicam panel would instigate the fault. I tried almost everything on the panel then noticed that a small coil, UL302, near the TDA2546 chip was mounted at an acute angle. Its pins appeared to have been soldered and looked to be intact, but I decided to resolder them anyway. As I did so, one of the lands for the coil came clean away. All was well when I replaced it with a wire link. I guess that the print had been damaged under the edge of the solder run. **D.S.**

Alba CTV4856

The main complaint was varying height. No mention was made of the fact that ITV (ch. 59 in our area) was right at the edge of the OSD tuning scale and that BBC2 and Ch 4 couldn't be tuned in. The power supply was producing the correct outputs, but a check at the 33V stabiliser showed that there was only 18V across it. A replacement made no difference. Checks on related components brought me to C504, an 0·1μF disc ceramic capacitor that's near the front of the PCB, right next door to a green mylar capacitor. It was leaky: a replacement cured the tuning and the height problems. **D.S.**

Ferguson ICC7 Chassis

One of these sets was brought in because there was no line or field sync. CV54 (0·1μF) was found to be open-circuit. **K.J.G.**

Grundig T70-440

This set displayed a very bright raster with flyback lines. The cure was to replace the TEA5101A RGB output chip on the CRT base panel and the 10Ω resistor in the supply to it. **M.M.**

Bush 2914

The colour balance was incorrect – predominantly red. It didn't take long to find that R919 (680kΩ) in the R output stage was open-circuit. **M.M.**

Sony KVM2171U (BE4A chassis)

This set was dead with CP602 on the secondary side of the power supply open-circuit. As there were no shorts I fitted a new 1A, CP-N25 fuse-link, which restored normal operation. About three months later the set was back with the same fault. A call to Sony produced the information that the cause is an inrush of current at power on from standby, and that there's a modification. Uprate CP602 to 2·5A CP-N75 and add two 5·6V zener diodes, one between pins 1 and 9 of IC803 (cathode to pin 1) and the other between pin 9 and chassis. Mount the diodes on the print side of the PCB. **M.M.**

Akai CT2185-10

This set was brought in because it wouldn't come out of standby. Resoldering dry-joints in the power supply and line output stage cured that. But every so often there was a static discharge around the speaker grille. A 1MΩ resistor connected between the grille and chassis cured this problem. Note that it must be a safety-rated component. **M.M.**

Toshiba 2552DB

There was intermittent loss of the picture, with just a blank raster. The cause was eventually traced to the service switch S202. I was tempted to link it out, but decided to obtain and fit a replacement. **M.M.**

Saisho FST212A

This set was dead with the relay open-circuit. The relay is no longer available, but an equivalent RS type can be used. **M.M.**

Sony KV19XMTU

Another dealer brought this set along. He couldn't understand why it wouldn't tune in and why there was drifting with the stations that had been tuned. I removed the IF can and resoldered the dry-joints at the coils. That cured the fault. Sony sets have, over the years, suffered from this problem. **M.M.**

Protech 7295

This 28in. Nicam set is fitted with a chassis, type 11AK12, that turns up in various brands. The fault was field collapse, though the TDA3654 field output chip was very much alive. The drive comes from a TDA8362A multi-function chip. Checks here revealed that pin 33, which is used to generate the field ramp, was at 0V. R810 (22kΩ) should provide a feed from the 33V rail. It had failed. **G.D.**

Panasonic TC1465 (Z1 chassis)

The complaint was "lines on the screen after an hour". I put the set on test and after a while the luminance began to vary erratically. The fault was also present with an AV input. Scope checks led me to the 2SC2636 emitter-follower Q303, whose output was a pale imitation of the input. A replacement cured the fault. **G.D.**

Sharp 66CS03

These large-screen sets with a portable's chassis worry us, often for good reason. This one had been seen by someone else, who 'couldn't get the parts'. It was not in too bad a state – just a few disconnected diodes and evidence of work around the line output transformer. This was repaired and the set was then switched on. There was tripping – at least the set wasn't dead! Visual inspection led me to C714 (1,000μF, 10V) which looked very upset. A replacement brought the set back to life, but there was arcing from the line output transformer. Once this had been replaced and the geometry had been set up we had a happy set and customer. Relief all round!

Whenever you get one of these sets in an essential precation is to resolder the pins at the scan coil socket. **G.D.**

Ferguson 59K5 (ICC5 chassis)

There was the "three strikes and you're out" kind a tripping with this set. Unplugging the audio panel is a good first move. It made no difference this time. The line output transistor measured OK out of circuit, but there was a 2kΩ reading between its collector and emitter connections. This resistance disappeared when pin 8 (HT) of the transformer was disconnected. The only other connection to the primary winding is the feed to the 200V rectifier, at pin 6. Sure enough DL55 (BA157) was short-circuit. As a result, CL58 (47μF, 100V) and RV82 (10Ω, on the tube base panel) had been damaged. Replacing them restored the picture. **G.D.**

Mitsubishi CT2607

"Twenty four years old and never gone wrong before" the proud owner of this set declared. It was not that old I think, but the fault was obvious – field collapse. Scope checks showed that there was a good field scan waveform, then a bell rang in the back of my mind. "Check the scan coils" it said. I did, and found that they were open-circuit. Since I'd nothing like them in the salvage box I split them and saw two odd loading coils, one with a broken wire. This was easily repaired, after which there was a good picture. For another twenty four years?! **G.D.**

Beko 30328T

This 28in. set showed no signs of life apart from the standby light, which responded to the remote-control handset – it flashed for a couple of seconds after receiving a command, but nothing else happened. I've had a number of 28in. Beko sets with duff LOPTs, so I jumped in and fitted one. Wrong: the set still sat there inactive. I then did what I should have done in the first place – used the scope to check for line drive. The cause of the trouble was now obvious. The line driver transistor T801 was open-circuit base-to-emitter. **J.H.**

Toshiba 214R7B

This set was OK with most scenes, but with high-brightness shots the picture pulsated wildly. Checks in the beam-limiter network revealed that D242 (1N4148) was short-circuit. **J.H.**

Mitsubishi Sets

I've had quite a few Mitsubishi sets with RGB variations and intermittent symptoms like flyback lines and varying contrast and brightness. In every case the cause of the problem has been hardly any solder on the tube base connector on the base panel. **J.H.**

Amstrad CTV3028N

This set was dead with the 2A mains fuse blown. The chopper power supply uses a BUZ90AF FET which was short-circuit, the cause being R108 (270kΩ) which was open-circuit. I replaced these items and switched on. The result was tripping, because the line output transistor was leaky. Replacing this completed the job.

I've had this chassis for repair in **Alba** and **Bush** sets. **J.H.**

Hitachi CPT2128 (G7P chassis)

There was no line sync and the display was displaced to the right of the screen. The phase detector in the TDA2579 timebase generator chip IC701 receives pulses from the line output stage at pin 12. They come via R726 (2·2Ω) and R605. R726 was open-circuit. **J.H.**

Ferguson B59N (ICC8 chassis)

I acquired this set for £5 during a recent visit to the local skip yard to dispose of some rubbish. It's a 59cm Nicam and Fastext set that produces excellent pictures – I have one myself. When I tested it there was field collapse, because the TDA8178 field output chip was dry-jointed and RF33 was open-circuit. This resistor is listed as 1·8Ω, but 0·33Ω was fitted. After replacing it and obtaining a König handset very cheaply I sold the set straight away. It's amazing what some people throw out. **J.H.**

Sony KV28WS2U (BE3D chassis)

The display produced by this widescreen set had bad EW bowing and excessive width. R870 (1Ω, 1W fusible) was found to be open-circuit. It's in the feedback network in the EW output stage. The replacement ran cold and the set was pronounced healthy. **G.M.**

Grundig T36-446 (CUC4410 chassis)

There was sound but no picture, because the line drive was missing. The chassis is slightly unusual in that there's no line driver transformer, a TDA8140 driver chip (IC526) being used instead. This and the field output chip IC411 were badly dry-jointed, but resoldering them made no difference. As IC526 had power and a drive input, and there were no short-circuits in the line output stage, a new TDA8140 chip was fitted. This cured the fault. **G.M.**

Sony KV14T1U (BE4 chassis)

This smart portable was dead. Its front LED blinked six times to indicate an over-voltage or excess-current fault. In fact, as usual with this chassis, the TDA9302H field chip IC501 was the cause of the fault. It becomes dry-jointed and fails.

But this particular set had a trick up its sleeve. There was a bad vertical shift error when IC501 had been replaced, with a 2cm deep black band at the top of the screen. Any attempt to alter it in the service mode resulted in foldover. The DC shift for the field coils is provided by Q500 and Q501. Checks showed that the voltages around these transistors were way out, though the associated components were all OK. The cure was to replace the very expensive MC44007P jungle chip IC301, which provides the drive for Q500. **G.M.**

Solavox 20T19 (ITT Mini chassis)

This rather old set was stuck in standby. Fuse Si651 (1AF) had blown because the BU508A chopper transistor T713 was short-circuit. The cause was eventually traced to C701 (4·7μF), which was open-circuit. It's a mains filtering capacitor connected just after the filter choke. **G.M.**

Sony KVM2101U (BE2A chassis)

There was bad EW bowing. Inspection showed that C806 (47nF, 250V) in the line output stage was bulging and had split open. Fortunately a replacement cured the fault and there was no other damage. I've since had this fault with a number of these sets. It's beginning to look like another stock fault. **G.M.**

Philips 21PT131B (Anubis A chassis)

This set seemed to be dead, but the power supply was producing a low HT output at 40V instead of 95V. The cause was traced to the BC848C error-sensing transistor Tr7537. It's voltage readings were wrong: there was about 6V at the collector and emitter, a slightly lower reading being obtained at the base. When this surface-mounted device was removed for checks it was found to be leaky collector-to-emitter. A replacement restored normal operation. **P.H.**

Sony KV2212UB (YE2 chassis)

This set was dead with no output from the power supply. As there were no obvious signs of failure I carried out some resistor checks and found that R603 (390kΩ, 0·5W) in the start-up supply was open-circuit.

As usual with this chassis, diodes D801, D802, D808 and D809 on the line timebase panel were poorly jointed. I find that the only way to get decent soldered joints here is to remove the diodes and scrape the leads before retinning them prior to refitting. **P.H.**

Hitachi CT2114TE-311

This set would intermittently revert to standby. Sometimes HT was present and field scan coil buzz could be heard. Sometimes the switched 9V supply was absent. In addition the text was sometimes corrupt, and remote-control commands were often ignored. A new microcontroller chip cured these problems.

Make sure that you identify the chip correctly before ordering it, as there appear to be two models with the same model number but different innards. This one used an SAA5296P/015 chip, which is expensive. **P.H.**

Monitors

Reports from Derek Bogiscin Philip Blundell, AMIIEelec Ian Field and Russ Phillips

Sony CPD100SX

This monitor's display was intermittently over bright: sometimes it reached peak white with flyback lines, after which there would be shut down. There was also a white line across the screen just after switch off.

CRT voltage checks with the monitor working normally and in the fault condition showed that the RGB drives and the first anode voltage didn't alter. But the control grid voltage did. Unlike most TV sets, the control grid is not simply connected to chassis. Instead the grid is used for flyback blanking, brightness control and switch-off blanking. R547 (220kΩ) was the cause of the trouble. It provides a negative bias derived from the –180V supply and had gone high in value. **D.B.**

CTX CPS1560

You could just hear a pulsing noise from this monitor's power supply. I checked the line output transistor Q401 which was short-circuit collector-to-emitter. But when a replacement had been fitted the monitor still failed to work. Checks in the power supply showed that D108 on the secondary side was short-circuit. When this had been replaced the monitor would briefly power up, with a burst of EHT, then revert to the standby mode. The cause was regulator transistor Q103, which was leaky. It produces a regulated 70V supply for the line output stage from an HT source at about 240V. **D.B.**

Sony CPD100SX

There was an intermittent problem with this monitor: the picture would flicker for only a frame or two then be fine for several minutes. During one occurrence there appeared to be frame foldover, then the scan looked to have reduced from the top. An oscilloscope connected to the frame output showed that the problem was clipping of the positive part of the frame scan waveform. An in-circuit cold check on the 1N4002 flyback boost diode D212 failed to show any defect, but when one end was unsoldered its forward resistance increased until it went open-circuit. After cooling down it read normally again. A new diode and boost capacitor restored correct operation. **D.B.**

Teco RE451

Man-made faults are always the best! I have recently been doing repairs for the local computer shop. The first few were mostly dry-joints, but this monitor had a poor grey scale – the blue was weak. The black-level controls worked normally but the white-point controls didn't. If the green white-point control was turned down, both the green and blue drive were reduced. All was revealed when the screening can had been removed. The shop owner had resoldered the joints on the CRT base PCB. They were rather blobby, and a solder bridge joined R206 and R205. The effect of this was to link the blue and green white-point controls. Fortunately no other damage had been done. **P.B.**

Compaq 140 (Series 473E)

The surge-limiting NTC thermistor next to the fuse had exploded, after melting the degaussing coil plug. No part of the component was still attached to the PCB. One lead and the smaller fragments had presumably left via the ventilation grille. It was possible to identify the SCK marking and part of the number – the third digit was definitely a 3. A comparison of the remains with the spares I keep in stock indicated that the component was almost certainly an SCK083.

Checks in the power supply failed to reveal any shorts, but beware: the degaussing posistor is connected to the AC line after the NTC device, so a faulty posistor could destroy it. **I.F.**

Dell 15FSEN

This monitor just ticked. A nice easy one I thought: replace the BUH715 line output transistor and increase the value of the flyback tuning capacitor. Not this time! The 2SB861 EW transistor Q508 had been well done: its collector was short-circuit and its base-emitter junction was 'punched out'. The insulating washer on D404 (BY329-1200) had punctured, which I at first assumed was the basic cause of the trouble. But when Q508 and D404 had been replaced the power supply still ticked. D405 (MUR460) was short-circuit as well.

The real cause of the fault was C409 (6·8nF, 1·6kV), which was dead short. Increasing its value to 8·2nF or 9·5nF increases the width sufficiently to fill the screen without introducing uncorrectable scan distortion – and the BUH715 transistor then runs much cooler. **I.F.**

Apricot XJ49905

This version of the **AST LR14** has an 8·2nF, 1·6kV capacitor in position C322, confirming a report from another reader that this value is sometimes fitted. I've commented on the value before. **I.F.**

Elonex HN044

This monitor's display had a cyan cast: red was not completely missing, but the picture was uniformly discoloured and it wasn't to do with the colour-temperature settings at

P3 of the OSG menu. The CRT base appeared to be OK. It had an Acer Peripheral custom chip and there were no presets whatsoever. Despite the fact that the soldering looked good, resoldering most of the chips, connectors, CRT pins and various discrete components cleared the fault. **I.F.**

Samtron 8514A

Someone had coated the CRT base panel with lacquer to stop arcing between the collector-emitter pins of one of the common-base transistors in the cascode RGB output stages. The CRT's heater supply had subsequently become intermittent, and it seemed to me that some of the copiously-applied lacquer had contaminated one or two of the CRT socket's receptacles. So I replaced the socket and gave the monitor a long soak test.

The monitor subsequently came back with the same fault. This time I discovered that there was a fine ring around the 6·3V supply pin at connector CN104 on the main PCB. If the monitor hadn't been taken to a bodger the fault would probably have been correctly diagnosed during its first visit. **I.F.**

Highscreen MS15AS

There was a flooded screen with flyback lines. It looked like a nice, easy one: either a dry-joint at the CRT's control grid pin, or an open-circuit high-value resistor somewhere in the scan-derived negative supply to the brightness control – or possibly a high-voltage electrolytic capacitor associated with this supply might be faulty. Since the brightness control didn't work, I started by checking resistors in this area and found that R467 (300kΩ) was open-circuit. A replacement restored brightness control operation – for just a few minutes. Then the line output transistor blew without warning.

A replacement didn't last long. It seemed that there had been intermittent shorting in the line output transformer's primary winding, and that this had now become more permanent. Despite extensive checks on other possibilities, including the flyback tuning, the power supply regulation and the EW control circuitry, no other fault could be found. A replacement LOPT cured the fault. **I.F.**

Hewlett-Packard Ergo Ultra

This monitor incorporates a Samtron chassis that's similar to several used by Compaq. The cabinet is elaborate and looks difficult, but isn't. Its bottom plastic cover slides off rearwards, giving access to most of the print side of the PCB. If necessary the main panel can be slid out without too much difficulty.

The fault was no picture, because the tube had almost no emission. As usual, temporarily over-driving the cathodes brought them back to life. But this was one of those rare occasions when they didn't revive evenly. The blue gun was best: the red gun revived just sufficiently to obtain grey-scale balance.

The heater supply is provided by a rectifier circuit that's fed from a secondary winding on the chopper transformer: the two electrolytics here, C134 (470μF, 35V) and C115 (100μF, 25V), work hard and should be replaced with low-ESR components. C115 has a disc-ceramic capacitor, C116 (0·1μF), in parallel to reduce ESR-loss heating, but its value is hardly adequate. Nevertheless even a CRT this worn can be kept going for a considerable further period by replacing the two electrolytics with good-quality, low-ESR types. In fact the cathodes will continue to recover for a time, so it's important to run the CRT in for several hours, preferably overnight, with a full peak-white raster. This will ensure that the cathodes settle before the grey-scale is set up. **I.F.**

Elonex TE1438A

The brightness was fluctuating. I soon discovered the reason for this: the CRT's 12V supply was fluctuating. In fact because of the sharp variations in CRT load most of the supplies were fluctuating. IC602 (7812CV) produces the 12V supply from a 22V input, which comes via a precision power resistor, R632 (43Ω, 3W 1 per cent). Because of the voltage drop across this resistor, the input to IC602 was at the minimum permissible level. The result was intermittent drop-out. IC602 was running very cool. R632, when checked out of circuit, was only slightly high in value.

I replaced IC602 and the supply decoupling capacitors, but this made no difference. Not having a 43Ω, 1 per cent resistor, I decided to try 39Ω, 3W. To check on the limits of the 7812CV regulator, I ran the monitor for a time with R632 linked out. The regulator got pretty warm, but the addition of a small, clip-on heatsink reduced its temperature to an acceptable level. R632 is intended to act as a fusible device in the event of a fault, so the link was removed before finishing the repair. The clip-on heatsink was left in place to provide an extra safety margin.

Once IC602 had an in-specification voltage at its input it ran no warmer than previously and the monitor worked perfectly. **I.F.**

Some Quickies

IBM 6314: There was a blank raster – no video. The M5307P chip IC301 had failed.

AOC 4NIR: This monitor powered up then went straight down. There were massive dry-joints on P401 – the flyback compensation coils.

Hewlett-Packard 700/92: This one was dead, with the chopper transformer sparking on its underside. A replacement transformer restored normal operation.

Viglen 14S: There was a very bright raster with flyback lines. R210 in the supply to the RGB output stages was open-circuit. This fault can also be caused by a short-circuit output transistor or by dry-joints on the CRT base PCB.

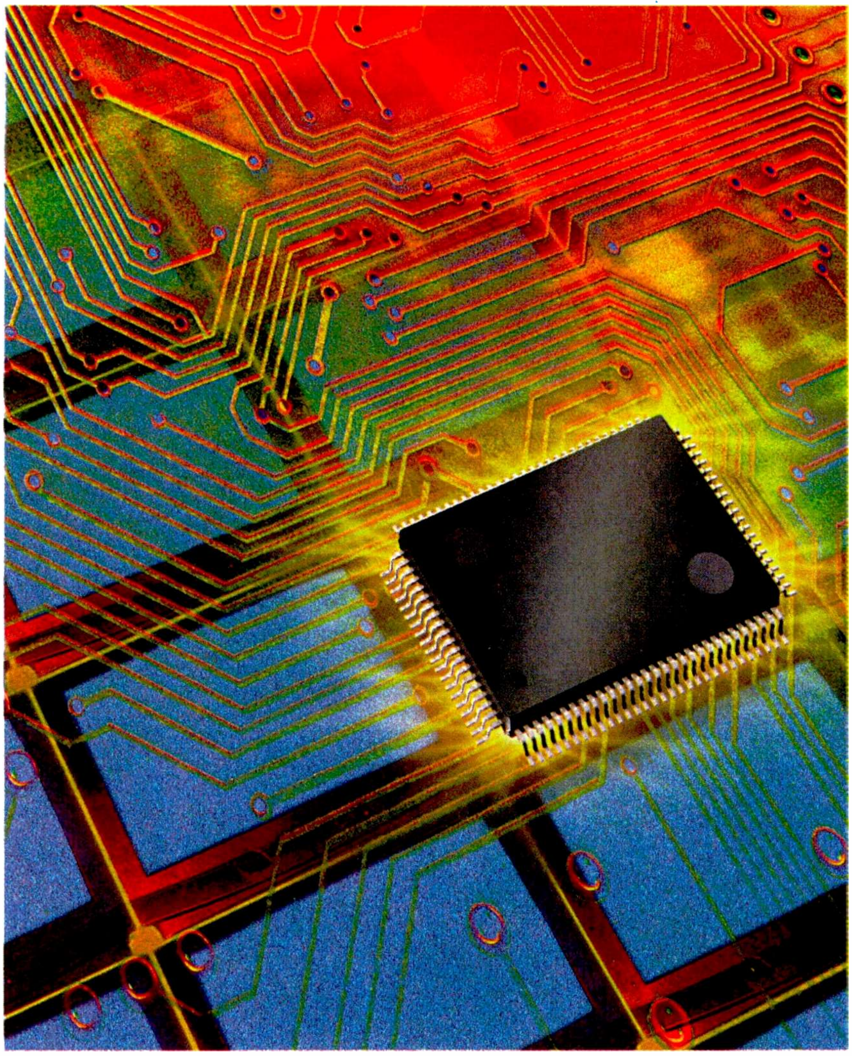
AOC CM335: This one was dead with J702 (1Ω fused resistor) blown. It supplies the LOPT with about 90V and is located beneath the transformer (viewed from the back).

Hyundai HCM401: Squealing can be caused by the 2SD1207 line output transistor or the STK7308 chopper IC.

Viglen CA1426LT: This one was dead with the 2SA3886A line output transistor Q312 short-circuit. In this event C322 (5·6nF, 1·6kV) should also be checked.

AOC CM335: This monitor was dead with R106 (68kΩ, 7W) open-circuit – it's the big resistor in the primary side of the chopper power supply. The usual cause of its failure is the UC3842 control chip going short-circuit.

Smile CK1450: This one was dead with big power supply problems. Q502, D509 and R527 had blown. Further investigation revealed a leaky diode in the secondary side of the circuit. The tube's heaters failed to light up because of a dry-joint on the tube base PCB. **R.P.**



We talk loosely about processors and micros. There are important differences however between the various devices used for digital control in TV sets and other equipment. K.F. Ibrahim describes this family of ICs and their operation

Microcomputer Systems for TV

The introduction of very-large and ultra-large scale integration (VLSI and ULSI) enabled the equivalent of a million or more transistors to be incorporated in a single integrated circuit. This has made it possible to manufacture complex circuits and complete systems on a single silicon chip. Four types of processor chips may be found in a digital TV set-top box: (1) general-purpose microprocessors for basic system programming and control; (2) dedicated processors such as video decoders and transport-stream demultiplexers; (3) microcontrollers; and (4) system-on-chip processors. Three basic technologies are used in the fabrication of ICs: bipolar (TTL), CMOS and NMOS. The latter two are normally used because they provide higher component density.

To make the operation of such processing systems clear, we'll start with a description of a basic general-purpose microcomputer system, see Fig. 1. It consists of the following elements: (1) a central processing unit (CPU); (2) memory chips, RAM and ROM; (3) an address decoder chip; (4) input and output interface chips, PIO and UART, for connection to other systems (monitor, printer etc.); (5) a direct memory address controller (DMAC); (6) programmable devices as required; and (7) a bus system.

The CPU

The CPU is the actual microprocessor. It's usually a VLSI chip that contains all the circuitry required to interpret and carry out program instructions. This involves data manipulation, logic and arithmetic operations, and timing and control of the system.

A microprocessor chip's capability depends on the number of parallel data bits it can handle. Common microprocessor chips have 8- or 16-bit capability (width). The smaller 4-bit and 8-bit microprocessors are generally used as dedicated devices in industrial applications and domestic appliances such as washing machines and TV receivers. Microprocessors also differ in the speed at which they can carry out instructions. Speed is specified as the system clock frequency, in MHz.

While the bit-width determines the quantity of information that can be handled in any one cycle of operation, the speed determines the number of operations that can be carried out per second.

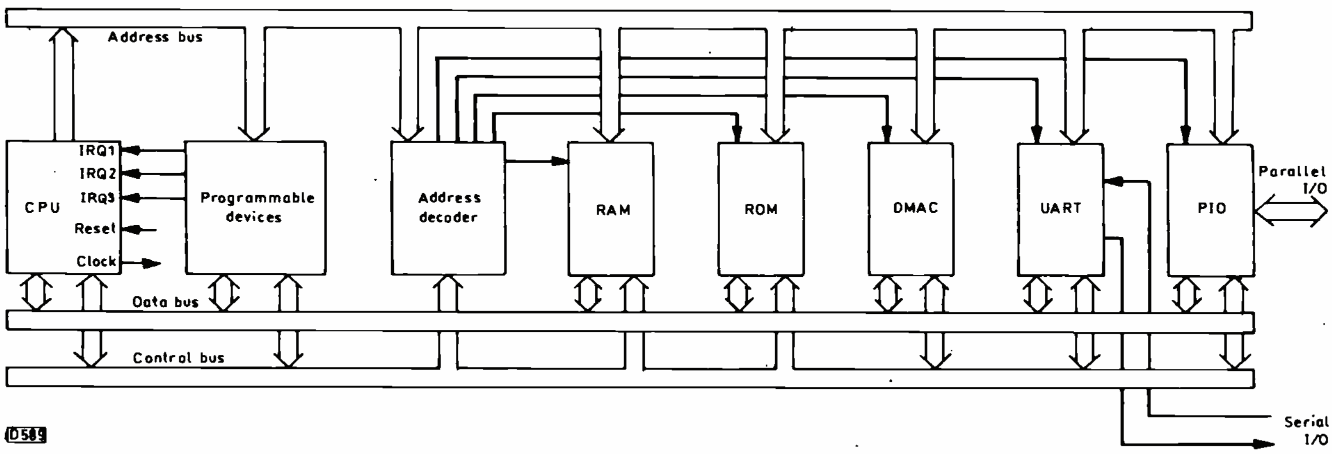


Fig 1: A basic general-purpose microcomputer system.

We will look at the CPU chip's internal operation later in this article.

Memory Chips

A microprocessor system requires a certain amount of data storage capacity where programs such as start-up routines and other processing control software are kept. The two types of chips normally used to provide the necessary memory space are DRAMs (dynamic RAMs) and ROMs. Other types, such as PROM, EPROM, EEPROM and flash, may also be used.

Address Decoder Chip

The input to this chip is a group of address lines. Depending on their states, one of the outputs is enabled – generally by taking it low. If such an output is connected to the CS (Chip Select) pin of a memory chip, that chip will be enabled, i.e. selected. With two address line inputs, four outputs are available, see Fig. 2. With three address line inputs eight outputs are available and so on. The arrangement shown in Fig. 2 is referred to as a 2-to-4 address decoder.

I/O Interfaces

Input/output devices connect the system to external items. They act as an input or output route for transferring data to and from items such as a keypad, display unit, remote control unit, video decoder etc. Two types are shown in Fig. 1, PIO and UART. PIO stands for parallel input-output: this chip provides a parallel communication path to and from the system. A UART (Universal Asynchronous Receiver/Transmitter) provides a serial data communication route to and from an external device such a modem or mouse.

With a UART there are two data lines, received data (RDX or RD) and transmit data (TDX or TD). There are also a number of control lines, known as handshake lines. The 9-pin RS232 D-type connector (port) is standard for use with a UART. Pin connections are 1 DCD (carrier detect), 2 RX (receive data), 3 TX (transmit data), 4 DTR (data terminal ready), 5 ground, 6 DSR (data set ready), 7 RTS (request to send), 8 CTS (clear to send) and 9 RI (ring indicator).

The input/output interface chips are programmable, i.e. they can be used to connect to devices with different specifications. A programmable chip incorporates a number of internal registers – small data storage areas, normally eight bits in length. The chip's mode of operation is defined by the contents of these registers – the CPU adjusts the contents. When an external device such as a modem requests attention, the CPU initialises the I/O interface (in this case a UART) by loading its registers with the appropriate codes for the modem's requirements, such as speed and bit length. Once the UART has been initialised, the CPU calls up a program known as a service routine. This enables the system to communicate with the modem.

DMAC

The vast majority of computer operations involve the transfer of data between different parts of the system. The microprocessor chip normally carries this out. Where a large amount of data has to be transferred a faster method, known as direct memory access (DMA), may be used. In this case a DMA controller chip takes over for the duration of the transfer. Once the data transfer has been completed, the DMAC hands control back to the CPU.

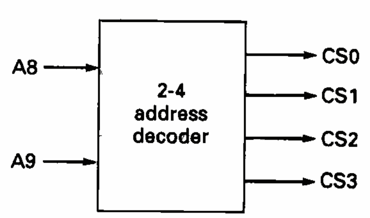
The Bus Structure

The hardware items so far mentioned are interconnected via a bus structure that has, as shown in Fig. 1, three sections, address, data and control. The address and data buses provide a parallel highway along which multi-bit addresses and data travel from one chip to another. The control bus is used for the lines that carry control signals to and from the CPU.

As its name indicates, the data bus is used to transfer data between the CPU and other chips in the system. The address bus carries data that identifies the memory locations where data is to be read (retrieved) or written (stored). It's also used to identify other parts of the system such as the input/output ports. The control bus carries the CPU control signals, such as clock, reset, read (RD) and write (WR).

Control Signals

The number and type of control signals depends on the microprocessor and the system design. Control signals are normally active low, i.e. the high state is the rest position, the low state (logic zero) being used to produce the required action. Active low signals are identified by a bar above them. The main CPU control signals are as follows:



A9	A8	Output
0	0	CS0
0	1	CS1
1	0	CS2
1	1	CS3

Fig 2: Operation of an address-decoder chip.

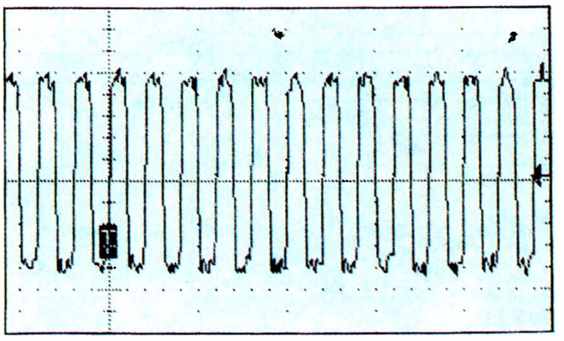


Fig. 3: Print-out of a clock pulse signal – taken from a digital storage oscilloscope.

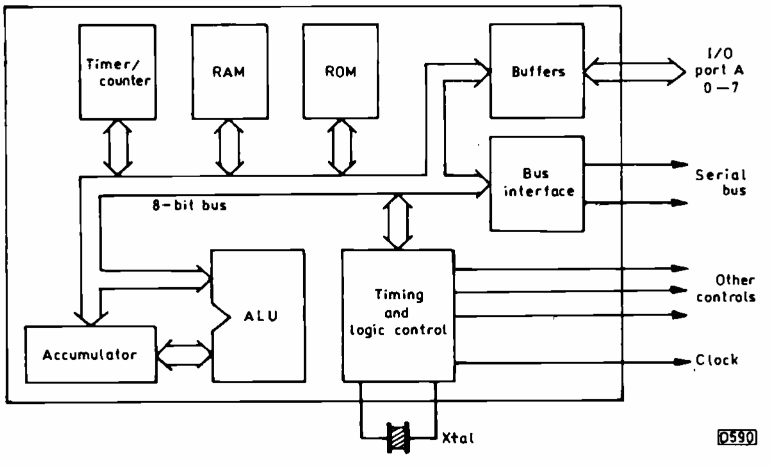


Fig. 4: Basic arrangement of an 8-bit microcontroller chip.

Clock pulses: A clock pulse signal, see Fig. 3, is an essential requirement for processor operation. It synchronises the movement of data between the various chips in the system and controls the operating speed – without it the system comes to a halt. The clock pulses must be accurate and stable, so a crystal oscillator is used to generate them – it's built into the CPU/microprocessor chip. Clock pulse frequencies vary between a relatively slow 8MHz and 100MHz or more.

Any drift in the clock pulse frequency may cause microprocessor malfunctioning. A logic probe can be used to monitor the pulses, but a frequency counter or an oscilloscope with appropriate bandwidth must be used to check the frequency.

Read ($\overline{\text{RD}}$) and write ($\overline{\text{WR}}$): The CPU's read and write lines determine whether it is to receive or transmit data. In a read operation the CPU receives data from an external memory location. The opposite occurs with a write operation.

Interrupts: When a peripheral device such as a channel decoder or a transport demultiplexer needs attention it sends an interrupt request (IRQ) signal to the CPU. When the CPU receives such a signal the main program is temporarily interrupted so that the request can be dealt with. Once the device's needs have been met, the CPU returns to the original program. The CPU will have one or more interrupt lines, which are referred to as IRQ1, IRQ2 etc.

With an IRQ the CPU completes the current program instruction before recognising the request. Other interrupts, such as **halt**, stop the execution of the main program to enable an external source or device to have a different program executed.

Reset ($\overline{\text{RES}}$ or $\overline{\text{RST}}$): This is a type of interrupt that overrides all other interrupts. The reset pin is normally held high. If it's taken low by a manual reset or by accident or fault, the CPU program is immediately stopped and the processor is reset. To restart microprocessor operation, the reset pin must go high again.

A simple *RC* charging circuit can be used to provide reset action, the capacitor charging via the resistor from the microprocessor's supply voltage. At switch on the capacitor will be discharged, the voltage across it providing the low state. As it charges it provides the high state. A discharge switch across the capacitor will provide a manual reset.

When the reset pin goes high the microprocessor immediately starts an initialisation process. This consists of directing the CPU to the memory location where the system start-up program is stored. It is necessary to ensure that all DC voltages have reached a steady state before initialisation takes place.

Resetting and Initialising: The registers in all programmable chips, including the CPU and power supply control chips, must be set to an initial state that determines the start-up parameters of the chips. This is known as initialisation.

After power-on, a reset pulse known as Power On Reset (POR) is generated and used to reset and initialise all the programmable chips. It occurs once the various DC voltages have reached a steady and stable level. This normally involves a delay of 20-60msec.

Operation of a Microprocessor

The internal arrangement (architecture) of a microprocessor chip is complex and varies from one manufacturer to another. There are however common elements, as follows: (1) an arithmetic and logic unit (ALU), (2) timing and control logic, (3) an accumulator and other registers, (4) an instruction decoder, and (5) an internal bus.

Microprocessors operate on a fetch and execute basis. During the fetch phase the processor receives an instruction from the memory location where the relevant program is stored. This is done by putting the address of the memory location on the address bus and enabling the read control line. The address decoder selects the appropriate memory chip, which then puts the contents at that address on the data bus. The CPU receives the instruction (data) and stores it in an internal register called the instruction register.

During the execute phase the CPU decodes the instruction and carries it out. To do this, the CPU has to generate the timing and control signals required for the execution of the particular instruction. The execute phase may involve a simple arithmetic operation, e.g. addition or subtraction, or more complex data transfer to or from memory or peripheral devices.

The fetch and execute phases may both take more than one clock cycle to complete, depending on the nature of the instruction. When the execution phase has been completed, the microprocessor puts the next program address, i.e. the address where the next instruction is stored, on the address bus and the next fetch and execute operation is carried out.

Timing diagrams show the relationships between the various signals such as clock, address, data and read/write.

The microprocessor performs its operations in a predetermined sequence known as a program. This is a series of instructions that breaks each operation down into a number of individual tasks. The instructions are in two parts: operator and operand. Each instruction, such as add or move data, is represented by a binary number known as the machine code, operational code or opcode for the particular processor. This is the operator part of the instruction. The operand part consists of the data that the opcode is to work on, e.g. the two numbers to be added or the data to be moved.

With an 8-bit system there will be an 8-bit operator and one or more 8-bit operands. Naturally an instruction with a number of operands takes longer to execute than one with fewer operands. Each make of microprocessor has its own set of machine codes known as the **instruction set**.

Writing programs in machine code is a lengthy and tedious process. So programs are normally written in a computer language that uses normal alphabetical letters and words. These are then translated into the appropriate series of opcodes. The simplest form of translation is the assembler, which employs an assembly programming language. In this language each opcode has a mnemonic name such as EN for enable, MOV for move, ANL for AND logic and INC for increment.

Types of Microprocessor

There are two basic types of microprocessor, CISC (Complex Instruction Set Code) and the faster RISC (Reduced Instruction Set Code). RISC processors carry out fast mathematical operations by using fewer, i.e. a 'reduced' number of, instructions. Examples of CISC processors are the Intel 80XXX and Pentium series; examples of RISC processors are the power PC and OAK.

Microcomputer Chip

The basic elements of a microcomputer system – CPU, memory, DMA controller, PIO and UART ports and a bus interface – can be incorporated in a singe chip. Microcomputer chips are used to control ASICs (Application Specific ICs) or ASSPs (Application Specific Standard Processors) such as analogue video and audio decoders, digital sound processors and digital TV demodulators and demultiplexers.

Dedicated Processors

Dedicated processors are designed to carry out one particular task, e.g. demultiplexing, video or audio decoding etc. They are programmed and controlled by the system microprocessor chip via the address/data bus and control signals or by a serial bus or both. Chips such as demultiplexers and video/audio decoders require their own dedicated memory store which is linked by local address/data buses. The processor has its own on-chip clock, which sets the processing speed. This is distinct from the system clock, which provides system synchronisation.

Microcontrollers

Microcontroller chips, also known as CCUs (Central Control Units), are dedicated microcomputer chips. They contain a microprocessor core plus RAM, ROM or other memory and input/output ports. A number of microcontroller chips are available from various manufacturers, for example the Intel 8048/49 series, Motorola 6805 and 146805, Texas TMS1000 and Zilog Z80 series. They are used as dedicated computer systems for applications such as car engine, washing machine, VCR and of course TV receiver control.

The difference between one microcontroller and another lies in the type and size of memory incorporated, the instruction set, operating speed, number of input and output lines available and the data width, i.e. four, eight or sixteen bits. Microcontrollers usually have their instruction program permanently stored in an internal ROM at the manufacturing stage, a process known as mask programming. Some chips in addition work with an external EPROM that can be used for user programming.

The basic architecture of an 8-bit microcontroller chip is shown in Fig. 4. Its program is held in the ROM, with a small RAM (1-4kbytes) available for data and other external control signals. The timer/counter may be loaded, started, stopped or read by software commands. In TV applications it is used to keep track of the sequence of lines and fields and prompts the device to carry out certain operations at specific times. One parallel 8-bit port (A) is shown. Each port may be assigned as an input or output. Two lines of a parallel port can be used as a serial input/output port. There is also a serial bus interface, which is used to control peripheral devices such as tuners and demodulators.

The ALU (Arithmetic and Logic Unit) carries out arithmetic operations such as adding two numbers or performs a logic function such as NAND or NOR on two numbers. The ALU therefore has two parallel inputs, one for each number. When an ALU operation is completed the result is temporarily stored in the accumulator for subsequent use.

The timing and control section provides the necessary system synchronisation. Interconnection between the various sections is via a multiplexed 8-bit bus.

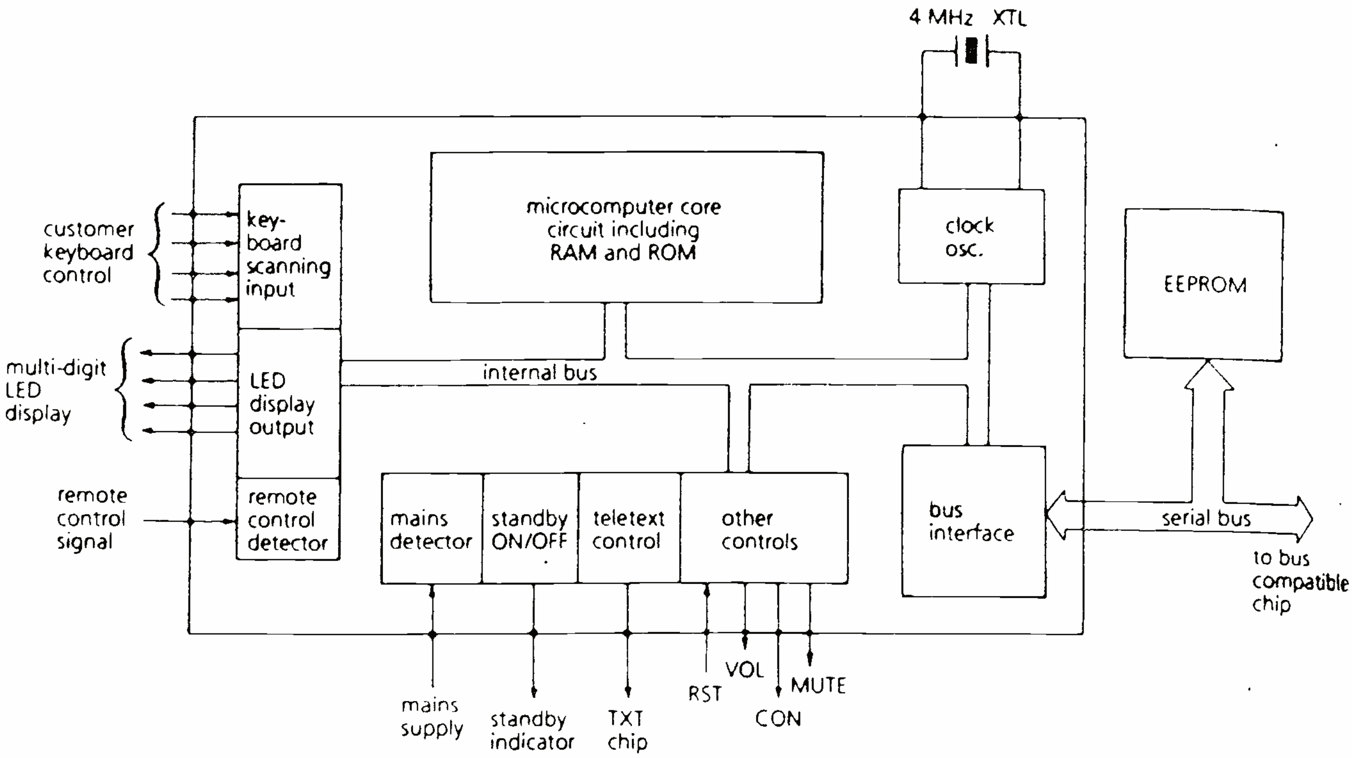


Fig. 5: Internal arrangement of a typical TV microcontroller chip.

Fig. 5 shows the internal arrangement of a typical TV microcontroller chip.

The Serial Control Bus

Microcontroller chips use a serial bus to control other devices. There are two main types of serial control bus, the two-line inter IC (referred to as IIC or I^2C) and the three-line Intermetall (IM) bus.

The I^2C bus has two bidirectionsl lines, serial clock (SCL) and serial data (SDA). Any device connected to the bus can send and receive data, which is transmitted as 8-bit bytes. The first byte of a transmission consists of the 7-bit address of the device concerned followed by a read/write bit to indicate whether data is required from or being sent to the device. A number of data bytes follow, the total number in a message depending on the nature of the information being transferred. Each data byte is followed by an acknowledge bit.

The first byte of any data transfer is preceded by a start condition, the message being terminated by a stop condition. An arbitration system is used to ensure that two devices don't use the bus simultaneously. The clock line is active only when data is being transferred, the frequency being variable – data can be sent at a slow or fast rate up to 100kbits/sec.

The Intermetall bus has three lines, I (Ident), C (Clock) and D (Data). The ident and clock lines are unidirectional between the microcontroller and the other devices linked to the bus. Data is bidirectional. The start of a transmission is signalled by the ident line going low. An 8-bit address is then sent along the data line. After eight clock cycles the ident line goes high to indicate the start of data transmission. Data is then transmitted via the data line for eight or sixteen clock cycles for an 8-bit or 16-bit data word, after which the ident lines goes low to indicate the end of data transmission.

A receiver may use both types of bus to provide connections to different sections. In the Thomson/Ferguson ICC5 colour TV chassis for example there are four different buses.

A number of chips are available for operation with I^2C or IM buses including microcontrollers, tuner interfaces, channel decoders, EEPROMs, ADCs and ASIC processors.

A serial bus can be checked by using a logic probe or oscilloscope to check for the presence of a pulse train. Make sure that a data transmission should take place when carrying out this test. This is easily done by using the remote control unit – say to change channel.

System-on-a-Chip (SoC)

The evolution of chip manufacturing technology has vastly increased the amount of circuitry and the functions that can be incorporated in a single chip. The change from 0·5μm to 0·18μm track width made available a vast amount of space that can be used for additional functions – processing and the provision of extra memory of various types. Merging different processes yields a single universal process known as a System-on-Chip (SoC) processor.

SoC is the latest advance in chip technology and is likely to replace ASIC technology over the next few years. It combines a microprocessor core with integrated memory, I/O ports etc. The core is a powerful RISC processor such as an ARM or OAK type.

SoC processors can carry out two functions simultaneously: (1) program and control of external devices such as video/audio decoders and terrestrial DTV demodulators, using the powerful CPU core; and (2) carry out a specific complex processing operation such as transport demultiplexing in a digital TV decoder. In short, a SoC doubles as a general-purpose and a dedicated processor. SoCs are already being used in DTV set-top boxes, for example the transport processor in Pace terrestrial STBs.

K.F. Ibrahim is a Training Consultant and Senior Lecturer at the College of North West London and author of several books including Television Receivers.

ADSL signal Distribution

J. LeJeune on how the traditional twisted pair can be used for digital communications purposes

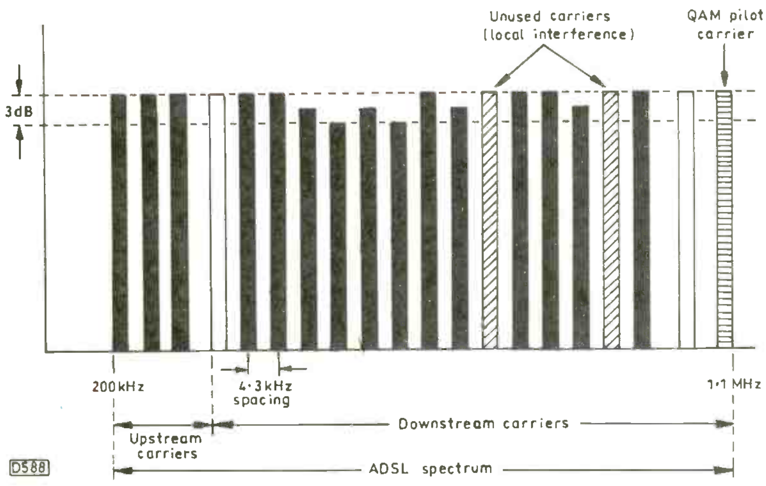


Fig. 1: Composition of the DMT modulation within the ADSL bandwidth.

Not so long ago the copper-pair telephone line to your home from the pole in the street was used solely for POTS, an industry term that stands for Plain Old Telephone Service. Those old enough to have used a modem in the Sixties will recall the painfully slow speed of the 300-1,200 baud units then available. As time went on, speeds became progressively greater until 56kbits/sec was achieved. That was the limit to any further speed increase.

During the last few years the situation has remained relatively static – unless you went to the expense of an ISDN (Integrated Subscriber Digital Network) line. Then ADSL came along. It stands for Asymmetric Digital Subscriber Line, and is a digital communication system with a fast downstream channel and a slower upstream one, both above the existing voice channel. It's fast!

The Technology

During the early stages of development it was found that at frequencies up to about 1MHz the phase change introduced by the line is proportional to frequency. This means that there is little distortion to a pulse signal. ADSL makes optimum use of the existing copper pairs, without disturbing the existing voice-frequency communications, by adding a data communication band that usually extends from 200kHz to 1·1MHz. The lower part of this band is used for an upstream (return) data channel, the remaining wider band being used for the downstream data.

Discrete Multi-Tone (DMT) modulation, i.e. a number of separate carriers, is used for ADSL. The spacing between the carriers, which constitute a Fourier series, is 4·3kHz, see Fig. 1. This ensures that there is minimal interference between adjacent carriers. In this respect ADSL is similar to the COFDM used for digital terrestrial TV transmission, though on a smaller scale and with a split band to provide forward- and return-path data. Individual carrier frequencies are sometimes avoided because of adverse line conditions, such as strong local interference from MF and LF transmitters.

With the specified frequency separation there are about 208 carriers. Each carrier is quadrature-amplitude modulated (QAM). The highest one is a pilot carrier which is used to sense line attenuation and other impairments: line equipment adjusts the transmission to counteract any problems that occur. The principle of QAM is by now well known. Briefly, there are two carriers at the same frequency with a phase separation of 90°. They are known as the I (In-phase) and Q (Quadrature phase, i.e. –90°) carriers. Each carrier is both phase and amplitude modulated to convey the data being transmitted. The two carriers are then combined. Although digital data is being transmitted, the signals produced in this way are in analogue form.

DMT was chosen because of its rugged performance in the face of high line attenuation, reflections, white noise, interference, cross-talk, RF ingress and impulse interference. Naturally not every line is suitable for ADSL: success depends on the length, quality and age of the copper lines.

Other versions of ADSL, known as the xDSL family, run at different speeds. With some the HF range is extended to 2·2MHz. Whether these versions can be used depends on the quality of the line and its length. With a clean copper pair the upstream delivery rate can be up to 10Mbits/sec, with 1Mbits/sec downstream.

Network Arrangement

At the subscriber's terminal a splitter separates the digital signals from the baseband audio (see Fig. 2). The later, at up to about 3·4kHz, is routed to the conventional telephone while the ADSL frequencies are fed to the appropriate home/office terminal. The equipment that handles the digital signals is called the ADSL network termination: it can contain modems suitable for feeding ATM (Asynchronous Transfer Mode) and Ethernet local networks.

For the path from the subscriber's terminal the splitter combines the telephone and digital return inputs to feed the copper pair that conveys voice and data signals to the end of its run, which is normally at the local exchange. Here it feeds a Subscriber Access Multiplexer. Voice traffic proceeds via the normal switched narrowband routes – the POTS network. The digital data is routed via a high-speed digital network which uses either fibre-optic or at least high-quality coaxial cable. Fig. 2 illustrates the path from a subscriber terminal to the POTS and data networks.

Digital signals forwarded via a trunk network increasingly use ATM, though other standards are employed depending on the type of data transport network.

To summarise, voice telephony carries on as normal over the POTS switched network. The digital data is separated from the baseband audio and then sent, via an

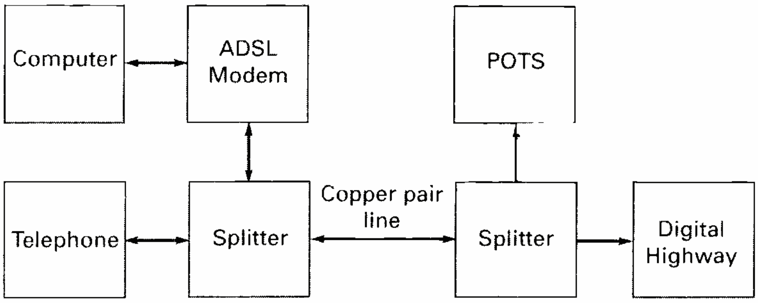


Fig. 2: ADSL path between a subscriber and the exchange.

ADSL modem, to high-capacity networks. The modem translates the data into whatever format is used by the data highway network.

An important point to note is that ADSL operates continuously: there is no dial-up procedure as with a telephone. The connection remains live and ready to pass data back and forth. Data destinations are signalled digitally within the data stream. Each computer connected to an ADSL line has its own IP (Internet Protocol) address. Where a number of computers are connected, one line will be a local network hub that acts as a PABX.

The introduction of ADSL backed by ATM enables wide bandwidth services to be linked to homes and offices. It was immediately recognised as a suitable way of providing video-on-demand (VOD).

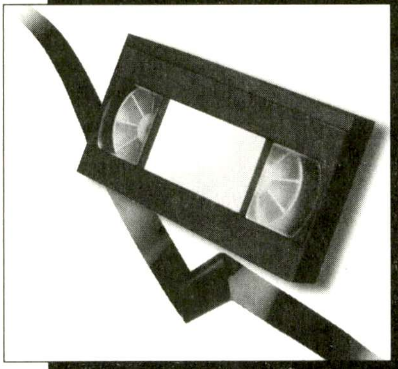
Current Situation

ADSL technology has been proved and is now being used in two areas – Hull, East Yorkshire and part of London. A consideration with many telephone company executives is its interoperability, which simply means that the technology should be able to work with modems from different manufacturers and any telephone, and that the signals can be routed over other network providers' lines without difficulty. The modem should be as simple to install and use as current POTS modems, Plug and Play or USB for example, and allow connection to any of a variety of services.

For cable TV operators ADSL means increased flexibility and capacity. The copper-pair drops to subscribers are short with a hybrid fibre/coaxial network, enabling wide bandwidths to be used. An ADSL service can complement the existing high-speed cable modems used in CATV networks. They could therefore achieve a significantly higher data throughput than would be available from BT with its longer and older lines. Where cable TV is not required, for example in business premises, the cable operator could offer ADSL to provide superior speed to POTS.

We are at present seeing the convergence of digital broadcasting and the internet. ADSL allows delivery of video via the telephone network, enabling the internet to be added to the system and breaching the demarcation lines that used to exist between different delivery systems.

Our heading picture shows a Kingston Interactive Television Local Link – providing connections for shopping, news and information services



VCR Clinic

Reports from Philip Blundell, AMIIEelec Eugene Trundle Kevin J. Green, TMIIE Derek Bogiscin M. Della Verita John Edwards Adrian Williams and Ronnie Boag

Mitsubishi HSM40V

If the machine won't thread up though the rest of the mechanism seems to be OK, the drive gears to the loading arms have probably lost some teeth. When the mechanism has been dismantled you will be able to see which of the following need to be replaced:
arm load T (take-up side) 592B047010
arm load S (supply side) 592B048010
plate cam B 641A311010. **P.B.**

Daewoo V235

We've had two of these machines in with a very obscure intermittent fault: the video and RF outputs were lost and all deck functions had failed, but the front display remained normal. In both cases the cause of the fault was a dry-joint at Q856, which is part of the switch for the 'on-off 5V' line. When the fault was present this voltage dropped to 1·25V. **E.T.**

Akai VSG770 etc

The machine we had in for repair was a Model VSG770, but the fault could no doubt arise with other models in this range. The symptom was comet-tail blips over the playback picture, sometimes in clearly-defined horizontal lines and sometimes disappearing after say half an hour's playing time. The cure is to remove the PCB atop the drum assembly (motor stator) to reveal the drum-earthing brush. Then clean and retension the brush and spring. If this is properly done there will be no interference on the playback picture even when you touch the rotating upper drum gently with your finger. **E.T.**

LG/GoldStar N3091

There was intermittent failure of fuse F107, the result being loss of the deck functions. The cause turned out to be a faulty loading motor: when tested it drew a high and irregular current from a fixed-voltage source. **E.T.**

Samsung VIK316

The 'dead' symptom was cured by replacing C35 in the power supply – it was virtually open-circuit. Although the machine then worked all right its fluorescent display panel was dim. Checks showed that the heater voltage was low. Full brightness was restored by replacing C38 (100μF, 10V). **E.T.**

Daewoo DVR7372, 5172

The F mechanism used in these models, now six years old, is beginning to show its age. A new (to us) fault is beginning to appear: the mechanism jams because of a broken plastic wall on the underside of the main drive cam. It's item 6-7, part no. 97S2707400. **E.T.**

Hitachi VTFX770E

This quite new model has much in common with the VTFX550 etc. The one we had in for repair was still under guarantee and was dead. It sprang to life when the deck was removed. On test I found that there was a heavy load on the 5V supply. A faulty capstan motor (part no. GP10254) was the cause. **E.T.**

Amstrad DD9900, UF20 etc

No rewind or fast forward are the symptoms when, in these modes, the machine attempts to drive the reels via the clutch. The root cause of the trouble is the M-lever holder assembly underneath the main cam. Its part no. is 255034 – you can get it from CPC under code no. AM255034. **E.T.**

Panasonic NVHD90

When this machine had been in operation for about half an hour the picture would become very poor – lines would appear across the recorded picture. The cause of the fault was IC301, part no. VEFH29H. **K.J.G.**

Aiwa HVFX1500

There was no drum rotation. Checks showed that the supplies to the drum were all OK. The cause of the fault turned out to be the stator motor (M2003), part no. S5895110070. **K.J.G.**

Sharp VCM311HM

This fault produced very deceptive symptoms. When a prerecorded tape was inserted only a few seconds of very snowy-looking picture were played back, with the counter running much too fast. It seemed to me that the control pulses were low or missing. Not so. The cause of the fault was Q652, a small DTC323 'digital' transistor. It had gone short-circuit, leaving the oscillator running all the time and thus upsetting my prerecorded tape. **K.J.G.**

Mitsubishi HS651V

This machine would come on then, after several seconds, power down and revert to standby. The cause of the problem was Q903. **K.J.G.**

Sony SLVE520
The customer complained about a permanent droning noise on the playback audio. I checked what I could around the audio playback amplifier section of IC101 and found that a cyclic noise could be seen at the output, even with the feed from the audio head shorted to chassis. So it seemed that the IC was introducing the noise. A check on the IC's supply showed that it was a little low, with a similar cyclic noise present. This led me back to the troublesome fusible link PR512 in the power supply section. It had the tell-tale brown line around it. When a higher-rated replacement was fitted the fault had been cured. **D.B.**

Osaki VR410
There was low or fluctuating sound with playback of this machine's own recordings: prerecorded tapes were OK. I traced the cause of the fault to C227 (1µF, 63V), which is connected to pin 11 of the preamplifier chip IC201 on the audio/video preamplifier PCB. The fault is probably caused by excessive heat from the nearby power supply radiator. **M.D.V.**

Toshiba V300
The sound in both the playback and E-E modes was fine, but the E-E picture was a mess. It could best be described as having poor interlace with constant vertical rolling. The playback picture was also affected by what seemed to be poor interlace, i.e. every other line darker or missing; and although it was locked, it had a 'dirty', low-gain look to it. The culprits were on the power supply-2 PCB. C826 (1,200µF, 16V) and C822 (47µF, 16V) were leaky; C823 (1µF, 50V) was very leaky; and C824 (220µ F, 16V) was almost open-circuit. **J.E.**

Samsung SI1260
When a cassette was inserted the tape loaded half way, as usual, but thereafter no other functions could be selected – whether via the remote control unit or the on-board controls. There was no drum or capstan rotation. When eject was selected the tape guides would unload but the tape remained laced up round the drum and the carriage remained down. The only way in which I could eject the tape was by rotating the loading-motor pulley manually. The next time I tried to insert a cassette the machine wouldn't let me.

Checks showed that the 15V supply to the loading motor control chip IC206 was very low at only 1·2V. D212 was found to be faulty by substitution – it checked OK with a meter. Once D212 had been replaced the machine accepted a cassette, but there was still no drum or capstan rotation. The eject mode now worked, but the tape looped on the way out. This time I found that the 5V supply at the cathode of D109 was low at only 0·5V. Once more the diode checked OK but was proved to be faulty by substitution.

At last I had a machine that worked normally. I remain suprised by the fact that the two diodes seemed to be OK when checked with a multimeter (diode test function) and an oscilloscope component tester but were nevertheless faulty. **J.E.**

Panasonic NVSD200 (K deck)
It's becoming quite common to find that the plastic pulley attached to the loading motor has cracked. This item is quite cheap and is readily available from the major suppliers. But the symptoms you get can vary. When I have mechanical problems with these machines I now inspect the pulley first – I could strike lucky! With this particular machine the tape functions all worked until eject was selected. It would then unlace and shut down, leaving the cassette in the down position – code F06 would sometimes be displayed. **J.E.**

Matsui VPA9401A
This machine appeared to be totally dead: there were no functions and no displays. But the power supply was in fact working. The cause of the trouble was protector ICP501 which was open-circuit. **J.E.**

JVC HRJ235
This machine refused to work after a thunderstorm. The mains fuse had shattered and, not surprisingly, the chopper FET Q901 was short-circuit. I replaced it, using the readily available 2SK1275. The driver transistor Q902, which is a high base-to-emitter voltage type, was also short-circuit. A BC4204 was fitted in this position. The only other failed component was the mains bridge rectifier. Once this was replaced everything worked well.

I had been asked to investigate pending an insurance claim. Although the power supply had clearly suffered, I was reluctant to commit myself to a quotation in case there was further damage. Hence the repairwork just described. The customer agreed that the cost of this didn't warrant losing his no-claim bonus and excess. **J.E.**

Hitachi VTM620
There was poor capstan servo lock in the play mode and, intermittently, the capstan would run away (fast). Using my Alan Willcox ESR meter I discovered that C901 (47µF, 16V) and C622 (10µF, 63V) both produced higher than normal readings. C622 was also leaking – this was not visible with the capacitor in situ. Replacements restored correct operation. Someone else had previously replaced the servo ICs. **A.W.**

Daewoo V200
If one of these machines comes in dead, replace the 1µF, 100V capacitor on the primary side in the power supply module and the two 22µF, 63V capacitors on the secondary side. **A.W.**

Toshiba V728
The fault with this machine was intermittent loss of the E-E sound. Scope checks revealed that oscillator QN201 was dry-jointed. Resoldering cured the problem. **R.B.**

Goodmans VN6000
This machine would intermittently fail to power up. The cure was to upgrade C822 in the power supply. A 1,000µF, 10V capacitor in this position cures the problem. **R.B.**

GoldStar RE703
This machine wouldn't play tapes because the final take-up arm did not pull the tape over to the capstan spindle. Fitting kit RK205G from SEME cured the problem. **R.B.**

Akai VSG245
When this machine's recordings were played back parts of the sound and picture were missing and the display said E03. The fault was cured by replacing the mode switch. **R.B.**

JVC HRJ265
There was no E-E or playback picture via either the modulator output or the scart connector. When I carried out video waveform checks I found that there was no output at pin 23 of IC7151. A new chip cured the fault. **R.B.**

Servicing the Philips L6.1 Chassis

This small-screen chassis has several features that could confuse those not familiar with it, including a series chopper circuit and a live line scan circuit. Alan J. Roberts describes the main circuitry and outlines correct servicing procedures

The Philips L6.1 chassis was introduced some three years ago to drive 14-21in. CRTs. There were teletext and non-teletext versions. The microcontroller chip in the teletext version contains the text circuitry, so there are no separate teletext chips.

An unusual feature of the chassis, certainly in Philips designs, is that the primary side of the line output stage and the line scan coils are not mains-isolated, sharing the same chassis line as the primary side of the power supply. An optocoupler is used in the line driver stage to isolate the low-signal sections of the chassis from the mains supply.

The following notes cover the operation of the series-chopper power supply and the line and field output stages. We will also look at the microcontroller chip connections and functions.

The Power Supply

The power supply is a self-oscillating down-converter. Fig. 1 shows the circuit. The basic principle is to use a switching transistor to control the energy stored in a coil: the chopper transistor is an STP4N40FI MOSFET, Tr7504. Note that the HT supply is not isolated.

When Tr7504 is switched on, the voltage at the output from mains bridge rectifier D6506 is connected to pin 2 of the chopper transformer T5500. There is a build up of current and energy in the winding. The start-up resistors R3513 and R3518 ensure that Tr7504 conducts when the set is first switched on. D6502 prevents Tr7504's gate-source voltage rising above 15V.

The earth return for winding 2-3 of T5500 is via safety resistors R3514/5. They are each 1Ω, so the combined resistance is 0·5Ω. The small voltage developed across these resistors is proportional to the current through winding 2-3. As the HT smoothing capacitor C2515 charges, a sawtooth voltage is developed across R3514/5. This voltage appears at the emitter of transistor Tr7501, whose base voltage is set by the feedback regulation system, see below. At a certain point on the sawtooth, set by the feedback bias, Tr7501 switches on and the chopper transistor switches off.

Because of the energy stored in T5500, the voltage at pin 2 of T5500 then swings negatively. At this point the efficiency diode D6504 switches on. Thus HT current continues to flow and the stored energy is released. During this period a voltage with reverse polarity is developed across winding 1-2 of T5500. The DC component is blocked by C2503. When the voltage across winding 2-3 falls to zero, the feedback via C2503 and R3511 switches Tr7504 on again and the cycle is repeated. The HT voltage depends on the stored energy, which in turn depends on the on time of the chopper transistor.

Voltage regulation is carried out by Tr7502 which, via R3503/4, sets the DC level at the base of Tr7501 and thus controls the point at which Tr7501 switches on (remember the sawtooth voltage at its emitter, see above) and Tr7504 switches off. The base of Tr7502 is fed from a potential divider connected across the HT line. Its emitter samples HT variations, in the form of the voltage that appears across R3509, D6501 providing a fixed voltage drop. This arrangement gives very precise control of Tr7504, and thus a stable HT.

Protection

One disadvantage of a series arrangement like this is that the output voltage could rise to the same level as the input, over 300V, should the chopper transistor go short-circuit. This would probably cause irreparable damage to the power supply and other circuitry. To prevent this, zener diode D6514 will conduct when the output voltage rises above 130V. This blows the mains fuse.

If the HT is low, because of a short-circuit downstream or incorrect start up, zener diode D6510 conducts. As a result, Tr7504's gate voltage rises very slowly (a few milliseconds). The current through winding 2-3 of the transformer takes a long time to reach zero, so Tr7504 is switched off for long periods. In this condition the current flow is very low, protecting the MOSFET transistor.

Secondary Voltages

Winding 5-6 of the chopper transformer feeds rectifiers D6503 and D6507, which produce outputs at about 9·5-

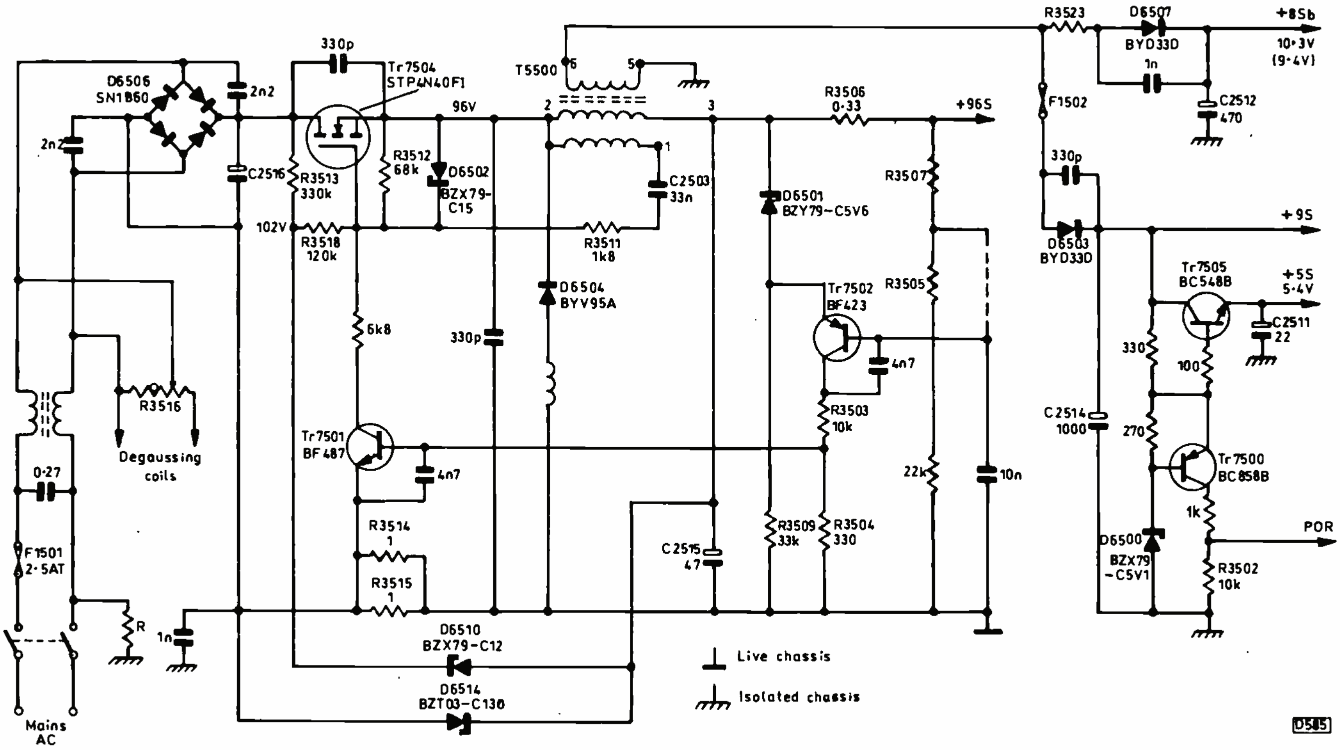


Fig. 1: The power supply circuitry used in the Philips L6.1 chassis. Do not measure the voltage at the gate of the MOSFET chopper Tr7504. The mains switch arrangement varies with different models: see the relevant manual for details.

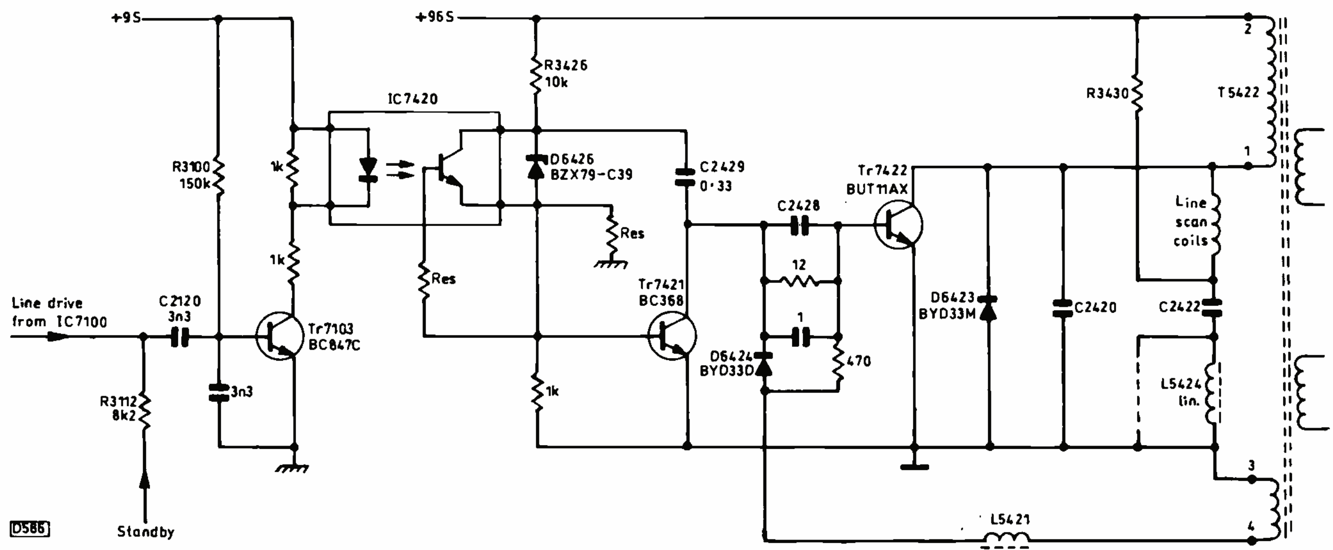


Fig. 2: The line driver and output stage (primary side only) circuits used in the Philips L6.1 chassis. Res = reserved position, allocated for possible future use in some models. Linearity coil L5424 is present in 20 and 21in. models.

10V. The output from D6503 also feeds the 5V regulator transistor Tr7505. A POR (power-on reset) voltage is developed across R3502.

Line Driver and Output Stages

As previously mentioned, the primary side of the line output stage and the line scan coils are not mains isolated. Because of this the line drive circuit is somewhat unusual, see Fig. 2. Optocoupler IC7420 provides isolation between the live circuitry and the low-signal parts of the chassis.

A TDA8361/N4 chip, IC7100, generates line drive pulses at pin 37. These are coupled to the base of Tr7103 by C2120. When Tr7103 is non-conductive, the LED section of the optocoupler is without bias and is therefore off. Since no light is produced within this device, the transistor section is also off. In this condition Tr7421 is in turn non-conductive. The BUT11AX line output transistor Tr7422 is then on. Current flows in the primary winding of the line output transformer T5422, and energy is stored.

When Tr7103 is switched on by a line drive pulse it activates the LED section of the optocoupler and Tr7421 is in turn switched on. Tr7422's base-emitter

Table 1: Components that vary with tube size

Component	14in.	20in.	21in.
C2402	1·5µF	1µF	1·5µF
C2420	7·5nF	10nF	10nF
C2422	330nF	560nF	470nF
C2424	680µF	1000µF	1000µF
C2428	NF	1µF	1µF
C2516	47µF	47µF	68µF
R3144	470Ω	NF	470Ω
R3405	4·7Ω	3·3Ω	3·3Ω
R3430	1kΩ	820Ω	820Ω
R3432	560kΩ	2·2MΩ	560kΩ
R3505	NF	NF	150Ω
R3507	1·5kΩ	1·2kΩ	1·2kΩ
L5424	NF	Lin. coil	Lin. coil
Tr7401	BD136	BD229	BD229
Tr7402	BD137	BD228	BD228

Table 2: Microcontroller chip pin functions

Pin	Function
1-7	Analogue outputs for tuning, volume, brightness, colour etc.
8-9	Band switching
10	Switches between AM and FM sound: high for UK sets
11	AFC input and standby output, non-teletext models
12	No UK function (used with multiband sets)
13	Chassis
14	Makes service mode active when connected to chassis
15	Ident: high if video present, low if no signal
16	AFC input and standby output, teletext models
17	Signal selection: high for internal, low for external (scart)
18	Status input. High for external signal, low for internal
19	Not used. Could be used for an on/off switch. Connected to +5S in present sets
20	LED drive. In sets with Tr7607 fitted, the LED lights brighter in standby
23	Internal video
24	External video
27	NIL output for non-interlaced teletext mode
32-34	OSD outputs in different colours
35	Fast blanking (FBL). Blanks the video in the OSD or teletext modes
36	Sandcastle pulse input (required for OSD)
37	Field flyback pulse input (required for OSD)
38-39	OSD generator
41-42	Oscillator. Non-text 4MHz, text 12MHz
43	POR (power on reset). Micro starts only when POR is high (5V supply correct)
44	Teletext option. Tells micro if teletext is present
45	Remote control input
46-48	Inputs from local keyboard
49-50	I²C bus. Connected to the EEPROM and other devices

Table 3: Error messages

OSD	LED	Fault	Possible cause
0	No flashing	No error	–
1	One flash	Micro error	IC7600
2	Two flashes	I²C bus fault	Bus low (s/c)
3	Three flashes	EEPROM error	IC7605

The microcontroller chip will detect errors in circuits connected to the I²C bus.

junction is thus shorted across and it switches off. C2420 tunes the flyback pulse and D6423 provides the efficiency diode action. The cycle is then repeated. Winding 4-3 of the line output transformer provides a positive-going pulse to switch Tr7422 on at the appropriate time. C2429 charges via R3426 to get the line output stage started – as described above, the line driver circuit (Tr7103/IC7420/Tr7421) provides the switch-off action. In the absence of line drive pulses Tr7422 could turn on hard and fail. R3100 prevents this: the positive bias it provides at the base of Tr7103 switches this transistor on and Tr7422 is thus cut off.

In the standby mode the microcontroller chip produces a low output that's coupled to pin 37 of IC7100 via R3112. This removes the drive pulses. Since Tr7103 is now biased on all the time the output stage is shut down.

Tr7423 on the secondary side of the circuit (not shown) provides line blanking. IC7100 is a 52-pin device that incorporates the IF strip and the colour decoder in addition to the sync and timebase drive pulse generator circuits.

Field Deflection

Pin 43 of IC7100 is the source of the field drive waveform, which is fed to a very simple discrete-component field driver and output stage. The driver transistor is Tr7400 (BC337). A complementary-symmetry (pnp/npn) pair is used in the output stage. The transistor types here depend on tube size, see Table 1. The 40V supply for these transistors is derived from the line output stage – R3427 (1Ω), D6420 (BYD33G) and C2424 (value depends on tube size) are the rectifier circuit components. C2401 (680µF) is the field scan coupling capacitor: the parallel combination R3402 (470Ω) and C2404 (10nF) is connected across the scan coils to damp parasitic oscillation.

A signal called NIL (Non-InterLace) is connected to the earthy side of the field scan coils to provide non-interlaced operation with teletext displays. It prevents character jitter and improves text legibility. NIL generates a small DC that flows through the field scan coils.

Teletext and Control

The teletext and control operations are combined in a single microcontroller chip, IC7600. Table 2 lists the pin functions. Note that the circuit diagram shows two numbers for each pin: those outside the IC symbol are for the text version, those inside for the non-text version.

Servicing

The PCB is conveniently marked on the print and component sides with functional blocks and text. Test points are also marked on each side of the board, using a letter code and number. For example test point P1 is test point 1 in the power supply. Other letters are L line timebase, F field timebase, S sync, V video, C control, T text and A audio. The numbering in any circuit block is done in a logical sequence: start with the lowest number and follow through

Service Default-alignment Mode

This is a predefined mode that can help when fault-finding, especially when there's no picture. Obviously the power supply has to be working. All analogue settings (volume, brightness, colour etc.) are set to their mid-positions; the set is tuned to programme 1; an OSD error message is displayed continuously (assuming that the power supply and timebases are working); the OSD button acts as search and auto-store on the highest programme num-

Fig. 3: A service default-alignment mode screen menu.

001	0023 S	1.0
	3 2 0 0 0	
–	SYSTEM BG+I	+

ber; the hotel mode is disabled; and auto switch-off in the absence of sync pulses (no signal) is disabled. All other functions remain normal.

All waveforms and voltages shown in the manual apply in the service mode. There are two ways of entering this mode: by shorting service pins S1 and S2 (this connects pin 14 of the microcontroller chip to chassis), or by pressing 'default' or 'align' on the dealer service tool. The mode can be left only by switching the set to standby or pressing 'diagnose 99 – OK' on the service tool, not by use of the on/off switch. Refer to the L6.1 service manual for information on the dealer service tool. The device can be used with this and other chassis.

When the default-alignment mode is active, the menu shown in Fig. 3 will be seen on screen. The top line shows, left to right: the option code (current options selected are shown bottom centre); an hours counter that indicates the number of hours the set has been in use – the S next to it indicates service-mode active; and the microcontroller chip's software version. The line at the centre of the screen shows the error code history: the last five errors are stored in the EEPROM. The last error that occurred is shown on the left. 0 indicates no error. This form of error indication is useful when dealing with an intermittent fault. The bottom row shows, as mentioned above, the current option settings.

The error buffer can be cleared by putting the set in standby or pressing 'diagnose 99 – OK' on the service tool. Switching off with the mains switch does not clear the codes. Table 3 shows a list of error codes.

An error is also accompanied by the LED at the front of the set flashing. This is useful if the set cannot display a picture.

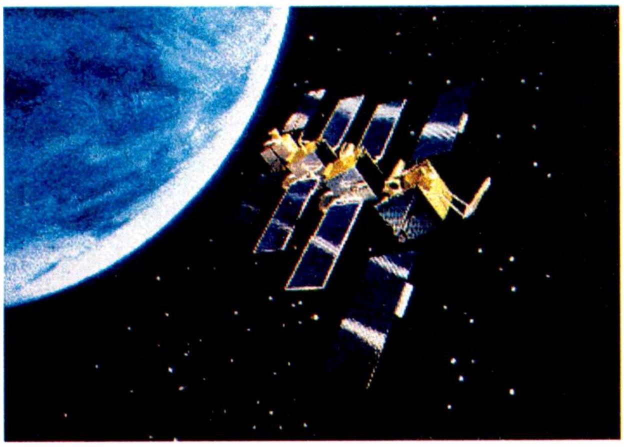
Repairs

Most repairs involve the power supply or line output stage. If the mains fuse F1501 has blown, a complete repair kit (part no. 4822 310 10663) should be fitted. The following items differed in early models: C2512 470μF; C2503 33nF; D6510 BZX79-C12; R3512 68kΩ. Make sure that these values/types are fitted in any set that comes in for repair.

The power supply will run off-load but not with a dummy load. It doesn't like being started via a variac.

Once the repair kit has been fitted and the above components have been checked for value/type, disconnect pin 1 or 2 of the line output transformer, apply mains power and check that the HT is correct (96V). It may read slightly high (98V) off load. Usually everything will be OK. If not, switch off and check through the power supply again.

Once the HT is present and correct, before connecting pin 1/2 of the LOPT again check the line output transistor Tr7422. If it's short-circuit, the line output transformer T5422 is probably also faulty. Check for a short between pin 1 or 2 and pin 3 (live chassis). If the LOPT seems to be OK, I would suggest replacing Tr7422, Tr7421, Tr7103 and the optocoupler IC7420 together. A fault in any of these components can damage Tr7422. Note that Tr7422 is type BUT11AX: it is important that the AX version is fitted – the AF version will work as a test but won't last long. Also note that T5500's type differs between 14in. and 20/21in. models (types are G5632-01 and G7529.00THCF respectively).



DX and Satellite Reception

Reflections on the DX hobby as we reach the year 2000. Terrestrial DX and satellite TV reception. News from abroad and of satellite launches etc. Roger Bunney reports

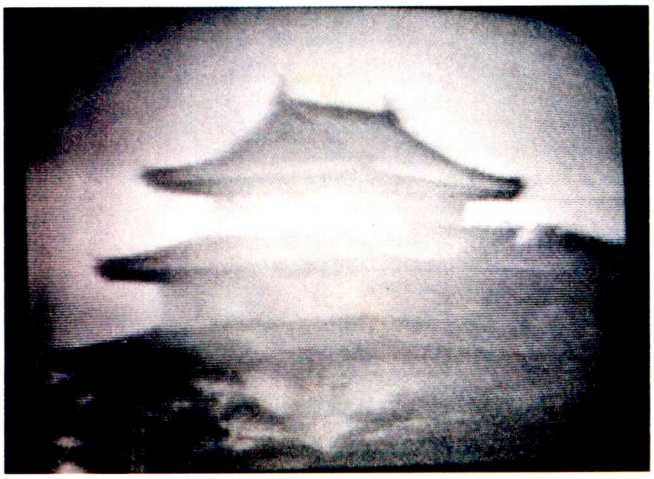
As this report appears we are about to leave the year 1999, the decade and the century. Technological developments continue to accelerate: there's innovation upon innovation, which amongst other things brings down consumer prices. We're now in a hi-tech, throw-away society, with few folk active as constructors. The RSGB has expressed concern about the future of Amateur Radio: it's easier to communicate via e-mail – no MUFs, fading or interference to worry about, just go down to the local computer shop, get a Pentium XYZ 500MHz Gbyte gizmo and, armed with your free Tesco or Waitrose internet access disc, communicate with the world.

When I took up DX-TV as a hobby in the Sixties it required dedication – technical awareness and the ability to innovate. You made your own aerials and modified 405-line sets for 625-line reception. Valves were all we had, then came the first breakthrough with the OC171 germanium transistor that could be used for Band I preamplifiers. The AF102 followed, providing amplification at up to 200MHz. In quick succession we then had the AF139, BF180, BF272 and BF449, followed by FETs and MOSFETs, providing lower noise and higher gain. Valves disappeared altogether as fully solid-state receivers came along, with newfangled ICs as well. These devices now have dozens of pins and contain many sections of a TV set.

A major change came with the advent of satellite TV transmissions. Now we rely on both terrestrial and satellite reception. Though I use the modern technology, including digital receivers, I've no idea of how much of it works. Do I need to, or even want to? But I still use four of the familiar Thorn 1690/91 type chassis for my DX antics. They date from the Seventies but work well and are very reliable. With four replacement tubes in store and a spare chassis I reckon they'll continue in operation well into the next decade. I even have a valved Eddystone receiver in use!

With the 1990 Broadcasting Bill and the ITV franchise sell-off, I and many of my colleagues found ourselves on the streets. I eventually ended up in higher education with a vocational media training job. Hardly broadcasting, but it pays most of the bills. Last year during a practical workshop I jokingly mentioned that the portable sound mixer I was demonstrating had no valves. There were blank looks all round and one student asked "what's a valve?" I realised I was growing old.

The future will be solidly digital, with ever more technical and commercial innovation. In other fields we must hope for cures to the many modern ills – cancer, diabetes and heart problems to name only a few. I wish all readers a Merry Christmas and a healthy and happy year 2000.



A pioneering global satellite TV programme with live pictures, this one from Japan, in the late Sixties. Southern TV, where I worked at the time, contributed Russian dancers on HMS Victory!

Monthly DX Report

October was nothing to write home about, with virtually no SpE reception. Though a high-pressure system produced a spell of tropospheric reception in the middle of the month, it failed to develop into a worthwhile opening. Cyril Willis in King's Lynn had SpE reception from Italy on the 16th, with RAI chs. IA and IB, TVA ch. E3 and Video ch. E2. The latter two are commercial TV stations. During the last season they have provided excellent reception, often bettering that from the national RAI Band I stations. There is still talk of a mega Leonids meteor shower in mid November. I hope so!

MUFs (Maximum Usable

Frequencies) have been rising however, with the daytime F2 layer providing sustained reception at up to low VHF. From mid October the MUF regularly rose to about 35MHz, producing for example reception of US communications – police, utilities, pagers and paramedics. At mid November the highest frequency so far reached has been 36·197MHz.

Use of a scanner will assist with low VHF monitoring. As examples, I've heard mobiles in Sudbury, Ontario at 34·780MHz, several paramedics between 33·7-33·95MHz, and utilities in Meridian (there are four large towns with this name in the USA!). NBFM pagers can still be heard at around 35MHz – the old 35·22 and 35·58MHz spot frequencies remain in use for this service.

I use a ten-year old Icom R7000 scanner which is at present fed from either a 25-1,300MHz discone aerial or a horizontal Band I dipole. The Icom's spin-tune wheel makes it easy to chase the rising MUF, though the peak suddenly drops like a brick when the sun sets far to the west in the late afternoon.

In past sunspot cycles there would be sudden early-morning F2-layer reception of say ch. R1 from the east at about 0800, rising from the noise to a strong signal within a few minutes. Unfortunately an early morning work start makes it impossible for me to monitor this at present. I'll go into F2 reception techniques next month. Meanwhile let me know about any F2-DX activity you log.

Satellite Sightings

As I type this on October 31st the loss of the EgyptAir Boeing 767 with 214 people on board dominates the news, with NSS-K (21·5°W) carrying both Fox News reports from a hurriedly-called press conference at JKF airport and the local ch. 7 NBC news output via the Reuters 11·566GHz V digital lease. Later the same lease featured live press calls from the Coast Guard Air Station at Cape Cod, Mass. and statements from the White House.

A call from John Locker (Wirral) on the 28th alerted me to the assassination of the Armenian PM Vazgen Sarkisyan and others when gunmen burst into parliament building during question time and sprayed the chamber with machine-gun fire. John, monitoring Armenian TV1 at 12·520GHz H (SR 4,340, FEC 1/2) via 36°E, found that the normal output had been replaced with updated news bulletins and sombre programming. This Eutelsat II F3 signal via the wide beam in theory gives 47dBW in southern UK, but the weak signal present wouldn't lock with my 1·2m dish. It was OK with John's 1·8m prime-focus dish.

Within minutes of the Paddington rail disaster on the 5th SISLink deployed several trucks to provide live video news coverage for UK networks and international services. As usual Eutelsat II F3 at 36°E was a main distribution point for outgoing circuits, several to the USA. NBC Paddington SISLink 25 UKI-125 at 11·064GHz H (5,632; 3/4) for example was active until late that night. SIS-35 UKI-495 ITN at 11·659GHz H provided a live feed for evening bulletins. Other SIS feeds were encrypted (SIS-2UKI-27) – one strong signal at 11·177GHz H (6,111, 3/4) refused to lock up. All feeds from the crash site were digital, a clear indication that sat-watchers will have to go digital. To emphasise this point, even the Sky analogue test pattern at 28·2°E has now disappeared down the digital plug hole – check the old frequency (12·324GHz V) and you'll find it with SR 27,500, FEC 2/3.

Incidentally during late October SISLink tests were being carried out at 11·097GHz H on the ITN Lyon circuit – just a blank screen with the test caption. The purpose has yet to be revealed!

Fortunately not everything during the month was disaster. The Italian-originated Video Cataract '99 test transmission on the 14th, via Eutelsat II F4 (10°E) at 11·077GHz H (analogue), featured colour bars with an inlaid video of a cataract being flaked away from an eye. Participation from other medical groups was invited. Most unusual.

I've not regularly checked Intelsat 705 (18°W) in recent months because so many Italian feeds have gone digital. On the 17th however I found Italian analogue TV still alive and well with at least three simultaneous circuits during the late afternoon. 11·134GHz V is one worth checking: the pictures are OK but the audio is often SIS (sound in syncs), so dust off your old EBU descrambler!

I often mention the travels of GMTV-UKI-149 Reuters around the UK with early morning items via NSS-K (21·5°W) for the breakfast show. This analogue offering appears at about 11·530GHz H. A variation on this theme was noted by Cyril Willis on the 6th, when he logged GMTV Whitehaven SCOT 1 UKI-284 at 11·676GHz H. The time was 0720 hours. This was a very rare catch .

Extensive 'live network TV' coverage of the loss of the Learjet aircraft carrying golfer Paine

A live report on the crash of the EgyptAir Boeing 767 is awaited from Washington. Digital reception via NSS-K at 21·5°E.

A US Coast Guard press call on the EgyptAir crash, again digital from 21·5°E.

Stewart was provided by the BT Washington circuit via NSS-K (11·492GHz H, 5,632, 3/4). PGA golf was fed over the Atlantic circuit to Sky Sports on the 31st. To cater for its programming needs Sky rented capacity on two satellites: digital via NSS-K at 11·590GHz H, a Globecast lease with SR 20,145 and FEC 3/4; then in analogue form late afternoon via PAS-3R/6 (43°W) at 12·728GHz V, with audio at 6·2MHz.

The whole South African Grand Prix motorcycle racing event was available in analogue form on the 10th via Eutelsat II F4 (10°E) at 11·078GHz H. The racing was uplinked from the Welkom circuit near Johannesburg by Dorna Satellite Transmission capacity, then carried by Centro de Control TV Madrid-S: it's likely that the Dorna feed to Europe (Madrid) was via C-band circuits.

An eye operation, removing a cataract, seen during a medical transmission via Eutelsat II F4 at 10°E. This time analogue reception.

Early October is the time for one of the twice-yearly equinoxes, when the sun tracks behind the Clarke belt and you get solar outrage noise/drop out with reception. Just before noon GMT the signal I was receiving via 10°E faded slowly down into noise then returned to normal. I assume that this was a solar outrage, but whether in the C band feed involved or the European Ku-band feed I'm not sure.

SISLink has just celebrated ten years of hard SNG (Satellite News Gathering) action for the UK's and world news services, from the fall of the Berlin Wall, wars in Yugoslavia (twice) and the Gulf, to air crashes, shipwrecks and much, much else, both good and bad – not forgetting extensive UK horse-racing coverage. Technological advances – digital compression and transmission, smaller dishes and lower powers – have encouraged SNG use. Digital links now require minimal bandwidth compared to analogue transmission. Happy birthday, SISLink.

Terrestrial News

UK: The RSL TV licence period has been extended from two to four years. TV 12, the Isle of Wight service, has been awarded the RSL TV licence for the Chichester, West Sussex region. TV 12 will start its new service later this year (2000), and is currently increasing its locally produced programming to thirty hours a week.

As a result of further ITC investigation, frequency allocations enough for another 36 RSL stations have been found. They will be on offer during the next licence round. At present about forty groups have applied for licences across the UK. The ITC is eager to promote community TV. Four services are now on-air.

Romania: A new commercial station, TV Bucuresti, is to open in Bucharest this summer. It will be on-air 24 hours a day and is being launched by the UK firm Red Colobus, with the London Television Service arranging for all programme acquisition.

Spain: The first Spanish digital network, Onda Digital, opened on November 15th. It provides fourteen themed chanels plus radio services, all subscription based though 32 hours a week will be free-to-view.

Eventually eleven digital multiplexes (60 channels) will be available, with two and a half reserved for the present terrestrial broadcasters, both national and regional.

The first FTV digital broadcasts should be available in early 2000. The government hopes to accelerate conversion to digital TV by making it a condition within the TV franchise renewal process.

Australia: The Australian Broadcasting Authority has announced digital TV allocation plans for several main population areas. January 1st 2001 is to be the launch date in "metropolitan markets", with "regional markets" coming on-stream subsequently but not later than January 1st 2004.

To make room for digital transmission interleaving (most will be at VHF), new analogue relays are proposed to duplicate existing services at UHF. There are no plans for a network of relays/translators during the first phase of the digital start-up: they will follow depending on how mains transmitter coverage and digital technology evolve.

Interference

Although the proposed use of power lines to carry data across the country (PLT – Power Line Telecommunications) has been dropped, a scheme to use the phone wiring from a nearby block/distribution point to homes for data transmission is to go ahead. VDSL (Very high speed Digital Subscriber Line) operation will provide one-way communication at up to 50Mbits/sec or two-way communication at up to 26Mbits/sec. Wide area distribution will be via fibre optic cables, changing to basic twisted pairs for local circuits up to 800m, with the data rate up to about 30MHz.

The potential for interference at HF and low VHF is high. A standardised VDSL system for UK operation is expected to be agreed this year (2000). Our thanks to the RSGB for this information.

Recently I found that the TV service in a local pub was intermittently swamped by patterning. The interference came from a nearby 31MHz cordless phone. Presumably the breakthrough was at IF.

Satellite News

In autumn 2001 Hot Bird 6 will arrive at 13°E, providing more Ku-plus Ka-band (18·3-22·2GHz) capacity. 28 Ku-band transponders will use a 'Super Widebeam' covering Europe, North Africa and the Middle East. Skyplex, Eutelsat's on-board multiplexing facility, will enable broadcasters to multiplex uplinked signals for downlinking as a single DVB MPEG-2 signal stream. Each Ka-band transponder will accommodate up to 18 carriers, depending on data rate.

NSS (New Skies Satellites), an offshoot of Intelsat, has ordered NSS-7 which will be positioned in orbit at 21·5°W in the autumn of 2001. It will have C- and Ku-band capacity for TV, data and general communications use. The launch will follow that of NSS-6 (formerly Intelsat K-TV) this summer at 95°E, with coverage of SE Asia and the Pacific Rim. The launch of NSS-6 has been delayed by fourteen months – it was returned to Matra Marconi for tests after other in-orbit satellites were found to suffer from solar-panel degradation, with loss of power capacity.

The development of Ka-band operation over the next two-three years will provide much cheaper links, since the higher frequencies enable narrower beams to be used. This in turn means more downlinking capacity in a given region, particularly when frequency-sharing is employed. Astrolink will come into operation in the autumn of 2002, initially for the Americas then Europe, the Middle East, Africa, Asia and the general Atlantic Ocean region. Hughes Spaceway will also be using Ka band, with satellites that have up to a hundred spot beams. Launch dates have still to be confirmed.

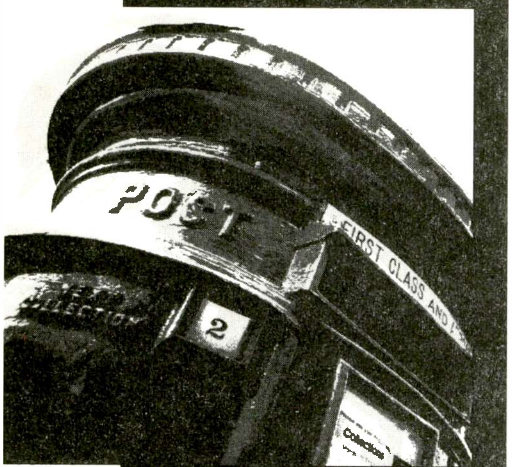
A Californian group, Assuresat, is investing in two Space System/Loral 1300 satellites that will have 36 C- and 36 Ku-band transponders, with on-board switching, extra fuel supplies etc. Assuresat thinks there's a need for flexible satellites that can be rapidly repositioned to any orbital slot to take over from a non-arriving or defective satellite. The group's first satellite is to be launched in early autumn 2001. Satellite operators can pay a retaining fee so that in the event of a satellite failure they get first-call on emergency backup from Assuresat, which can deploy to any orbital position.

The Kuwait Sport Channel has been testing in clear PAL at 11·859GHz V via Arabsat 3A (26°E). Another sports channel, the International Football Channel, will be available in Europe next May – its Latin American launch was at end-1999. The programme schedule will include football and mainline basketball (NBA). It's a stand-alone service, similar to Eurosport, for DTH or cable viewers.

The floating rocket-launch platform Sea Launch placed DirectTV's 1R satellite in orbit at 101°E in early October. It was the first successful launch of a commercial satellite from the marine platform, which is a modified oil-drilling rig. The satellite has 16 high-power Ku-band transponders for service across North America.

Sirius-3 will soon arrive at 5·2°E from 28·2°E where it has been providing backup for Astra 2A. It will replace the ageing though still serviceable Sirius-1.

Finally, the Swedish Kunsskaps-TV (Knowledge-TV) channel can now be received in clear D2MAC at 12·053GHz H via Thor (1°W). The channel is also available in digital form (SR 27,800, FEC 3/4) from the same orbital position at 12·303GHz V.



Letters

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

Universal Remotes

I recently bought a universal remote control unit to replace the four remote control units we have in our living room and the three for the TV sets upstairs. But attempting to set it up proved to be frustrating and potentially damaging to a TV set. The instructions require a code to be entered for the manufacturer, obtained from the instruction booklet, then stepping through the separate codes for that manufacturer. At each code the off button has to be pressed to turn off the TV set. If it turns off, it has to be turned on again and the other controls have to be checked for correct operation. If the controls don't work correctly, you have to select the next code and repeat the whole process. This could mean turning the set off and on several times in quick succession, which is not good for the tube.

Having tried several codes and decided that it was not a good idea to keep switching the TV set off and on I decided to use the remote control unit's 'learning' feature. I programmed several of the buttons from the original unit, but when I tried to use it a major design flaw came to light. The TV set is a Philips one that uses the RC5 remote control system. This sends out different codes on alternate presses of the same button, to be able to distinguish between separate key presses and an interrupted infra-red signal. The universal remote control unit can learn only one of these codes, hence consecutive presses of the same button are not recognised. Try selecting page 888 on teletext.

Another flaw concerns programming to control the CD player. The same procedure has to be followed – set the manufacturer, step through the codes until the player turns off, then check the other functions. Except that I cannot turn the CD player off with the remote control unit. The learning facility is again useless, as the CD player uses the RC5 control system.

A call to the "superb help line" was useless, as all that could be provided was the manufacturer code. I had at least hoped that it would be possible to obtain individual codes for particular TV sets, VCRs etc. In the end I returned the unit, got by money back and had to continue to use the individual controls for all the equipment.

Has anyone a list of specific codes for TV sets, VCRs etc. for these universal remote control units, or are there control units that have a more user-friendly and TV-life friendly setting-up procedure?
Keith Wevill,
Ratby, Leicestershire.

Test Card Music

As a regular reader and member of our trade, I was interested to read the letters on Test Card music in the September issue. Details of the excellent Chandos discs were provided in those letters. Peter Litler drew attention to the discs available from Apollo Sound. In addition to the volumes 1 and 2 mentioned by Peter, a third is now available featuring more original tracks from the good old days! This latest disc features, for the first time, some contemporary arrangements of well-known traditional tunes as well as a wide selection of other items, from full string orchestras to brass and synthesizers.

There has been a lot of interest in these discs and, provided this interest continues, there are plans to issue further compilations. Those wishing to receive regular news on this subject should write to Apollo Sound, 32 Ellerdale Road, London NW3 6BB – telephone 0171 435 5255.
Chris Churcher,
Gosport, Hants.

Your correspondents talk about Test Card music, but where has the Test Card gone? Ceefax pages have replaced the Test Card time during close-down on Friday/ Saturday nights, with a two-tone test sound signal and no music.

Please bring Test Card F back again BBC, we rely on you, or better still how about bringing out a DVD disc of the test cards through the years, so that we can all enjoy the nostalgia, music and full-definition gratings? And why not bring us up-to-date with the widescreen version of Test Card F, so that we can see the linearity achieved by the latest digital sets and check on the definition of their pictures?
Mike Wallworth,
Edgeley, Stockport.

How many cards?

In answer to Kevin Davies (Letters, December), I would first say that we musn't write off the cable companies too quickly. Secondly, much of the future of digital or subscription TV depends on the traditional "what the market will stand". At the moment, firms that offer subscription services are weighting their advertising along the lines "digital TV gives better picture quality than most analogue TV" rather than "you only get what you pay for". If enough customers decide that this is a rip-off, our viewing habits will revert to the old system of one TV in the lounge or 'television room', and watching it only when something worth seeing is on.

I think that in future there will be a projection TV in one room, with a purpose-built screen as part of one wall, giving a large picture with good-quality sound. This will replace the small screens in every room, and save on subscription charges, but will affect the sales of smaller-screen digital TV sets. If subscription profits were to fall as a result of this, companies would offer a box that decodes the signals before they are fed to the tuner or satellite receiver, enabling one card to act for all digital sets in the house. In the meantime they will make as much profit as they can from separate cards/subscriptions.

My website www.tvworkshop.freeserve.co.uk gives the current 'state of play' as I see it, from both sides of the fence. It's updated as new information becomes available, and I would welcome any modifications, provided they are accurate, from any subscriber, manufacturer, publisher, transmission company or technician who is prepared to stand by their statements or opinions.

Something that you can be sure of is that as long as transmitters transmit and receivers receive, there will always be a future for those who are capable of repairing electronic equipment whether it's sold, loaned, rented or given away. And if you expect to be ripped off, you won't be too disappointed if it doesn't happen.

John Hopkins,
The TV Workshop,
Felixstowe, Suffolk.

RTV Silicone Rubber

In his letter on "those rubber wedges" (December) Martin Pickering refers to RTV silicone rubber. Some further explanation may be of interest to readers. RTV stands for Room Temperature Vulcanising, which means that on exposure to air the silicone reacts with atmospheric moisture. This cures the silicone, forming a permanently elastic silicone rubber. Fully cured silicone rubber immersed in water doesn't absorb water – if this was to happen most domestic fish tanks would fall to pieces, being constructed of silicone sealants and glass.

Many silicone sealants do give off acetic acid vapour when curing. Potentially damaging corrosion can however be avoided by using Servisol Silicone Adhesive Sealant: this is a low-odour neutral curing sealant that's non-corrosive. It is widely available through most trade distributors. If any reader requires further information, please phone me on 01278 424 200.

Will McAlister,
Product Manager – Servisol,
Ambersil Ltd., Bridgwater,
Somerset.

The Aussie ESR Meter

I am the lucky owner of the Aussie ESR meter reviewed in the January 1999 issue of *Television*, and have been so pleased with it that I advised several colleagues to order one. Some that have failed to work first time have ended up on my bench, the complaint being that they wouldn't stay switched on and/or gave incorrect readings on some ranges. The cause seems to have been a batch of BC328 pnp transistors used as power and range switches. They diode test OK, but a gain test produces a reading of almost zero and there's a measurable leak. Any general-purpose pnp transistor will do. I've used BC327s with satisfactory results.

Jim Kirkman,
Poulton-Le-Fylde, Lancs.

State of the Trade

So far I've resisted the urge to contribute my penn'orth to the debate on where the trade is going, if anywhere. However the article on vacuum cleaner servicing by Richard Bartlett (December) does, I suggest, say it all. I'm sure that he means well, but the fact that he is prepared to do this type of work to stay in business seems to me to emphasise the dire situation we face. I mean no disrespect to those whose main stock in trade is the repair of vacuum cleaners, washing machines and so on, but I for one didn't spend five odd years at college learning the intricacies of circuit design, operation and repair to attain the age of 45 and find myself dealing with such cleaning and greasing operations.

There *is* still a living to be made by the independent electronics repairer – I know, because I'm doing it – but it gets harder every year. 'Living' is the key word. I never expected to get rich repairing consumer electronics equipment but, conversely, I didn't expect to be what I considered to be poor.

In real terms my earnings have decreased significantly over the last five years or so and, if we didn't have another business that's admirably handled by my wife, I don't know just where we would be financially. Looking at job adverts for the trade, I saw one recently in *Television* offering "up to £22k for the right person". Well, at the moment Tony Blair's government is advertising on the TV that if your income is only (?!!) £23k they'll give you some more to help with your childcare. I saw another advert in the same issue from a major national firm offering "£ competitive". With what, I wonder? With perhaps my friend the plumber, a reputable tradesman, who can charge £45 per hour? I don't think so somehow.

At the moment I specialise in audio equipment repairs – anything from professional mixer decks to personal cassette players. It's a specialist field, and there are not too many who have a genuine understanding of this type of equipment and a high level of repair expertise. Most of the work I do is for the trade, locally, and I don't get many complaints, so I must do a fair job. I scratch a reasonable return from it most of the time, but this wouldn't be adequate on its own to maintain a family. Sometimes I have a couple of good weeks and think that things are picking up, but there will then be a run of very poor or average weeks. I have never in many years of servicing work known it to be so unpredictable. This makes being in business a very worrying matter, and is not conducive to doing a good job.

I'm not a doom and gloom merchant. I've been in this trade, man and boy, for the better part of thirty years and I love what I do. Until recently I couldn't conceive of doing anything else. But at the end of the day I'm also a realist.

The equipment that we are now responsible for maintaining has advanced beyond all recognition. Much of it is designed by computer or run by software and, with the best will in the world, even the cleverest of us cannot be expected to really understand how it all works. Without this knowledge, we stand little chance. Witness Jack Armstrong's comments about the satellite receiver he couldn't fix.

We have perhaps reached the point where, apart from power supply faults, defective lasers etc., the equipment is no longer practically serviceable from the point of view of making an independent living.

Having to take the likes of vacuum cleaners on in order to supplement the workshop's income would certainly suggest this. I really think that the death knell may well be sounding over the trade as we know it, and that to ignore this would be to bury our heads in the sand.

Much as I don't really want to, I'll be watching the signs, and my income, very closely over the next twelve months, with a view to a possible substantial change of direction in my life. I hope that I'm wrong, and that it doesn't come to this, but I'm going to try to be prepared if it does.
Geoff R. Darby, Proprietor Monitech,
Earls Barton, Northampton.

Cost of Spares

I am always surprised at the high trade prices charged for so many common spare parts. When you consider that in most cases many hundreds of thousands have been and are still being made, the cost price must be pennies. Another factor is that prices vary considerably from one supplier to another for the same item. Gone are the days when you just picked up the phone and ordered a part. It now makes sense to get quotes from all your suppliers first. I know that suppliers have to make a profit, but so do service engineers. With so many job estimates being refused simply because of the cost of a spare part, no one wins. The repair trade doesn't get the work, and the suppliers are stuck with dead, over-priced stock. I don't blame customers. They know that a cheap, brand-new set can be bought, often offering more in terms of quality and features than the set they would like to have repaired, for only a little extra money.

If the parts supply trade wants the brown goods repair industry to survive, it has got to rethink its pricing policy across the board. For our part, the typical hourly labour charge or wage is already at a ridiculously low level in comparison with all other technical professions, and there's no more room for manoeuvre – except to quit the trade and leave suppliers with all that dead stock.

It's sad, but not surprising, that amongst all the career opportunities school leavers contemplate the brown goods servicing industry is not seen as a serious option. I carried out my own survey of 24 teenagers, including two of my own, who have recently left school and are awaiting their exam results. Their unanimous opinion was that it's too technical, involves too much studying and is too lowly paid. Say no more!
John Edwards,
Welling, Kent.

Sales pitch for your service

It concerns me greatly that we, as repairers, are being forced into a corner by the customer. Can you imagine walking into a barber's shop and saying "I want a haircut, but I don't want to pay more than £1 because I can buy a wig for £10"? Or to take your car to the garage and say "I want it fixed, but I don't want to pay more than £50 because I can get another second-hand one for £89"? It doesn't happen. Have we lost the ability to sell? Here are some very persuasive points that might encourage customers to keep their old units.

(1) Modern VCRs that cost less than £200 are likely to last just long enough for the 12-month warranty to expire. Reliability is poor, parts are generally expensive or difficult/impossible to obtain, and the repair cost will be high because the machines are pigs to work on. Should you let the customer go and pay £120 for a unit that will last one year, or persuade him to pay £75 for a repair that will last two years? Can you afford to give a two-year warranty? Maybe you should consider it, along with a higher repair charge.

(2) Older VCRs are better made, will last a long time with minimal maintenance, and can often be used to record piracy-protected videos. I'm not advocating this, and I'm not saying that they will. It's simply a point that many customers might want to consider.

(3) New video recorders will shortly use completely different technology. Designs using DVDs and hard-disk drives will be with us before long, possibly built into the TV set. Neither of these systems will lend themselves to permanent off-air recordings. If the powers-that-be have their way, you will have to 'pay' for prerecorded material.

(4) New TV sets and VCRs will incorporate digital decoders to cope with the new digital transmissions. At present they are expensive, and it's quite possible that they will be incompatible with the proposed standards by the time that analogue TV is switched off. At best they will lack certain features, and at worst they might not work at all. Far better to use an existing TV/VCR with a less expensive set-top box that can be thrown away or upgraded as the technology progresses.

(5) The new units are likely to be much more difficult to repair than existing designs. In fact repair might simply not be viable. As an example, look at SkyDigital receivers. We, as independents, are supposedly not permitted to have the copyright diagnostic software, so fault-finding becomes very difficult. Investment in new equipment is required to be able to carry out soldering/desoldering and fault-finding, all of which is going to be time consuming even if it's possible. Worst of all, the public perceives the box as being free, so will your £195 repair estimate be accepted? No. Better to start planning for the return of units to the manufacturer, but you'll still have to quote at least £95 to the customer. Remind him of that as he marches out of your shop with the comment "I'm gonna buy a digital".
Marin Pickering, B. Eng.,
Sandbach, Cheshire.

Two-way guarantee!

This must have been the best two-way guarantee ever – can anyone better it? Recently I sold my doctor a widescreen TV set with which he is well pleased. I myself, being 72 years old and fraying a bit at the edges, have a regular medical check. At the last one my doctor joked, or at least I hope he did, that "I've go to keep you alive or I'll loose my TV guarantee!" Knowing a good deal when I hear one, I accepted it. The best part is that neither of us had to pay for an extended guarantee.

I'm still trading and still get a great buzz when I do a deal. Luxury hours now however, 11 a.m. to 4 p.m. six days a week – and no loss of trade. Tea or coffee and biscuits every hour. Don't accept the doom and gloom. Best of luck to you all!
E.R. Webb, KTV Electronics,
Camborne, Cornwall.

John Edwards' Casebook

Ferguson C49F (TX90E chassis)

There was no picture or sound, just a loud fizzing noise and a smell that reminded me of the cap gun I had when a child. The cause of this was obvious once the back cover had been removed. There was a large, carbonised hole where the print from the collector of the line output transistor to the transformer had once been supported – a thin, discoloured and twisted strip of print provided the only continuity between the two. I scraped around the hole with a small screwdriver, removing loose print tracks and carbon deposits, then used 22 SWG rigid wire to remake the circuitry.

When I switched the set on again an orange glow accompanied by more fizzing noises came from around the base of the transformer, telling me that I'd missed something. The components are mounted very close together in this area, so I couldn't pinpoint where the arcing came from. To improve visibility, I removed the line output transistor complete with its large heatsink. I could then see that the 9·1nF, 1·6kV tuning capacitor CL22 and RL24 (2·2kΩ, 0·7W) were both badly scorched. Replacements restored correct and silent line output stage operation. Note that the value of CL22 varies depending on tube type.

While the set was on test I found that slight flexing of the main board produced shutdown or partial field collapse. This chassis is well known for dry-joints that cause problems in the power supply and the line and field output stages. The present set was no exception, and wasn't declared fit until a further hour had been spent resoldering here, there and everywhere.

Hitachi C1414T

This set's power supply had shut down because the HT over-voltage protection diode ZD952 was short-circuit. When I replaced it and switched the set on again the EHT anode cap fizzed and cracked. Fortunately I had my finger ready and switched off pronto. Clearly the HT was much too high.

Checks in the HT sensing network revealed that R951 (39kΩ, 0·5W, 5%) was open-circuit. It's on the chassis side of the potential-divider chain that feeds the base of the error-sensing transistor Q951. A replacement cured the problem.

I recall that on a previous occasion I had, after repairing the power supply, to replace the TA8427K field output chip IC601 as well. So be prepared.

Alba CTV6682

The symptoms were field collapse and no sound. Replacing the TDA3654 field output chip made no difference, neither did replacing the TDA8362A multi-function (timebase generators, colour decoder etc.) chip. Time for rational thought. Well, I always start off with that, but somehow I always get diverted.

Some checks revealed that there was no voltage at ramp generator pin 43 of the TDA8362A chip. The voltage for the *RC* ramp generator network is obtained from the 33V tuning supply, which was missing. Hence the loss of sound as well. When I checked back to source, which turned out to be the 149V HT supply, I came to R818 (22kΩ) which was open-circuit. As it showed no signs of distress I simply fitted a replacement and switched on. There was full scan and normal sound.

Toshiba 2112DBT

There were three flyback lines at the top of the screen. They were quickly removed by replacing the boost supply reservoir capacitor C333 (100µF, 35V) in the field output stage.

Hitachi CPT2128 (G7P chassis)

The mains fuse was shattered but the surge limiting resistor R901 was OK. A quick check on the BUW11A chopper transistor showed that it was short-circuit. I fitted a replacement and glanced around for signs of distress elsewhere. Two capacitors (C928, 2·2nF, 2kV and C919, 1·5nF, 2kV) in the chopper transistor's collector circuit were discoloured and their cases showed signs of cracking. So I replaced them as well.

Then I remembered that a common cause of chopper transistor failure when the drive comes from a TDA4601 chip is failure of the high-value resistor connected to pin 4 of this IC. There are two resistors, R932 (120kΩ) and R931 (150kΩ), connected in series in this chassis. Checks showed that R932 was indeed open-circuit. I decided to replace them both then, pleased that my brain still retained some useful information, I switched on. Another TV had been brought back from the dead.

Toshiba 201E4B

This set's sound output was normal but its screen display was strange to behold. There was a full raster with the colour content pulsating very rapidly on and off and misconvergence. The picture geometry was a mess, with all vertical content distorted. A scope check across the mains bridge rectifier's reservoir capacitor C810 (120µF, 400V) showed that some 35V peak-to-peak of ripple was present here. In fact the waveform was a virtually unsmoothed rectifier output. A replacement capacitor cleared the problem.

Answer to Test Case 445

– see page 145 –

Sage, who devised this little test, was a schoolboy back in the Fifties. But he had an interest in radio and TV, and knew that in addition to electrons a CRT gun emits heavier particles called ions. If these were allowed to bombard the tube's screen they would, in time, burn the phosphor. The fact that they are not deflected by the scan coils means that the damage ('ion burn') would be at the centre of the screen. It also offered a solution to the problem.

The gun was bent so that the ions were directed, harmlessly, at the wall of the tube's neck. An external 'ion-trap' magnet directed the electrons towards the screen for deflection. In modern tubes the phosphors are protected by a sprayed-on film of aluminium. So bent guns and ion-trap magnets are no longer needed.

The PD500 was a large triode valve able to dissipate over 30W. It was used as a shunt stabiliser to maintain a constant colour-tube EHT of some 25kV when the voltage was obtained from a half-wave rectifier (GY501) valve. In this way the picture size and focusing were stabilised over the whole brightness range, and correct convergence was maintained. Subsequently solid-state diode (silicon and selenium) multipliers came into use. These provided better stabilisation, particularly in conjunction with fifth harmonic tuning of the line output transformer.

The PD500 was wasteful of energy and, especially with dark scenes when its current was high, the valve emitted X-ray radiation. For this reason it was provided with a screening can. Operation without the can, or working beneath the set where the can didn't provide screening, was a health hazard.

Because early line output transistors couldn't withstand the very high collector pulse voltage that was produced when they were switched off at the end of the line scan, it was common practice with early transistor line output stages to use two series-connected transistors. This enabled the pulse voltage to be shared between them. There was a procedure to trim the drive waveforms, which were obtained from separate secondary windings on the driver transformer, to ensure that the transistors switched off simultaneously. Developments in transistor technology made all this unnecessary.

A satellite transmitter has severe power constraints in comparison with a terrestrial transmitter. The use of FM instead of AM for the video signal helps considerably in this respect: with FM, the power can be reduced by some –20dB. FM requires a greater bandwidth, but this is of less importance at SHF. There is a further advantage in the use of FM: noise, which consists of amplitude changes, can be greatly reduced. Below a certain threshold (carrier-to-noise ratio) however an FM discriminator finds it difficult to distinguish between signal and noise. Its output then includes noise components which appear on the picture as 'sparklies'.

PAL and similar systems were devised as a compromise solution for terrestrial transmission – to get colour into the same channel bandwidth as a monochrome signal. It was found to work with satellite transmissions, but produced the same problems as with terrestrial TV – a tendency to cross-colour interference and colour-bleed. There is also the problem with FM that the higher frequencies are more susceptible to noise interference than the lower frequencies – the PAL signal uses an HF subcarrier of course. Though a better transmission system, MAC, was available, PAL continued to be used to maintain compatibility with existing receivers.

These problems were overcome with the advent of digital signal transmission. The transmission of a video signal in digital form was impractical before signal compression was devised, because of the very wide bandwidth that would have been required. Removal of redundant picture information reduced the bandwidth requirement to that of an analogue signal. There are two main forms of redundancy, spacial and temporal. Spacial relates to unnecessary information within a TV frame, e.g. large background areas with little detail; temporal relates to information that doesn't change from frame to frame. MPEG compression removes both types of redundancy.

To recreate an analogue signal for display, the MPEG decoder in a digital receiver requires a certain amount of semiconductor memory. Some 16Mbits of DRAM, corresponding to three frames, need to be provided. The temporal MPEG coding uses I frames (intraframes, i.e. complete frames, one every twelfth frame), P (predicted) and B (bi-directional) frames. The DRAM enables compressed frames to be stored while complete frames are assembled.

There is also redundancy in the digital signal (e.g. recurrent zeros and ones), which makes further compression possible.

From ion traps to DTV has taken half a century. We've covered it in just over half a page. Wow! A happy and prosperous new year to all our readers.

NEXT MONTH IN TELEVISION

LOPT testing

Line output transformers can be troublesome and are expensive. So, at a time when the viability of TV repairs has become a more important factor than ever, it is a great help to be able to assess LOPT condition easily. Alan Willcox has designed a simple LOPT tester that provides accurate diagnosis. In presenting the tester, Alan takes the opportunity to discuss basic LOPT fault conditions and line output stage testing.

The Setanta Sports satellite receiver

Hugh Cocks describes the operation of the tuner used for reception of Setanta TV, an Ireland-based satellite sports subscription TV network.

Servicing modern audio equipment

Quite a lot of audio equipment is worth repairing, especially the more up-market gear. Edgar Beddow provides a guide on what to expect.

Diodes

There's the simple pn junction diode and there are various more specialised versions. Pete Murchison provides a bit of 'back-to-basics' theory.

Servicing the Vestel 11AK08/10 chassis

These chassis are found in sets with various brand names on the front. Alan Dent provides a fault guide based on NEI-badged models.

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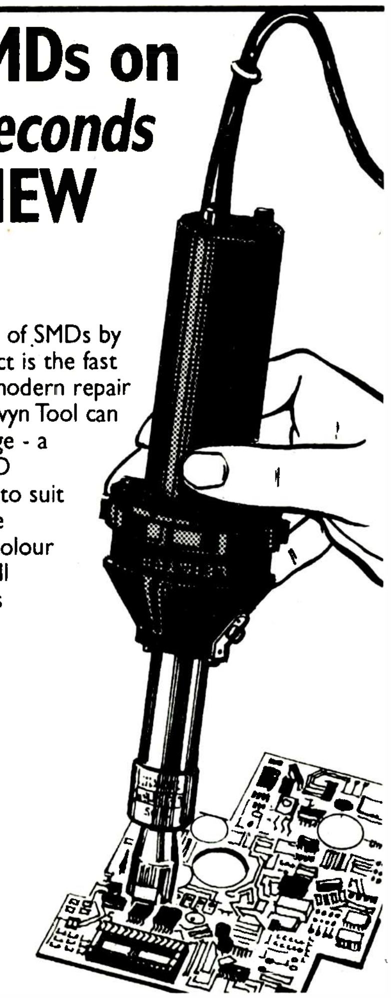

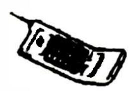

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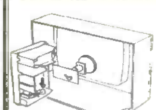

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At ScottishPower the customer is our number one priority. We aim to get things right first time and when a customer's product is in need of repair our Engineers' technical ability is paramount. With our one team approach we intend to be the best.

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You will need technical skills in electronic repairs with strong diagnostic techniques and an awareness of new technology developments to provide quality repairs for our customers. Experience of electronic/product repair is essential to enable you to diagnose to component level when fault finding on a wide range of products. Communication skills will enable you to liaise between Callcentre, workshop and stores. City & Guilds 224 qualification or equivalent is essential in this role.

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For both roles, you can expect an attractive salary and benefits package. Training will be tailored to your needs, so don't worry if your skills need polishing, as we offer all the support you need.

Please write, with your CV, stating current salary details to: Mark Perrier, Recruitment & Training Manager, ScottishPower, California Drive, Whitwood Industrial Estate, Castleford, West Yorkshire WF10 5QX. Email: mark.perrier@scottishpower.plc.uk

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You'll need a good knowledge of broadcast television systems including serial digital video and digital video broadcasting, an interest and enthusiasm for problem solving and excellent communication skills. An HND (or equivalent) in electronics is desirable although relevant work experience is equally important. Shift working is a prerequisite of this post.

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POSITOR-2322 662 98012		50p
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V212		£188.00
PANEL TELETEXT G8P – ISSUE 6		£10.00
PANEL-TELETEXT PC315-11 – ISSUE 7		£15.00
PANEL-TEXT VT753E		£20.00
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STR 4211 ISSUE 10		£8.00
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AA Batteries made by STC Group of Companies		10p each

ITT

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5929-03-41	EACH	£3.00
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1996/7 MATSUI

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D1096 VXA110 VP 9401		£16.00
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PHILIPS

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IF PANEL FOR CP90-CP110		£5.00

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36482, 36761, 36831, 36832
36943, 36962
2432211, 2432351, 2432491, 2432851
2432871, 2432981, 2432984
2433952, 2434141, 2434393
2434451, 2434492
2435016, 2435062
2435064, 2435085, 2435121
2435372, 2435701, 2436773
2436792, 2436795, 2436797, 3216001
243066, 243063
3220029, 3714016, 47003481
AT2076/78, AT2076/88, AT2078/25
AT2077/81
DST81N243/472593-00
DST85B235/47328700 & /40153200
DST88N234/400086AD, &/47805200L
DST88N234/47320041, &/47317590
DST186N243/473058-00
TFB3035D, TFB3069D, TFB4023AD
TFB4039AD, TFB4066AD

FERGUSON
TX9
TX10
TX85, TX86
TX89, TX98, TX99
Y260781
FSTY260482
LOPT RED SPOT
LOPT WHITE SPOT & YELLOW SPOT

PANASONIC
TC2203, TLF 1456B
TLF1457B, TLF701/6

TOSHIBA
TFB 3035D, TFB 4023AD, TFB 4032BD
TFB 4038AD, TFB 4110AD
TFB 3089D, TFB 4088AD

VIDEO DECKS

AIWA 1500 MATSUI VXA 1100 MATSUI 1500 ORION D1094 ORION D1096 ORION D2096 ETC	£5 POST WITH HEADS EACH	£20.00
CAPSTAIN MOTOR FOR ABOVE DECKS		£15.00
AND HAND SETS		£3.00
4 HEAD DECK FOR 1500		£20.00
20 HIGH VOLTAGE CAPS 1500V – 2000V MIXED		£1.00
VIDEO PATTERN GENERATOR MODEL T9535 240V		
MAINS SMALL		£5.00
PAL TV ADAPTOR – RGB IN UFH OUT		£5.00
MOTOR 12V		10p

HANDSETS

AMSTRAD		
4600		£3.0
4700		£5.00
6000		£15.00
6800		£4.00
UNIVERSAL		£3.00
DECCA		
NICAM LCD		£4.00
FERGUSON		
BSB		£1.50
FV41R/3V59 FV41R/FV42 – FV51-52		£10.00
ICC5		£7.00
IK2000, IK7000	EACH	£4.00
SRD2, SRD3, SRD4	EACH	£1.00
T780		£2.00
TV/SATELLITE WITH FST		£3.00
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CPT2158 (NO REPLACEMENT)		£5.00
VIDEO RM933E VIDEO PLUS		£30.00
MATSUI		
1500		£5.00
VSR 1500		£4.00
VX3000		£3.00
3000/ORION – TV AND VIDEO		£2.00
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MITSUBISHI		
RM35 – VIDEO		£5.00

NOKIA		
RC202		£4.00
VP9401		
D1096		
VXA1100		
AND VIDEO PLUS		
ORION		
TV AND VIDEO		£2.00
VIDEO WITH LCD – 1992/93 MODELS		£5.00
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EUR51142		£10.00
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TX2034, TX2044, TX2200, TX2234	EACH	£8.00
TX2244, TX2300, TX2636, TX3300	EACH	£8.00
RC201 – TV – REPLACES TNZ1411/2		
PERDIO		
PV 1188		£3.00
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NEW TYPE UNIVERSAL		£8.00 (3 in 1)
RC4001		
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HANDSETS, TV & VIDEO – 12 TYPES EACH		£3.00
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UNIVERSAL VIDEO		£3.00
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TV/VIDEO – 1994 MODEL		£5.00
THORN		
9000, 9600, TX9, TX10, TX1000		
TEXT AND NON-TEXT	EACH	£10.00
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COMPLETE REPAIR KIT, CLUTCH AND		
PINCH ROLLER, IDLER D2906		£7.00

TUNERS

IF TERC8-022A TBJZA-00ZA-ALPS		£3.00
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SATELLITE		
WITH BASE BAND MIN SXT2302234		£4.00
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VHF/UHF – TEKE4-112A		£4.00
4944		
U321, U341, U342, U343 U344, U411, U412, U944 U743, 7744	£2 EACH	
AMSTRAD		
UE33-BO1		£3.00
MRF7-7E33		
MATSUI ORION VIDEO TUNER IF		£5.00
FERGUSON		
IF2105-RE		£5.00
MTP2011-AP00		£5.00
UHF – ICC5		£5.00
VHF – ICC5		£5.00
TX85, TX86, TX89, TX90	EACH	£4.00
TX98, T99, TX100	EACH	£4.00
ORION		
1500 – UE33 BO9		£4.00
PANASONIC		
SMALL UHF/VHF		£3.00
FERGUSON		
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SHARP		
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2SC7350	15p	AN5551	£1.00	BU508AF	£1.00	BY187	5p	BZW83-C20	3p
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2SD820	£1.00	BF870	20p	BU807	50p	BY299-800	30p	HA1185	£1.00
2SD868	75p	BPW41	15p	BU808DFI	£1.00	BYT71-800	15p	HA1196	50p
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2SD1264	50p	BU105/04	80p	BU826	£1.00	BYV28-200	15p	HA118041NT	£1.50
2SD1266	£1.00	BU108	£1.00	BUK444/800	£2.00	BYV95B	10p	HA513385PI	£2.00
2SD1398	£1.00	BU124	50p	BUK445/600	£2.00	BYV95C	12p	HA51338SP3	£2.00
2SD1415	£1.00	BU126	80p	BUK454/600	£1.00	BYV96D	10p	HCF4520	50p
2SD1427	£1.00	BU180A	65p	BUT11	50p	BYW20-08-9	£1.00	HCF4520BE	50p

HD6140425J	50p
HD6140815	£1.00
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HGA1124A	50p
HM6264	
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LA7831	£1.00
M708 ABI	£1.50
M708 LBI	£1.50
M37204ECSP	£1.00
M58658P	£1.00
MN650	£1.00
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SAA5010	£2.00
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