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**Digital satellite
receiver design**

**Low-ohms meter
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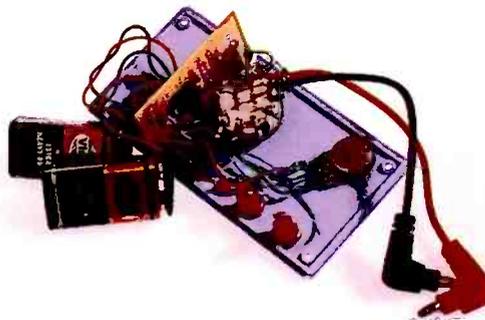
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Delivering TV

How will we be getting our TV signals in say ten years time? Right now the options are on the increase, with digital TV giving us more for our money technically. The three basic options of course are off-air terrestrial, cable and satellite: all, during a transition period, in either analogue or digital form. There is also the added complication of the internet – one already sees references to webcasting and internet channels.

Digital TV will give us more channels whatever the transmission medium. But one interesting by-product of the digital revolution is duplicated services. We will for example find that the same BBC channel is there whether we are receiving in the traditional off-air way, via a dish or via cable. This raises the question of whether all these alternative methods of delivering TV signals are necessary?

You could say that off-air TV exists for historical reasons. It came first, and in the early days of TV there were no satellites and cables were prohibitively expensive and had limited bandwidth. So we stuck our aerials up and tuned in. Cheap and simple and you got all that was on offer. Right now off-air is still the cheapest option, but is also the most questionable way of going about it. If TV was started from scratch today, satellites would undoubtedly be the way of doing it.

Cable is relatively expensive but has certain advantages. It's simple to bundle with a telephone service, giving full access to the internet and the possibility of various data links. Cable is never likely to be an option for everyone however. Right now 18m of the 22m homes in the UK are in cable franchise areas, and the

cables run past about two thirds of these homes. While these cable networks cover a lot of the country huge, sparsely-populated areas are not covered and probably never will be. Many such areas have also had problems with off-air signals, hence all those relays. The obvious solution for those outside the likely extent of the cable franchise areas is the dish. Satellite signals get almost everywhere.

A case could thus be made out for cable services in urban and suburban areas, with satellite as an alternative option that extends coverage to just about everyone. No need for traditional terrestrial TV. Close down the transmitters and sell the airwaves for other use. It could happen.

It could, but then again it may not. People are used to their off-air signals, which most can receive using a simple set-top aerial. It's a cheap and cheerful option. Pay your licence fee and get the excellent services provided by the BBC, the ITV companies and others. People would be reluctant to give this up. It's become a sort of right. Why pay more for services that, in terms of value for money, provide little extra – or extras such as interactive TV that many are happy to be without? But services have been withdrawn before, and are going to be again: 405-line VHF transmissions ceased with barely a whimper, and analogue transmissions will be cut off before all that long.

Right now satellite TV seems to be making greater headway. It has two disadvantages, highish cost and the need for a dish. Cost could be reduced (as with cable) by offering smaller programme packages, while dishes are not all that

conspicuous today – size has decreased as transponder powers have increased and LNB noise figures have fallen. It's the ideal solution for rural areas.

The interesting thing to watch will be the development of cable. Networks have been laid in the UK at enormous cost – £8bn to date – and so far there has been negligible if any profit. Someone must see profitability in the future however. Hence the takeovers that have now led to three main players controlling nearly all the networks in the UK. Hence also moves like the amalgamation of ATT, a leading long-distance 'phone company in the USA, and TCI, one of the main US cable companies, with interests in the internet field. This is of course the clue: all that data and information down the line, with easy implementation of interactive services and so on. Developments in software and other computer technology will enhance this considerably.

The problem with cable has always been its relatively high cost. This is why there are only some 2.5m cable TV subscribers in the UK, a take-up rate of 22.4 per cent. And the churn rate is still high, at over 30 per cent on average.

But there's a lot of money going into cable, presumably because of the technological prospects. It is interesting that Disney, the world's largest media company, is developing web TV technology – and it's not on its own in this respect. Cable has an assured future therefore. The satellites offer less technically but are a cheap and cheerful way of delivering TV. Where does this leave the traditional terrestrial off-air approach? It's unlikely that we shall have all these options indefinitely.

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2SB1143	0.77	2SD1651	2.38	BC212B	0.19	BD902	0.60	BY133	0.08	FXT749	0.43	SGSIF344	10.70	TA8739P	0.35	TDA46502	1.97
2SB1243	0.60	2SD1858	0.43	BC212L	0.18	BD911	0.52	BY206	0.20	HAI3001	3.85	SL1430	1.92	TA8739P	0.35	TDA46502	1.97
2SB560	0.43	2SD1877	2.14	BC237	0.12	BDT64C	1.18	BY227	0.13	HAI3119	2.05	SL1431	2.82	TA8739P	0.35	TDA46502	1.97
2SB643	0.29	2SD1878	2.63	BC237B	0.19	BDT65C	1.68	BY228	0.26	HAI3151	13.20	SN74141N	0.17	TA8739P	0.35	TDA46502	1.97
2SB647	0.57	2SD1879	3.16	BC238	0.11	BF194	0.22	BY2291000	1.31	HA51338SP3	7.69	STK4132I	10.00	TA8739P	0.35	TDA46502	1.97
2SB649A	0.77	2SD1884	3.35	BC238B	0.16	BF195	0.07	BY255	0.14	HM6251	14.32	STK4141I	10.23	TA8739P	0.35	TDA46502	1.97
2SB688	1.61	2SD1887	3.56	BC307	0.06	BF197	0.18	BY299	0.18	ICH281	0.26	STK4142I	9.40	TA8739P	0.35	TDA46502	1.97
2SB698	0.35	2SD288	0.85	BC307B	0.15	BF199	0.18	BY397	0.20	IR9594	15.79	STK4152I	10.95	TA8739P	0.35	TDA46502	1.97
2SB716	0.43	2SD350A	1.97	BC308	0.09	BF258	0.04	BY398	0.16	IRFBC40	5.98	STK4192I	14.64	TA8739P	0.35	TDA46502	1.97
2SB772	0.50	2SD381	1.66	BC308A	0.09	BF420	0.21	BY399	0.12	KIA6210AH	6.15	STK5332	2.82	TA8739P	0.35	TDA46502	1.97
2SB774	1.61	2SD400	0.34	BC308C	0.26	BF421	0.24	BY448	0.30	LA4270	2.73	STK5342	4.07	TA8739P	0.35	TDA46502	1.97
2SB891	0.60	2SD401A	0.77	BC309B	0.10	BF422	0.19	BYD14J	0.35	LA4280	3.12	STK5372H	6.84	TA8739P	0.35	TDA46502	1.97
2SB892	0.35	2SD468	0.28	BC327	0.10	BF423	0.14	BYD33D	0.12	LA4282	5.11	STK5421	9.52	TA8739P	0.35	TDA46502	1.97
2SC1008	0.24	2SD667	0.38	BC328	0.14	BF459	0.43	BYD33J	0.16	LA4445	3.45	STK5481	8.12	TA8739P	0.35	TDA46502	1.97
2SC124	0.48	2SD669A	0.64	BC337	0.14	BF471	0.37	BYD33M	0.26	LA4460	2.50	STK7253	7.69	TA8739P	0.35	TDA46502	1.97
2SC1318	0.19	2SD718	1.90	BC338	0.06	BF487	0.57	BYV10-40	2.55	LA4700	4.27	STK7308	6.41	TA8739P	0.35	TDA46502	1.97
2SC1473	0.21	2SD756	0.47	BC368	0.18	BF491	0.41	BYV95B	0.21	LA6324	2.05	STK7348	5.74	TA8739P	0.35	TDA46502	1.97
2SC1573	0.52	2SD837B	1.12	BC369	0.18	BF494	0.12	BYV95C	0.28	LA6510	2.94	STR11006	7.37	TA8739P	0.35	TDA46502	1.97
2SC1675	0.14	2SD856	0.79	BC372	0.53	BF759	0.38	BYV96D	0.27	LA7830	1.88	STR4211	9.40	TA8739P	0.35	TDA46502	1.97
2SC1685	0.21	2SD882	0.43	BC546A	0.11	BF869	0.38	BYV96E	0.53	LA7832	2.40	STR50020	9.38	TA8739P	0.35	TDA46502	1.97
2SC1740	0.16	2SD898B	0.61	BC546B	0.12	BF871	0.41	BYW56	0.31	LA7835	2.99	STR50103	4.48	TA8739P	0.35	TDA46502	1.97
2SC1815V	0.11	2SD965	6.47	BC547	0.11	BF959	0.18	BYW95C	0.21	LA7837	4.19	STR50103A	5.56	TA8739P	0.35	TDA46502	1.97
2SC2001	0.23	2SD965R	1.05	BC547A	0.04	BF960	0.30	BYW96E	0.50	LC7132	4.70	STR54041	5.15	TA8739P	0.35	TDA46502	1.97
2SC2023	1.18	2SK1117	3.40	BC547B	0.11	BF970	0.43	BYX55600	0.23	LED33	0.10	STR5412	4.02	TA8739P	0.35	TDA46502	1.97
2SC2073	1.03	2SK1118	3.4														



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.

End of the CRT?

I can recall when colour TV was fairly new in the UK and a 22in. four-channel, manual-control set cost about £300. Most were snapped up as soon as they were made. At that time a TV serviceman earned £26 a week, or £32 if he repaired colour sets. A new car cost about £600 on the road. When VCRs first appeared they cost about £650. The first satellite receivers came in at about £1,500 installed.

Now, with increased competition and reduced production costs, prices have dropped to the extent that a 22in. colour set which costs £300 has remote control, 99 channels and teletext. A VCR can be bought for £100, and satellite receivers are given away free with washing machines.

But a new age looms. The TV licence is nearing the £100 mark, and digital TV transmissions will be available for between £300-£400 per year extra. After a suitable period, the analogue transmissions will be closed down.

Projection TV seems to me to be the coming thing. Forget the old rear-projection units that have been around in one form or another since the days before colour, and have to be watched from one chair in the centre of the room: I'm talking about front-projection units. There are two main types, CRT driven and lamp-driven LCD units. The former have to be installed permanently, usually mounted on the ceiling, and are converged rather like early colour TV

Letters

sets. The latter are about the size of a VCR and project a wall-sized picture from your coffee table, with little or no setting up required. They cost from under £700 for a poor-quality basic model to £4,000 or so for a good one, and will project pictures from satellite receivers, VCRs and DVD players.

The picture quality produced by these projectors is increasing daily. The cost is decreasing fast as newer models hit the market. Last year's models now cost 20-30 per cent less than when they first appeared. At the present time the CRT driven models have the edge in picture quality, but the LCD types are catching up fast. If sales increase, production costs will be less than those for a standard TV set. All that's needed is for one innovative manufacturer to flood the shops with a good-quality unit at less than £2,000 on sale or return and I think we will be saying goodbye to TV sets as we know them.

So, is the end in sight for the CRT that has been a part of our daily life for almost half a century, and will we get decent-quality projection TV at about £500 (in terms of today's prices) within a few years? If so, what will be the fate of the flat-screen, hang-on-the-wall TVs that have been in the pipeline for the past thirty years? Anyone out there got a crystal ball?

*John Hopkins,
Felixstowe, Suffolk.*

Non Account Holders

Graham Richards (Letters, May) asks why manufacturers treat non account holders the way they do. The theory is that manufacturers expect an account holder to meet certain requirements in terms of premises, test equipment, spares stock etc. In other words the account holder is expected to invest in order to obtain an account. It is for this reason that preference is given to account holders for spares and technical advice. In addition, manufacturers seem to find it more cost-effective to appoint distributors to handle non account holder spares orders and, in some cases,

provide technical advice. In principle this should work, but there are flaws – here's a brief list.

(1) The distributor often doesn't hold a comprehensive stock of spares for each manufacturer, preferring to keep in stock only fast-moving lines. Other spares are obtained to order. This causes problems and can delay a repair for up to ten days. You then appear to your customer to be inefficient. All distributors require a minimum order of between £10 and £50, otherwise hefty handling and postage charges are incurred.

(2) As a non account holder one would expect to pay more for a part. The question is, how much more? In some cases the increase can be over 200 per cent. One distributor makes no price distinction between a trade account holder and a member of the public referred to it by a manufacturer. One customer took me to task because he had phoned up the manufacturer who had given him the trade price of a component over the phone. This price was much below what I had to pay my local supplier for the part. Most distributors price spares at what appears to be a retail price. SEME prices Panasonic spares half way between the dealer and retail prices.

(3) Willow Vale's technical line is excellent. It is manned by trained engineers who have been on manufacturers' courses and have developed close relationships with the manufacturers concerned. Not all manufacturers support the service however. Thus it cannot always match the experience of manufacturers' engineers who have first-hand knowledge of the products through carrying out repairs themselves.

The policy of giving technical advice to account holders only started some ten years ago, with Grundig. Presumably the company was fed up with having valuable time wasted by some engineers who called about simple faults before they'd even taken the back off! Since then other manufacturers have adopted this policy.

There are exceptions. Toshiba offers an excellent technical advice

service to all engineers. Ferguson also gives technical advice to non account holders. I was recently told by Samsung that if I faxed a technical query I would get a faxed reply. I did, complete with part numbers.

To resolve my own problems I have come to an agreement with another dealer who has accounts with several manufacturers. He lets me have parts at cost price plus a small handling charge of say five per cent. If you do the same with local dealers it will make your life much easier and your service more efficient.

Some manufacturers allow you to open a spares account even if you operate from home. You will be expected to spend a certain amount annually. If you can find others who will buy spares from you it should be possible to reach the target. The advantage of having a spares account is that you get an account number which you can use to obtain technical advice.

*Michael Maurice,
Wembley, Middx.*

The Front Line

I started in this business in 1955. After nine years as an apprentice, improver, bench and field engineer and subsequently service manager, not to mention National Service in the Royal Signals, I decided to work for myself – a mixed blessing, as many will confirm! Now retirement looms, and I find myself reflecting on the failure of our trade to recruit more idiots like me, and the current lack of training provision, as mentioned in the April issue leader "Preparing for Digital TV".

The number of competent engineers in my area has fallen year by year. I taught some of them at Blackpool Technical College and Fleetwood Nautical College. Many were trained by Rediffusion, Granada and other rental organisations, now mainly defunct. I consider those I know who remain working to be the salt of the earth, ever ready to share information, service manuals and spares – a far cry from the lack of support those of us in the front line receive from many manufacturers' service departments today. Who hasn't heard the fateful question "Have you an account, sir?" from a disembodied, usually female voice, finally contacted after six diverted calls and engaged lines, with over-loud, irritating music while you wait? We are the front line and collect all the flack: we deserve better support. I know firms only want to sell their latest widescreen, digital offerings – but these will be even more full of dry-joints than the one whose cabinet splits at the drop of a hat!

Never mind, tempus fugit and I

must return to that nasty Nicam VCR with the expensive multi-wound video head and a totally ineffective, not to say damaging, auto head cleaner. But that's another matter. Take care!

*Jim Kirkman,
Poulton-le-Fylde, Lancs.*

The End is Nigh

I have been fascinated by recent letters in *Television* on the future of the servicing trade. I refer to the *servicing* trade, as for many of us the *retail* side of the trade evaporated several years ago because of falling prices.

Unfortunately this downwards price spiral is now hitting the repair trade as well.

I find that customers bring in three-four year old TV sets or VCRs, plunk them on the counter, ask me to take a look at them and then say "if it's going to cost 'owt, I'll bin it and get new". This also applies to microwave ovens, where the cut-off point for servicing seems to be about £35. You can get new ones for £60 in Argos! In my part of the country, prices for new equipment are typically £99 for an Alba VCR with LP and VideoPlus, and £249 for a 25in. Alba TV set with Nicam and Fastext.

Mike Haywood asks (July) where people will take this cheap stuff when it goes wrong. The answer is back to Aldi, where they will be handed a replacement or refund under the guarantee. Once out of guarantee, it will go to the tip!

I started in this trade in 1966 BC (Before Colour), served a five-year RTRA indentured apprenticeship and am now an impoverished sole trader, repairing TV sets, VCRs, Hi-Fi and satellite equipment and microwave ovens for little reward (financially or otherwise). It is galling to hear of rising interest rates because of economic overheating and rising wages. In 1967 I was delivering £300 colour TVs in a £500 van (new). Now it's £250 TVs in a £10,000 van. The end is certainly nigh!

*Mike Scott,
Southport, Merseyside.*

Lucky Hips etc

I can shed some light on the "LUCKY HIPS" label that Chris Plaice (Letters, May) mentioned seeing in GoldStar TV sets. HIPS stands for High Impact PolyStyrene. The cabinet back could have been made of this commonly used plastic material, which was probably made by Lucky, GoldStar's parent company.

Incidentally Acer flatbed scanners of recent manufacture have a small movable pointer in the mould tool to indicate whether the case is made from

ABS or HIPS. The pointer can be seen on the underside of the lid in one corner, near the "clocks" that indicate when the cabinet was moulded. HIPS is cheaper than ABS, but doesn't feel so good to the touch. This gives retailers the choice of a 'luxury' model at a higher price or a cheap version to be sold at a discount.

In the June issue Donald Bullock mentioned the tiny speakers used in Daewoo portable TV sets and the awful sound they produce. These "singing yoghurt pots" seem to be used in many TV sets with screen sizes up to 21in. nowadays. I think the idea is to prevent annoying rattles with today's flimsy plastic cabinets!

Also, I cannot understand the current trend to use mini-neck tubes in sets with screen sizes up to 21in. Although the deflection power required is less, the purity tolerance and focusing are poorer than with the older so-called narrow-neck tubes. Electronic image sharpening is often used to compensate for the poorer focus, but this can cause ringing, with the result that the small print at the bottom of some commercials is almost unreadable. Tatung for one seems to prefer the wider narrow-neck type of tube, possibly for this reason.

*Simon Pearson,
Chipping Norton, Oxon.*

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TELETOPICS

Digital TV: Here we Go!

BSkyB has launched its digital satellite broadcasting service to the UK. Some hundred channels are available from Astra 1D at 28.2°E – there were just two or three during the test period. BSkyB has described the start of its service as a “soft launch”. It’s being offered to selected existing subscribers initially, during the period when set-top boxes will be scarce. Other subscribers will then be offered the service, with a general public offering in the autumn. BSkyB plans to spend £100m on promoting its digital service, which will be under the Sky banner.

The ITV companies are refusing to allow BSkyB to add their programmes to the digital satellite channels. However the BBC has announced that its programmes will be available. Four TV channels will be offered initially, BBC-1, BBC-2, BBC Choice and BBC News 24. Two more, BBC Learning and digital Ceefax, are to follow. The BBC’s five radio stations will also be available via the digital

satellite service. To comply with copyright agreements outside the UK, the BBC’s channels will have to be scrambled. So viewers will require a conditional access (CA) smart card.

British Interactive Broadcasting (BIB), which will be offering interactive facilities with Sky’s digital satellite service, has now been given the go-ahead by the EC’s competition authorities. The first BIB services are expected to become available next year.

Meanwhile on the terrestrial front BDB has, as previously announced, selected the MediaGuard CA system and the Mediahighway interactive system (from Canal+). Philips and Canal+ are helping BDB to finalise its set-top box specification, which has taken longer to develop than expected. As a result, few IDTVs (Integrated Digital TV sets) are likely to appear in the UK before next summer.

Hitachi plans to be one of the first to launch, later this year, IDTV models designed for digital terrestrial TV

reception. Model C28W40DTN, at around £1,400, will be a 28in. 16:9 receiver with a Dolby Pro-Logic decoder, a Super Flat CRT and a common interface for use with a variety of CA systems. Model C32W40DTN will, for some £1,600, provide the same features with a 32in. CRT.

The BBC has been running a pilot digital terrestrial TV channel – a world first. Amongst material it has broadcast is World Cup football in widescreen format. Programmes have been shown at public displays around London and parts of southern England – display equipment has been provided by Hitachi, Philips and Sony. Transmissions are from Crystal Palace, which is being fed via a satellite link. The BBC believes that between 50-66 per cent of British homes will be receiving digital TV by 2007.

A Japanese government panel has recommended that terrestrial digital TV should start in 2000, five years earlier than previously planned.



US Electronics has introduced The Integrator remote control/keyboard unit (see photo) which has been designed for use with PC, TV, VCR, satellite and DVD systems. It integrates a multi-function remote control for TV sets, cable converters and VCRs with a compact PC keyboard. The latter is revealed when the cover is removed and is compatible with all Windows applications. US Electronics' UK arm, based at Chesham, Bucks, can be reached on 01494 794 382.

Cable TV

In a significant move towards consolidation in the UK cable TV and communications industry, NTL has acquired ComTel and Diamond Cable. The deals are worth some £1.4bn. This leaves just three major players in the UK cable industry, CWC, Telewest and NTL. Comcast was also acquired by NTL recently. NTL wants to establish its Digital TeleNetwork, which will offer customers digital TV, internet access and telephony services.

According to the latest figures from the ITC, the cable TV take-up rate rose to 22.4 per cent in the first quarter of 1998, the highest level for this quarter. Cable service penetration (TV and/or phone) rose to 33 per cent, its highest level yet. Broadband cable services now pass over 11m homes, with almost 3.65m TV and/or phone connections.

The ITC's annual survey reveals that the average monthly TV subscription is £24.29 including VAT. This means that on an annual basis cable TV subscriptions are generating over £718.8m including VAT.

The Digital Dish

Satellite TV equipment distributor Longreach Group Plc has announced a multi-million pound deal with Cambridge Industries. Longreach is to stock the digital dish system that has been developed by Cambridge Industries and Channel Master to meet the requirements of BSkyB's digital satellite transmissions. It consists of an elliptical dish with an integrated, matched elliptical feedhorn. The elliptical design minimises dish size while maintaining high efficiency with minimum off-axis (adjacent satellite) interference.

Skew setting is simplified with a new saddle-clamp design that provides 0°, ±4° and ±8° fixed positions. There's a basic 13.5° offset for Astra 2A in the UK.

Soldering on Solder

A bismuth-tin solder developed by Mining and Chemical Products Ltd. enables new connections to be added to joints that have already been soldered. The MCP solder has a melting point of 135°C, some 45°C lower than that of ordinary lead-tin solder. It can therefore be used for secondary soldering-on, or close to a conventionally made joint, without any risk of melting or softening the existing lead-tin solder.

MCP's bismuth-tin alloy wets readily and can be used to solder any metals that can be bonded by lead-tin solder. It is one of a range of specialised low-melting point alloys developed for soldering at temperatures between 58°C and 220°C. The series includes several lead-free formulations. Manufacture is to ISO 9002 quality-assurance standards.

MCP is based at Whitchurch, Hants and can be reached on 01256 897 200.

Business News

Alba's pre-tax profits last year rose by 29 per cent to £12.6m, helped in particular by strong sales of home-cinema TV sets in anticipation of the World Cup. The company's brands include Bush, Goodmans, Roadstar and Dirt Devil.

Thorn, the Radio Rentals group, has sold its American business to Renters Choose for £545m.

Carlton Communications has bought Nimbus Technology, a leading manufacturer of video and compact discs, for £160m. Carlton already owns Technicolor, the world's largest producer of prerecorded video cassettes.

Philips has sold, for what is believed to have been a nominal sum, its only manufacturing plant in Russia. Some £40m had been invested in the plant, which manufactured CRTs. A quadrupling of energy prices and import tariff cuts made it impossible to operate profitably. The Velt plant had a production capacity of 2m tubes a year but had been running at less than five per cent of this.

FireWire Chips

Texas Instruments has announced four new link-layer FireWire (IEEE 1394) chips that will enable designers of PCs, peripheral equipment and consumer electronics to increase the data throughput of their systems – the chips are optimised for 400Mbits/sec operation. The GP2Lynx (TSB12LV32) is for general-purpose PC and peripheral equipment applications; the PCILynx2 (TSB12LV21B) for PCI bus-to-1394 applications; the TSB12LV01 for high-end networking equipment; and the DVLynx (TSB12LV42) for consumer electronics products involving digital video.

The DVLynx, which is intended for use in items such as camcorders, VCRs and set-top boxes, enables the system processor to operate at peak performance levels by automatically parsing digital video data and non-DV isochronous data into 1394 packets for transmission: this transfers some of the burden from the processor, whose capability can thus be devoted to system-level requirements. With its large on-chip FIFO (8kbytes) and a bulky data interface, the chip can perform full bi-directional DV data transfers or

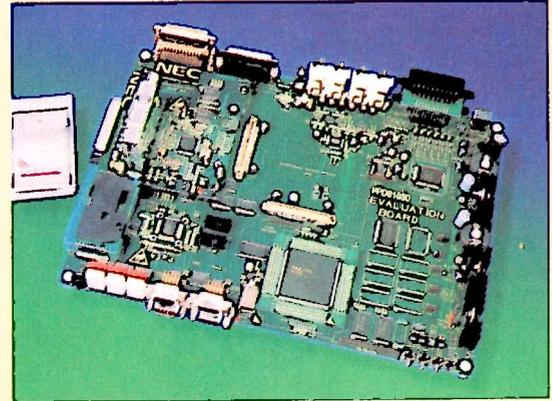
simultaneous DV and isochronous data transfers.

TI has also announced a breakthrough in CMOS transceiver technology that will more than double the speed at which information can be accessed, saved and shared across networks. The technology makes it possible to send and receive data simultaneously at speeds up to 2.5Gbits/sec.

BSkyB Remote Control

Philips was selected by BSkyB to develop and manufacture a universal remote control handset for use with its digital set-top boxes. Volume production has now started. The handset was designed jointly by Frazer Designers and Philips Remote Control Systems. It's pre-programmed to work with most TV brands sold in the UK, and has an easy-to-follow programming process.

Philips has licensed its RC6 technology to BSkyB, and the RC6 transmission protocol has been optimised for set-top box use. This version of RC6 will also be used for future IR input devices, such as wireless keyboards, to cater for interactive services such as those to be provided by BIB.



NEC has introduced what is claimed to be the world's most advanced digital set-top box/TV receiver chip, the μ PD61030, which combines a high-performance, code-efficient 64-bit processor (VR4110), an MPEG transport stream demultiplexer, MPEG A/V decoders and a graphics generator: peripheral support functions include smart card interfaces, IEEE1284 parallel port, I2C interfacing and UARTS. The chip therefore requires only the addition of memory, an appropriate front-end and interface components to provide a digital set-top box system. The μ PD61030 comes in a 304-pin PQF package and can be used with a low-cost, two-layer PCB. Our photograph shows it in an evaluation board that has been designed by NEC Electronics (U.K.) Ltd., which can be reached on 01908 691 133.

Dixons Recognises Union

Dixons has entered into an agreement with the Amalgamated Engineering and Electrical Union (AEEU). It covers some 1,600 technicians and back-up staff employed by Mastercare. Shop staff are not included. The agreement is also limited to the brown goods arm of the company, and includes a no-strike deal. The AEEU estimates that half the engineers at Mastercare are members.

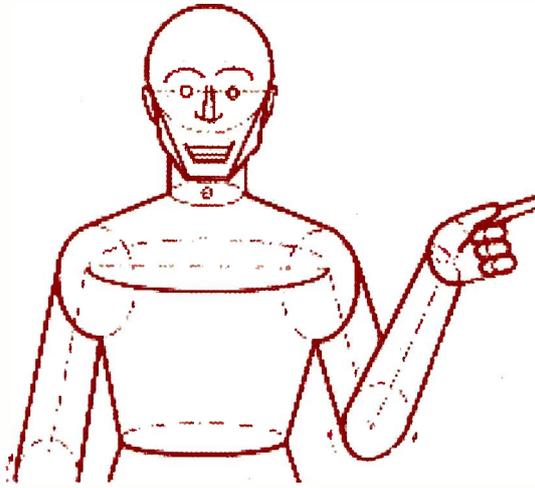
DVD/Video News

Sharp has announced its first DVD player, Model DV650H. Features include digital gamma correction and Super Picture circuits. The latter provides edge detail sharpening. Other features include Dolby Digital and MPEG-2 decoding and Dolby Virtual Surround sound. The AV connectors include component (Y, Cb, Cr) video, S video, composite video out (phono), scart, audio via six phono sockets, stereo headphone and coaxial and optical digital outputs. It is expected to sell at about £500. Sharp forecasts that UK DVD player sales will reach some 30,000 this year rising to 350,000 in 2001.

Dolby says that worldwide sales of DVD players have reached 720,000, with an estimated quarterly growth of 270,000. Dolby Digital processing is a feature of 95 DVD models worldwide.

The DVC digital camcorder format seems to have taken over in Japan, where apparently eight out of ten camcorders sold are now of this type.

Hitachi is to start producing projection TV sets at its Hirwaun plant in South Wales. 34 and 45in. models with Dolby Digital Surround sound will be available from next summer.



Toshiba

Service Briefs

More know-how from Toshiba, based on Technical Bulletins CDH/AH70 Feb/May

TV Sets

Model 2151TB (C4E-R Chassis)

Tuning drift. Will not stop at channels during a search tune. Fine channel tuning is possible, but the channels pull off tune slightly when the channel is changed: The AFT buffer transistor Q106 has collector-emitter leakage. As a result, the AFT voltage at pin 9 of ICA01 is incorrect. Replace Q106, which may be either type 2SC1470S (part no. 23114528) or 2SC1815Y.

Models 2557DB, 2857DB and 3357DB (C5SS Chassis)

RF and AV inputs both produce a ringing (ghosting) effect with distorted verticals and poor colour and contrast: The TC9090N digital comb filter chip QZ01 is faulty. Replace. Part no. is B0410687.

Green smear when the colour is turned up (check with a colour-bar generator): The B - Y signal amplitude is low because capacitor CQ35 at pin 23 of the TA8772AN chip QQ02 (1H DL PCB) has fallen in value. Replace CQ35 (0.47 μ F, 50V).

Models 2557DB, 2857DB and 3357DB (C5SS Chassis), 2577DB, 2877DB and 3377DB (C7SS Chassis)

Distorted sound at power up (sounds like a Dalek). Distortion clears when the set warms up: There is ripple on the audio mute line because the 12V rail that supplies the base of the off-mute transistor Q612 is insufficiently smoothed. The cure is to add a 47 μ F, 25V electrolytic capacitor on the print side of the PCB, with its positive lead connected to the junction of R612 and the anode of D612 and its negative lead connected to chas-

sis. Fig. 1 shows the points at which to make the connections.

Models 2577DB, 2877DB and 3377DB (C7SS Chassis)

Good picture but swirling patterns and no sound: The 8V output from the power supply is inadequately smoothed because C897 is open-circuit. Replace C879 (2,200 μ F, 16V).

Models 28MW7DB, 28MW7DG, 32MW7DB and 32MW7DG (C7SS Chassis)

Very slow channel change. Channel selection can take typically ten seconds or more. Although this is the primary symptom, other effects may be encountered as follows:

- (1) The channel ident, which is obtained from teletext packet 8/30 and is normally displayed at the bottom of the screen, is missing.
- (2) When text is selected, no text is displayed. If the mix mode is selected there is only an L-shaped picture at the left and bottom of the screen with the rest of the picture blacked out.
- (3) The picture has a mosaic effect.
- (4) There is incorrect Fasttext operation.
- (5) There is an oversized OSD display within a normally-sized OSD window.

The cause of all this is a data communication problem between the teletext processor chip and the DRAM on the text module. The cure is to fit service kit part no.

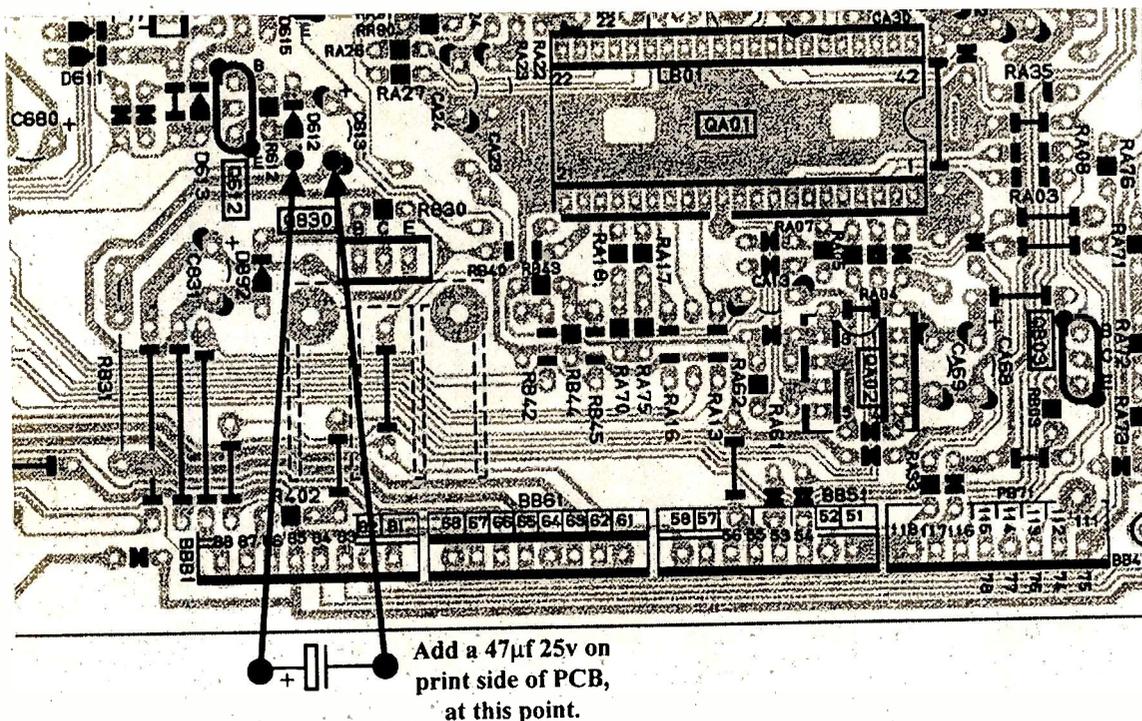


Fig. 1: Where to add extra smoothing (47µF, 25V) in the C55S and C75S chassis.

TCP01421 in the case of Models 28MW7DB and 28MW7DG, or service kit part no. TCP01422 in the case of Models 32MW7DB and 32MW7DG.

Model 32W6DB (C6SS widescreen chassis)

No picture (blank screen), text and OSD both OK: If the video input at pin 15 (VA) of the 100Hz UP converter unit U908A is OK but there is no output at pin 9 (UU), and the external power supplies, timing signals and data/clock bus inputs at the converter are OK, replace the Up converter module. The part no. is 23709123.

Projection TV

Models 48PJ6DB and 55PJ6DB (C6SS Chassis)

Dead with the 2A fuse F807 open-circuit: The STR-S6708 switching device Q803 has an internal short-circuit. When this happens the 6.2V zener diode D854 also goes short-circuit. Replace Q803, part no. 23904247, and D854, part no. A7270200.

Dead with the PRF5000 circuit protector Z889 open-circuit: The LA4282 audio output IC Q601 has failed. Replace Q601, part no. 23318413, and Z889, part no. 23144451. To prevent a repeat failure it is advisable to replace the IC protection diodes D601/2/3/4, all type 1N4148, part no. 23115599.

Right-hand channel is very noisy with TV and AV inputs. Noise does not vary with volume control adjustment and finally mutes the sound: The 2SC2878-A mute transistor Q682 is faulty. Replace. Part no. is A6342206.

VCRs

Model V226B (V3 CAT 1)

Appears to be dead, is actually running in the back-up mode: Power Good 5V supply is missing at pin 5 of the power supply connector BP002 because resistor

RP052 (1kΩ) has gone high in value. Microcontroller chip IT001 runs in the back-up mode when this supply is low or missing, i.e. the 32.768kHz clock is running but the main 16MHz clock is shut down and there's no display. Cure is to replace RP052.

Models V804B, V825B, V854B (V3 CAT 2)

One level meter displays maximum output when a hi-fi recording is being played back: The PNR (Playback Noise Reduction) amplifier in IC920 has a short-circuit decoupling capacitor. This is C928 for the left channel, C929 for the right channel. Both are 10µF, 16V. Replace whichever one is faulty.

Models V856B and V857B (V3 CAT 2)

No E-E or playback video: Check whether the video output signal at pin 11 of the video processor chip IV001 is reaching the buffer transistor TV011. If not, RV011 has gone open-circuit. This is a 100Ω chip resistor, part no. 24872101.

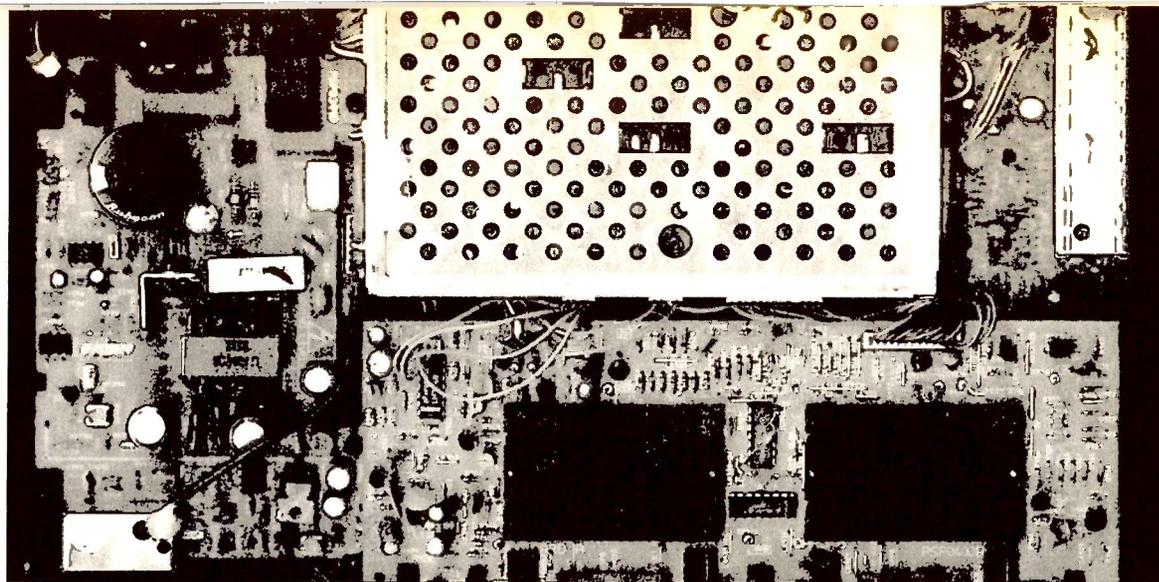
Reverts to standby within seconds of powering up: The 2SC2236-Y 12V regulator transistor TW003 is probably leaky. As TW003 also forms part of the standby switching circuit, the VCR switches back to standby. Replace TW003, part no. A6325549.

Clock Crystal

An alternative 27MHz teletext clock crystal is being supplied by Toshiba, under part no. 23153472. It's a replacement for the crystal used in many models, with the component reference number XT01 or ZF01 and part number 23153012, 23153457 or 23153472. The new crystal comes with a 10pF capacitor which replaces CT02 (crystal XT01) or CF16 (crystal ZF01).

Technical Information

Version 2 of the Toshiba Technical Data Disc, part no. TTDD98, is now available from Toshiba Spares, Units 6/7 Admiralty Way, Camberley GU14 3DT at £8. Version 2 of the Toshiba Technical Repair Book, part no. TTRD98, is available at £6.



Satellite Notebook

**Reports from
Hugh Cocks
and
Chris Watton**

Motorised Dish Problem

A Pace MSS508IP receiver-positioner that was connected to a fairly ancient 3m Channel Master dish via an 18in. motor arm would intermittently display "dish error" while the dish was moving between two satellite positions. Once the message appeared, the dish would no longer move until a new channel had been selected at the receiver.

The unit had been replaced a couple of years previously and was quite quiet in operation. A sure sign that oiling is required is when loud noises come from the arm, more often than not when the dish is being moved a fair distance between two satellites spaced far apart. Such noises are guaranteed to annoy the neighbours, but in this case the dish was way out in a field at the back of the house, well away from the neighbours.

A reed switch was used as the sensor, connected in the positioner circuit to indicate that the dish is in motion. It's adjacent to a rotating magnetic disc which is driven by the actuator's gearbox. When the motor is turning, the reed switch should open and close. In this case the reed switch was faulty. Moving it fractionally nearer to the magnetic disc helped a little, but it subsequently refused to work.

The easiest way to test a reed switch is to connect a multimeter set to the low-resistance range to the wires that are normally connected to the receiver's pulse input, then move the motor east or west. The meter should 'kick' (an analogue meter is best for this test) as the motor moves and the reed switch opens and closes. When the switch stops working, it will stick in either the open or shut position.

Some receiver-positioners don't

like driving the motor when no pulse feedback is present, though they can usually be persuaded to do so in the 'set-motor limit' mode. Take great care during this test. If the dish's mechanical limit switches have not been set correctly there is nothing to stop the arm at the two ends of its travel. This could lead to a bent arm or dish or, at worst, both.

Be careful not to confuse the reed switch and motor wires. If the reed switch is connected across the motor supply it will certainly not work afterwards!

Older systems used a ten-turn wirewound potentiometer as the sensor. This method fell out of favour some years back, mainly because of the inevitable corrosion in the potentiometer case, leading to intermittent wiper contact.

Manufacturers of motor actuator arms often stick a label on the unit to warn that the motor must be mounted uppermost - there's a drain hole at the bottom of the case to let out any water. H.C.

Switch-on Channel

When they phone us some customers have trouble describing the problem with their satellite receiver. For some years, since the introduction of the PRD series, all Pace receivers can be forced to switch to a designated channel when mains power is reapplied after a power cut. This can make it easier to understand what the problem is. Wherever possible with our installations and repairs we force the receiver to switch on with Sky News, usually on programme position one. If a strange fault appears to be present, we ask the customer to unplug the receiver, plug it in again and report back on what he

sees. Sometimes Sky News appears and the problem has been solved. If not, at least we have a clearer idea about what's happening.

Programming MSS series receivers is fairly straightforward. If you have a Pace Link PC programming system it's easily done by going into the "global options" menu and selecting the appropriate switch-on number. Direct programming of PRD models with the remote control unit is a little tricky. Proceed as follows.

Press the function (F) button followed by Recall in quick succession. At this point the receiver shouldn't return to the channel it was previously on (this is the normal recall function of course). Quite often a receiver seems to have a problem obeying this command, so keep the buttons depressed a little longer than for normal channel changing and keep trying until the receiver remains on channel.

Once this has been done press the P- button on the remote control unit (top left) and enter the number of the channel you wish the receiver to select at switch on. A message, "Press Store to confirm", should then be displayed in the middle of the screen. Once store has been pressed, "enabled" will be displayed. Remove then reapply mains power to test that the switch-on works correctly.

To remove the auto switch-on facility, repeat the procedure described above (remember to enter the correct channel number!), the only difference being that the final message will be "disabled" instead of "enabled".

You may find that the receiver is somewhat reluctant to be programmed in this way. Several

attempts may be required for success. Remember the button sequence: F, Recall, P - then two numbers (message appears) and finally Store. H.C.

Scrambled Pictures

Mr Goodfellow owns a Pace MSS138 receiver that's connected to an external VideoCrypt decoder. This model is similar to the MSS100, but doesn't have the internal decoder. He was having some very unusual problems when trying to watch certain videocassettes. For some reason they were "full of lines", though the sound was OK. Other tapes played back perfectly.

The Panasonic VCR was connected via a scart lead to the MSS138 receiver's video scart socket. It could thus record satellite pictures on AV. Playback was via the same scart lead to the MSS138, which was connected to the TV set via its TV scart socket. As the decoder was connected to the MSS138's third scart socket, and the hi-fi to the phono sockets, the receiver's rear panel was full to capacity. Connected in this manner, the

VCR would override satellite pictures when playing a tape, the MSS138 acting as a scart switching box. This is where the problem lay.

The VideoCrypt decoder also 'saw' the tape. Unfortunately all the programmes taped from Sky included the VideoCrypt scrambling information at the top of the picture. The decoder was reacting to this information, which is not affected by the unscrambling process. It thus thought that it had to unscramble the off-tape image, thereby turning it into scrambled lines! An instant diagnosis is simply to disconnect the decoder from the receiver. This is the same system that VH1 (Germany) uses to prevent VideoCrypt-decoder equipped UK viewers watching its Astra signal!

The cure is straightforward: disconnect pin 8 of the decoder scart lead. This stops the decoder's automatic switching facility triggering the receiver's switching circuitry. As a result, all VideoCrypt channels had to be altered to "Dec V" in their set-up menus, to route video into the decoder ("Dec AV" could be used, but external sound switch-

ing isn't required with VideoCrypt). This is rather a tedious business, but had to be done only once - it was then added to the Pace Link PC memory, in a file for MSS138s with an external decoder.

I keep four different channel-setting files for this model: German Astra channels first, with menus in German; VideoCrypt Sky channels with an external decoder; non-scrambled English-speaking TV and radio channels first; and finally a Eutelsat 13°E file. We have several of these receivers out on rental: they sometimes require a change of 'personality' depending on the customer's nationality! H.C.

Amstrad SRD400

The customer complained that the terrestrial TV picture became snowy when he switched his satellite receiver on, and that the satellite channels didn't produce any pictures. A check on the switched and unswitched 12V supplies showed us why. The latter was at 8V. Both rails were at 5V when the receiver was switched on. The cause of the problem was CP03 (4,700µF). C.W.

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Low-cost Digital Satellite Receiver Design

Chris Carter explains the operations that have to be carried out in a digital satellite TV receiver and the way in which the current STMicroelectronics chip set handles them

Without compression, a broadcast-quality digital TV signal would need over 200Mbits/sec to transmit. This would call for a bandwidth many times that of the initial analogue video signal. So compression is essential, and the standard chosen is MPEG-2 – named after the Motion Picture Expert Group that defined the specification. MPEG-2 uses both spatial and temporal compression to reduce the data rate required to 4-8Mbits/sec (16Mbits/sec maximum), with only a minimal loss of quality. Spatial compression removes redundant information within a field: temporal compression avoids unnecessary repetition of information between one field and the next – in practice between a series of fields.

For temporal compression, three types of frame are used, intra (I), predicted (P) and bi-directional (B). I frames are subjected to spatial compression only, using techniques similar to those employed in JPEG compression for still images. P frames are compressed likewise, but first a prediction based on the previous I frame is subtracted so that only the much smaller difference between the frame and the previous I frame need be compressed. B frames are similar to P frames, but the prediction is based on a combination of previous I and P frames, giving a further data reduction. The frames are arranged in groups of twelve: each group starts with an I frame, the following sequence consisting of three P frames and eight B frames (the full sequence is I B B P B B P B B P B B).

Satellite transponder bandwidths are typically within the range 26-54MHz, giving useful bit rates in the range 20-60Mbits/sec, see Table 1. Thus with compression a single transponder can transmit 4-10 digital channels (compared with only one using analogue transmission). The satellite operator, broadcaster and viewer all benefit. Services such as near video on demand (NVOD) can be offered. NVOD works by transmitting the same programme on several digital channels with the start times staggered by say twenty minutes. For example a two-

hour film could be broadcast on six channels at twenty-minute intervals, so that on average the viewer is no more than ten minutes from the start of the next broadcast.

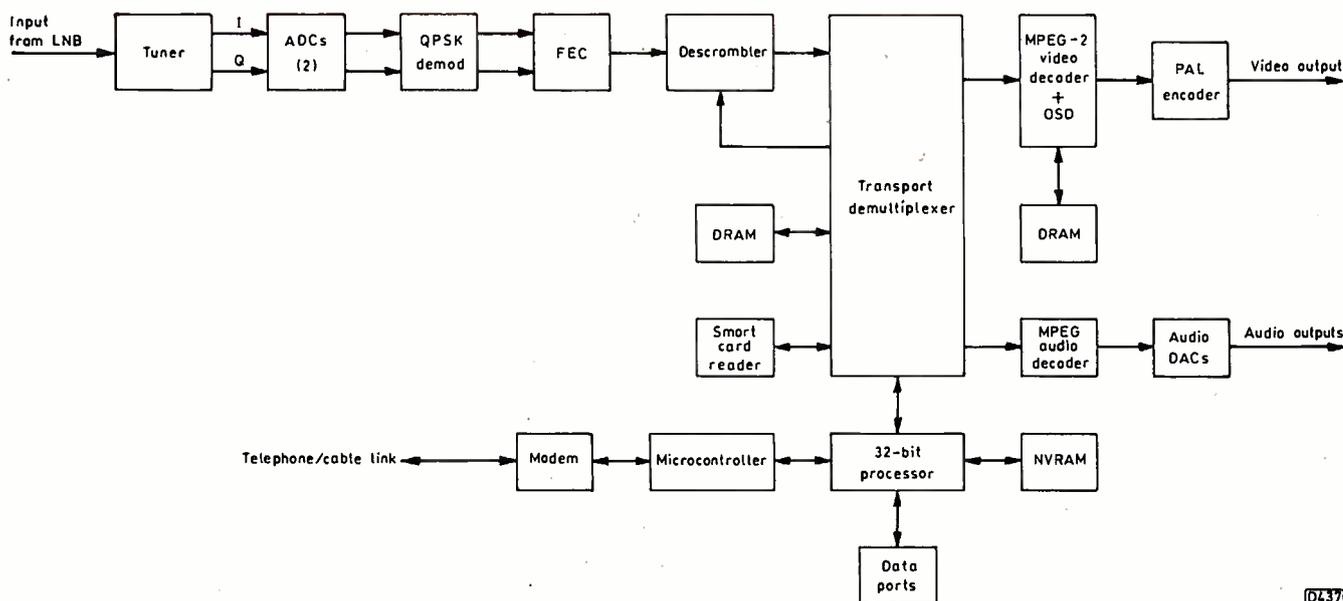
Transmission equipment manufacturers, receiver manufacturers and service providers have obviously had to adopt systems that work together. A considerable amount of work went into developing standards for the whole digital satellite system, not just the compression part. The majority of systems around the world now conform to the European Digital Video Broadcast (DVB) specification, which covers most requirements.

Receiver Block Diagram

Fig. 1 shows the basic building blocks required in a typical digital satellite receiver. European digital satellite TV signals are normally transmitted in the Ku band range 10.7-12.75GHz, using QPSK modulation. The LNB at the dish downconverts the signals to an IF band of around 1-2GHz for feeding to the tuner, which selects the required channel and produces baseband outputs in separated I and Q (In phase and in Quadrature with the carrier) form. Because, with QPSK modulation, the transmitted signal is in analogue form, analogue/digital conversion is next required to produce suitable data streams for digital demodulation.

The QPSK symbol rates are anywhere from 3-7Msymbols/sec when the transponder is being used for a single channel (SCPC – single channel per carrier) to more than 30Msymbols/sec when the transponder is being used to transmit several channels (MCPC – multiple channels per carrier).

The raw data streams (I and Q) obtained from the demodulator will have errors introduced by noise. This is anticipated and catered for at the transmitter by adding forward error correction (FEC) data to the original data stream. The process involves Reed-Solomon and convolutional encoding, the result providing robust protection from such errors. Signal recovery in the



0237

Fig. 1: Block diagram showing the basic operations that have to be carried out in a digital satellite TV set-top box.

receiver is carried out by an FEC circuit that performs the required Viterbi decoding, de-interleaving and Reed-Solomon decoding. The result is a clean bit stream that contains the service data. It's called the transport stream, as it 'transports' the video, audio and other information.

With a pay-TV service the transport stream will be scrambled. So some hardware, i.e. a descrambler, and some software are required to make the data usable. Authorisation is normally carried out by interaction with a smart card that contains data to identify the user and enable charges to be levied. This can be done with a prepaid card, or the set-top box may contact a subscriber management centre for authorisation via a low-speed (e.g. 1.2kbits/sec) modem with the smart card to identify the viewer. This, together with the infrastructure required at the transmission end and the subscriber management centre, is referred to as the conditional access (CA) system.

The DVB standards specify the descrambler hardware and a mechanism for transmitting CA data, but they do not specify how these are to be used together. This is at the discretion of the CA provider.

All this activity requires software to run in the box. For this, and other functions that will be covered later, a powerful (normally 32-bit) microprocessor is required.

We have seen that the transport stream contains video, audio and other data. As each bit stream can contain

data for several channels, there may be several independent video, audio and data streams within one transport stream. To enable these to be identified and separated, the different streams of data relating to different channels are put into 'packets'. Each packet is labelled with a header that contains a Packet Identifier (PID). This enables the channel to which a packet belongs to be identified. With a TV transmission, the transport demultiplexer uses the PIDs to separate and pass on the video and audio packets for the channel the viewer has selected. With digital radio, only the relevant audio packets are demultiplexed.

The video and audio packets obtained in this way then have to be decompressed for display. MPEG video and audio decoders are required for this purpose. The decoded video must then be PAL encoded so that it can be displayed by a standard TV set. To ensure that the video and audio are synchronised, software in the main processor checks the time stamps that are sent with each data packet and makes sure that the outputs are correctly aligned.

To enable the set-top box to know which PIDs relate to which channel, Service Information (SI) data is also transmitted as part of the transport stream. This data includes information on which transponder handles which channel. The software in the box can thus tell the tuner which transponder to select. In this way, and using other data transmitted at the discretion of the service

Table 1: Useful bit rate versus transponder bandwidth.

Transponder bandwidth (MHz)	Symbol rate (Msymbols/sec)	Useful bit rate (Mbits/s)				
		1/2 conv	2/3 conv	3/4 conv	5/6 conv	7/8 conv
54	42.5	39.2	52.2	58.8	65.3	68.5
46	36.2	33.4	44.5	50	55.6	58.4
40	31.5	29	38.7	43.5	48.4	50.8
36	28.3	26.1	34.8	39.1	43.5	45.6
33	26	24	31.9	35.9	39.9	41.9
30	23.6	21.7	29	32.6	36.2	38.1
27	21.3	19.6	26.2	29.4	32.7	34.4
26	20.5	18.9	25.2	28.3	31.5	33.1

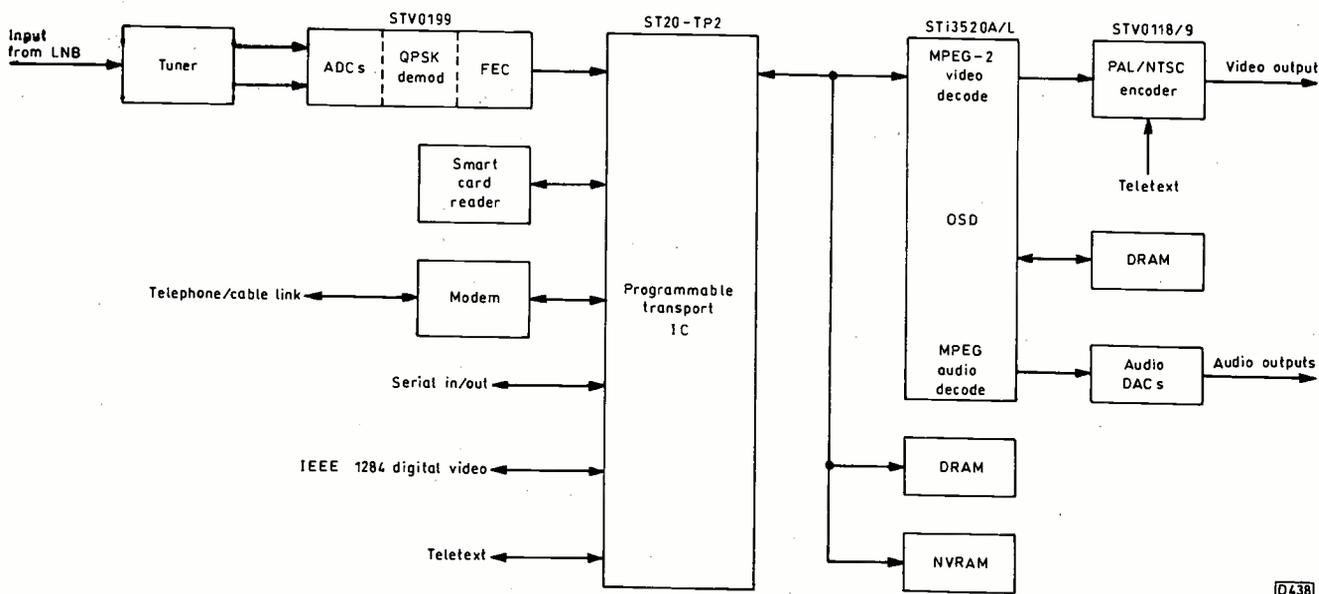


Fig. 2: Block diagram showing the way in which the current STMicroelectronics chip set handles digital satellite TV signal processing.

provider, a more or less sophisticated set-top box user interface can be arranged. If the service is scrambled, this user interface also has to handle the conditional access requirement.

The User Interface

Initially, user interfaces consisted of basic graphics and text. Some service providers consider the way in which the user interacts with the box to be part of the overall service however. So there is a trend for providers to insist on more sophisticated graphics. In some cases they have taken on the responsibility of defining how the user should interact and what is displayed.

One way for a service provider to do this without having to write the whole software for the set-top box is to specify an Application Programming Interface (API), a software layer that the box manufacturer must provide in his products. The API is integrated with the service provider's application software before the box is approved for sale. Examples of such APIs are MediaHighway from Canal Plus and OpenTV from Thomson-Sun Interactive (TSI).

An on-screen display (OSD) capability is required to generate the graphics. Various options are possible, depending on the amount of memory available in the box – higher colour depths and multiple display planes require extra storage. Most current receivers use four bits per pixel resolution (from a large palette of colours) with three graphics planes (video, graphics and text). There is a trend towards eight bits per pixel however, and extra graphics planes, e.g. for showing bit-mapped images such as icons and advertising stills.

Better graphics are required only in set-top boxes that provide a high level of interactivity. In such a case the modem can, in addition to providing viewer authorisation for specific programmes, also be used as a back-channel for requesting non-broadcast data. In the case of home shopping for example, the viewer might want information on a specific product. A higher-speed modem is required for such applications.

Design Solutions

Low-cost silicon chips are required for the production of digital satellite set-top boxes at a price viewers will be

prepared to pay. STMicroelectronics (previously known as SGS-Thomson Microelectronics) has developed suitable chip sets which are already in production. Fig. 2 shows the current STMicroelectronics solution for a digital satellite set-top box. It consists of four ICs that carry out all the functions previously described and have been designed to work together.

The STV0199 is an integrated digital receiver that incorporates two A/D converters, a QPSK demodulator and FEC circuitry in a single low-power package. As it can handle data rates from 2-45Msymbols/sec it can be used for either SCPC or MCPC transmissions with a single tuner.

Because of its high level of integration, the ST20-TP2 programmable transport IC replaces several ICs in previous set-top box designs. It combines a 50MHz, 32-bit microprocessor (ST20) with the transport demultiplexer function and all the peripherals required in most satellite set-top boxes. Its main blocks are as follows: (1) An ST20 microprocessor that carries out demultiplexing and runs the system software. (2) A dedicated interface to the STV0199 QPSK receiver chip. (3) Dedicated memory space for connection with an STI3520A MPEG decoder, so that the selected video and audio packets can be fed out with minimum processor overhead. (4) A DVB descrambler – for conditional access systems that use standard descrambling. (5) ISO-compliant smart-card interfaces for conditional access and other services. (6) PWM outputs for synchronising the system clock with the source encoder clock. (7) A teletext interface to allow for teletext reinsertion in the vertical blanking interval, using the STV0118/9. (8) An IEEE 1284 interface – the DVB standard parallel interface. (9) UARTs implementing RS232 interfaces, low-speed data ports etc. (10) I2C for control of peripherals such as the ST0118/9, the ST0199 and EEPROMs. (11) Parallel input/output for other control requirements.

The STI3520A combines an MPEG-2 MP@ML video decoder and an MPEG audio decoder in a single chip. In other MPEG decoders three frame stores are required to decompress the video bit stream, one each for the current I and P frames and one for the display. With a PAL picture this calls for just over 16Mbits of memory. To avoid the need for an extra DRAM with each decoder,

the STi3520A incorporates lossless memory usage optimisation to fit PAL in 16Mbits, thus saving set-top box cost. The STi3520A also incorporates an on-screen display generator that can provide up to sixteen colours (four bits per pixel) from a palette of 16k colours in each region defined on the screen.

The STi3520A has become a de facto standard MPEG-2 decoder worldwide. For higher-end applications the STi3520L version, with eight bits per pixel of graphics resolution and provision for an extra bit-mapped graphics plane, is available.

The STV0118 is a video encoder able to provide PAL or NTSC outputs in all common formats as well as RGB, composite video and S-VHS outputs. It can also perform closed-caption, CGMS or teletext encoding, and includes several unique features such as line skipping/insertion to reduce the amount of external circuitry required. The STV0119 version includes provision for the widely-used Macrovision anti-taping system.

Other Digital TV Transmissions

Cable and terrestrial transmission are the two main alternatives to satellite services.

Cable has the advantage of providing two-way communication: the user can send requests and receive data on demand. In the short-term this is likely to be internet data or dedicated services such as home shopping or banking. This requires a large infrastructure investment, as the cable network has to provide switching and expensive servers are required to store data. Transmission is normally QAM, with QPSK for the return channel.

Telecom companies already have a switching network and connections to homes. For them low bandwidth is the problem, as the connections were originally installed for voice telephony only. Their problem is to find a low-cost way of re-using this slow connection for video transmission. Asymmetric Digital Subscriber Loop (ADSL) technology solves the problem, but expensive servers are still required if true on-demand services are to be made available.

Terrestrial transmission uses the same broadcast frequencies as current analogue TV services. Digital compression enables more channels to be broadcast in the same spectrum space, or alternatively the same number of channels can be broadcast with higher definition (HDTV). The modulation technique to be used in Europe for digital terrestrial TV is Orthogonal Frequency Division Multiplexing (OFDM).

With all these transmission schemes, except HDTV which requires a higher-performance MPEG-2 decoder, the processing of the bit stream once it has been demodulated is much the same – transport demultiplexing, MPEG video/audio decoding and display, generation of a user interface, etc. So the processing and silicon required are the same in each case.

Next Generation

There are at present two trends in set-top box design. One is cost reduction, which will be achieved mainly through a higher degree of integration on the silicon. The other is for designs that incorporate provision for the alternative forms of transmission mentioned above.

With respect to integration, STMicroelectronics has recently announced the availability of its One-chip Multimedia EnGine Architecture (OMEGA) ICs. These integrate on a single chip an ST20 microprocessor with its associated functions, an MPEG video/audio decoder and a PAL/NTSC encoder. The first member of this family of devices is the STi5500, which is a single-chip

set-top box back-end (post demodulation) IC suitable for satellite, cable and terrestrial use.

It is interesting that this combination of a processor, MPEG decoder and video encoder is the same as that required in a DVD player. So, with different software, the STi5500 can also be used for DVDs.

The level of integration in the STi5500 produces cost reduction not only because of the lower device count but also because less memory is required. The OMEGA family uses a patented memory-reduction technique that saves more than 4Mbits of the DRAM required for video decoding. As the MPEG decoder and microprocessor in the STi5500 can share memory, the freed capacity can be re-used by the processor to optimise overall memory use. Performance is also improved, as the bus between the processor and the MPEG-2 video decoder is wider than is possible using two separate devices.

The other trend requires new devices for the front-end section of a set-top box. STMicroelectronics already has the STV0197 for cable use and is about to announce an OFDM chip. For services that use the existing telephony structure, the company has a chip set for ADSL.

STMicroelectronics is to introduce new devices to provide market diversification. They are to be based on the same technology, providing long-term design security.

Acknowledgement

The above article is an edited version of a paper presented by Chris Carter at the recent Cable and Satellite '98 Show.

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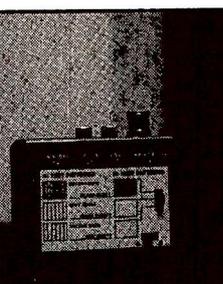
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Astra's digital network control centre in Luxembourg will be at the centre of the digital satellite TV revolution.



Cable & Satellite '98

This year's Show featured many digital TV products and systems. Two mini shows, Digital Terrestrial Television (DTT) and iTV (interactive TV) ran alongside the main show. George Cole was there to report for us

This year's show was again held at Earl's Court 2, in late May. The emphasis, with UK services due to start later this year, was naturally on digital TV. France, Germany, Italy and Spain have had digital TV for some time. The UK is now gearing up for its first services, from BSkyB and BDB.

BSkyB

BSkyB had a large stand that included a vast demonstration area. Most of the things on show, such as the Electronic Programme Guide (EPG), had already been seen at the *Electrical Retailing* Show earlier in the year. This time however the four digital satellite set-top boxes (called Digiboxes) that the manufacturers selected by BSkyB – Amstrad, Grundig/Hyundai, Pace and Panasonic – will be producing were on show. My favourite was Amstrad's box, which has a smart silver/grey fascia. Although the boxes look different, they all have the same basic specification. This includes 4Mbytes of DRAM, 4Mbytes of flash memory (a form of EEPROM) and a TP2 processor.

The Application Program Interface (API) is the computer instruction system that the set-top box understands. BSkyB's box uses a version of Open TV. The boxes also provide Dolby Pro-Logic (but not Dolby Digital) sound. Software upgrades will be delivered by

satellite downloading – the software for British Interactive Broadcasting's interactive services will also be provided in this way.

The list of developers will give you an idea of the complexity of the box. STMicroelectronics (previously SGS Thomson Microelectronics) has developed the key ICs and supporting software; Open TV Inc. has developed the operating system software and API; NDS has developed the EPG application software; Oracle has developed the BIB interface software. This helps to explain why the boxes will cost some £400 to manufacture – their subsidised price is to be about half this figure.

The Digiboxes also use the same universal remote control unit, which has been developed by Philips (see Teletopics). It also controls many TV sets. This is a good idea, since it means that shop staff need to learn how to use just one handset to control all four digital receivers. The handset has been designed to suit both right- and left-handed users (as a left-hander I thoroughly approve of this!). The unit will be used for a wide range of operations, including EPG navigation, ordering pay-per-view events and the use of interactive services.

There was also a chance to see the new digital dish. It's an elliptical design with a maximum 53cm diame-

ter. Cambridge and Grundig will be manufacturing the LNBs.

By the time you read this more information on programming and charges should have been released. At the show it was suggested that BSkyB will be offering a series of subscription packages, including a low-cost one at about £6-£8 a month.

Astra

Astra Marketing also had a large stand, and was showing digital TV from various countries including France, Germany and Spain. There were also transmissions from Astra 1D at 28.2°E. The Astra 2A satellite was due to be placed in orbit at this position late last year, but because of technical problems the launch has been postponed to this autumn.

The Astra-Net system was being demonstrated. This delivers data and internet information to PCs at high speed. The company was also pushing its "disappearing dish" campaign, to get through to consumers that a satellite dish can often be located in a discreet location and camouflaged.

Eutelsat

Although not as well known in the UK as Astra, Eutelsat's satellites deliver TV services to over 65m homes across Europe. The Hot Bird satellites at 13°E provide a mixture of analogue and digital TV channels.

A new service, Convergence1, was being demonstrated. It delivers digital TV, the internet and multimedia services via satellite. Tests are currently being conducted using transponder 74 aboard Hot Bird 3. The data rate is high – up to 40Mbits/sec. A pilot service has been started in the UK: it also involves BT Broadcast Services and the internet service provider Easynet.

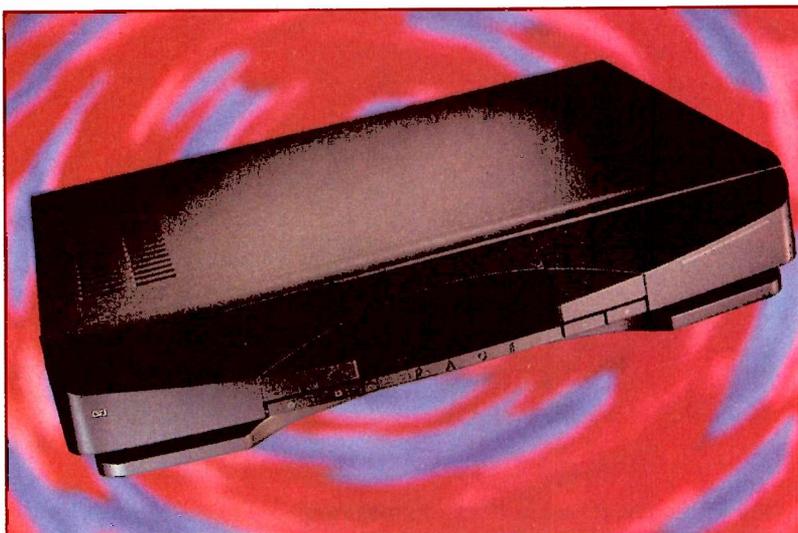
To use Convergence1 you need a Digital Video Broadcasting (DVB) compliant satellite set-top box, a dish and a PC equipped with a special card. Convergence1 uses the DVB standard to deliver a mixture of digital TV, internet and multimedia services within the same multiplex. At present the TV pictures are delivered to the set-top box and the data to the PC, but according to Eutelsat both services will in future be delivered to either a TV set or a PC.

Eutelsat is also testing a system called Skyplex. It will provide satellite multiplexing of digital TV, radio and multimedia material. The conventional way of 'bundling' such signals is to send them to a ground-based, centralised multiplexing facility then uplink them to a satellite. With Skyplex, signals can be uplinked from a number of locations then bundled into a single DVB multiplex at the satellite for retransmission to Earth. The Hot Bird 4 satellite can assemble material from up to six uplink carriers, with a net bit rate of 6.3Mbits/sec. The downlink data rate is 38Mbits/sec. Hot Bird 5, to be launched later this year, will be able to handle bit rates as low as 350kbits/sec, using time-division multiplex techniques.

Set-top Boxes

The Pace stand was full of set-top boxes, including those for BSkyB and BDB. There was also a WebTV box – this is a system that brings the internet to the TV screen. The system is owned by Microsoft and has some 300,000 users in the USA. A UK trial is planned, involving BT.

The "WorldBox" that was on show has been developed for News Corporation, which has a forty per cent stake in BSkyB. It is to be launched later this year for

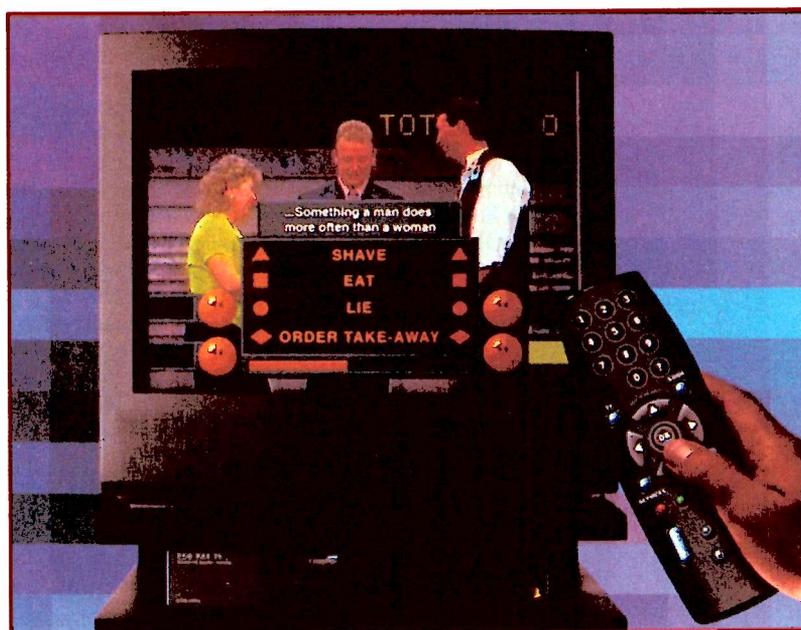


The Pace BSkyB digital set-top box.

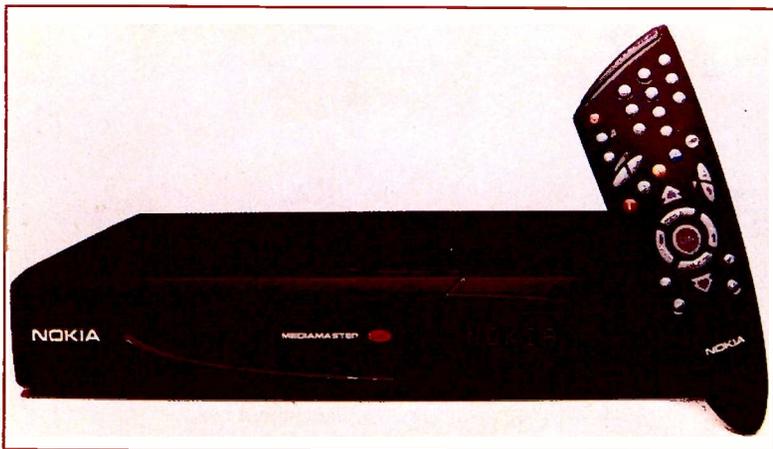
use by Sky broadcasting operations in Mexico and North America. The set-top boxes will have slightly differently-configured software in each country.

The analogue satellite set-top box display included models in the MSS100 and MSS1000 ranges. Andrew Wallace, Pace's marketing manager, said that analogue TV will continue to be an important part of the company's business.

He also had some interesting things to say about interoperability between the BSkyB and BDB set-top boxes. The present plan is that users of BDB boxes will be able to receive digital satellite transmissions via an optional "side car". According to Andrew Wallace this might not be the best solution, as the side car will be large, expensive and will require its own power supply. He felt that it would be better to opt for a separate digital satellite box or invest in an integrated digital TV (IDTV) receiver that could be fitted with a modular upgrade. These views were shared by a number of manufacturers at the show.



A Two Way TV interactive display. Screen shot reproduced by kind permission of Carlton Television Ltd.



One of the latest Nokia Mediamaster range of digital set-top boxes, with remote control unit.

Nokia Multimedia Network Terminals had a number of digital set-top boxes on show, including the 9850T which has been built to BDB's specifications. It was a working prototype, as some of the finer points in the specification were still being ironed out. The preliminary specification includes an MPEG-2 video decoder that can handle data rates of up to 15Mbits/sec and offers 4:3 and 16:9 displays. Its audio decoder conforms to the MPEG-2 standard and offers mono, dual channel, stereo and joint stereo sound. The box has a 32-bit RISC processor, 2MBytes of RAM, 4Mbytes of SDRAM for the video/graphics and 4Mbytes of flash memory. The input frequency range is 470-862MHz and the bandwidth 8MHz. AV connectors include an RF loop-through, twin scart sockets, two phono sockets for analogue audio and one to provide a digital output. There's also a 9-pin serial data connector and a telephone socket. For conditional access the 9850T has a smart-card reader. It also has a common interface connector. As with its BSKyB decoder, software upgrades can be sent over the air.

Nokia's second-generation free-to-air digital satellite set-top box, Model 9800S, has a new EPG that enables each viewer to create a favourite channels list or select groups of channels by theme or genre, such as films. It will be launched this autumn.

To show that analogue is not dead, Nokia demonstrated a switching system for use with analogue and digital satellite receivers. The Smart Priority Switch enables viewers to switch between two receivers fed from a single dish. If both receivers are switched on, priority is given to the analogue receiver.

There was a special Nokia presentation hosted by president Heikki Koskinen and Helmut Stein, who is senior vice-president of new technologies and operations. Mr Koskinen highlighted the problems of developing an IDTV receiver, as there are more than a hundred possibilities. These include aspect ratio (4:3 and 16:9), screen size, projection technology (front or rear) and resolution (standard or high).

Helmut Stein believes that internet pages delivered via the DVB system will become an important part of TV reception. He foresees a time when viewers will be able to select internet pages from a carousel of the five hundred or so most interesting web pages. Since set-top boxes will be addressable via a conditional access system, viewers could use their remote control unit to call up specific pages, with the telephone line as the back-channel to the broadcaster.

According to Helmut Stein the next generation of set-top boxes will use single-board chassis and have an expansible amount of DRAM up to 24Mbytes. He talked about the problem of creating a standard API for set-top boxes. The current multitude of APIs means that we have what he calls an "electronic Babel". There is MHEG-5 (Multimedia and Hypermedia Information Coding Expert Group), which has been selected by the UK Digital TV Group for DTT broadcasting, and Open TV which is to be used by BSKyB. Others include Java from Sun Microsystems and Windows CE from Microsoft. It's certainly a confusing business.

At the Grundig stand there was a working BSKyB decoder and a non-working BDB decoder.

Digital Terrestrial TV

The Digital Network, which includes all the major broadcasters that are involved with DTT, had a large stand. Live DTT broadcasts from the Crystal Palace transmitter were being displayed using a 16:9 Sony TV set. There were DTT boxes on show from manufacturers including Grundig, Nokia, Pace, Sony and Toshiba – but the Philips space was empty. It was clear that none of the boxes had reached the final production stage. In fact one or two of them looked like mock-ups. There was a DTT decoder on the Thomson stand.

Interactive TV

The Two Way TV company developed an interactive TV system some years ago. It transmits text and graphics, which can be superimposed on a TV picture like teletext, during the vertical blanking interval. The idea is that viewers can participate in live or recorded programmes by answering multiple-choice questions on the TV screen. Answers are given by pressing a button on a special remote control handset. Two Way held an interactive trial in the Central TV area a few years ago. By all accounts it went fairly well.

Two Way TV was originally a proprietary system, but with the arrival of digital TV the company has decided to reposition itself. It is now offering the system to digital satellite, terrestrial and cable broadcasters.

The company has also developed "Puck", which is a cross between a remote control handset and a wireless computer mouse that can be used to navigate around a TV screen. Two Way says that as TV screens begin to resemble computer displays, viewers will need a simple-to-use device. Apparently a number of companies have expressed interest in the Puck.

Another company that has repositioned itself is Acorn Group. It has much experience of interactive TV, having developed interactive set-top boxes and run a large iTV trial in Cambridge.

Acorn is now offering the acTiVe range of digital technologies, which includes a powerful Strongarm 1500 processor that can decode MPEG using software. A second stream can also be decoded. Andy Mee, Acorn's vice-president of marketing and development, says that this feature could be used to provide a more flexible digital TV recording system – like satellite TV users, digital TV viewers will be able to record only the channel the set-top box is tuned to.

In Conclusion

The message from the broadcasters and manufacturers at CabSat '98 was that digital TV is coming. In many ways this is the easiest bit – the trade has now to convince the public that digital TV is worth the investment.



Reports from
David C. Woodnott

Electrolytics

The extremely useful **Capacitor Wizard** was reviewed in these pages recently (June). One of them now has a permanent place on my workbench. I agree with all that was said in the review, but would like to add a note on its use.

Anyone who is familiar with the Camcorner page will realise that I have to replace a lot of electrolytic capacitors, especially the small types used in the Canon E60 range etc. When using the Wizard to check these capacitors the readings obtained could lead to misunderstanding. The Wizard's display is divided into three sections, Good, Compare and Bad. The instructions supplied emphasise that a degree of judgement is required in interpreting readings in the Compare area. This is fine. But note that these small electrolytics show up as Bad even when new! I checked several dozen from a reel. All measured Bad but were perfectly OK. A really bad capacitor of this type (10µF, 16V) won't even move the pointer off the end stop!

So beware of misinterpreting the readout. Always compare and everything will be OK. It's a truly excellent and much-needed piece of equipment.

Sony CCDTR805E

Intermittent operation was the complaint with this Hi-8 unit. On test everything at first seemed to be OK, but after a while the unit powered down. It wouldn't switch on again

Camcorner

until the supply had been removed then reapplied.

When it was working again (in the play mode) I noticed that if the bench power supply's output voltage was slightly altered – by only about 1V from nominal – there were picture disturbances. These took the form of horizontal bands that moved in the background of the picture, or white spots that covered it completely. I also noticed – nothing much gets by me! – that the unit didn't always power down correctly. Even when the supply voltage was reduced below the nominal cut-off level, to about 4.5V, it would still hang on.

The cause of the trouble was a faulty MC141600FU DC-DC driver chip, IC231, in the power supply. When a replacement has been fitted the unit needs to be set up correctly as per the manual.

The chip is used in various models and is suspect whenever this type of fault occurs.

Sony GVS50E (Video Walkman)

This particular unit is used as part of a mobile surveillance system. It came in for repair because there was no AV input operation. Playback worked correctly via the LCD, and there were AV output signals. But there were no LCD pictures, or monitor pictures via the AV connectors, in the record mode.

The cause of the trouble was failure of circuit protector PS402 on the audio PCB (AU147), on which the AV connectors are fitted. This CP is at the earth connection side of the video input socket. Another CP (PS401) provides similar protection for the audio input. No cause of the failure could be found – it's likely that an incorrectly earthed input had been connected, producing a voltage across the CP.

Samsung VPJ52

Intermittent record colour was the reported symptom. The effect could be readily seen in the E-E mode. Playback of a previous recording was OK. The cause of the trouble was

simply dry-joints on the multipin connector between the camera head and the main PCB.

We've had other intermittent faults caused by these connections. Impact damage is probably the basic cause: the connections are very close to the case internally.

Sony CCDTR350E

No operation was the complaint with this newish Handycam. In fact there was no power up, and an inspection revealed that circuit protector PS901 was open-circuit. As no shorts could be found, a replacement was fitted. The unit was then switched on.

A check on the various outputs from the power supply showed that they were all missing. The DC-DC driver chip IC901 was suspect and was replaced, curing the fault.

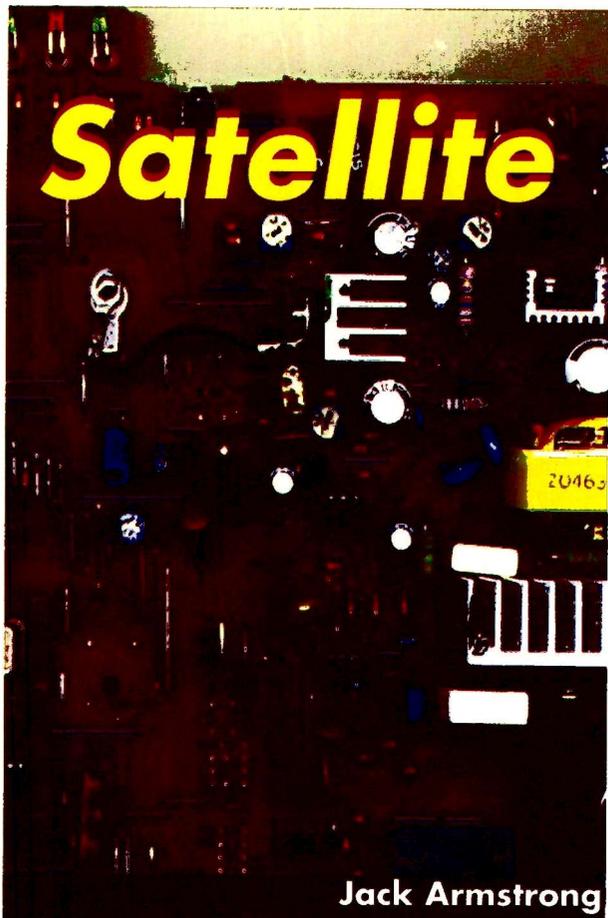
With all functions now working, the final step was to set up the power supply circuits as laid down in the manual.

Sanyo VMEX280P

We recently replaced the complete lens assembly in one of these camcorders because the iris vanes had become contaminated with oil that had leaked from the motor unit. As cleaning is seldom successful, and the iris assembly is not available separately, the complete unit usually has to be replaced.

Focusing may not work correctly when a new assembly has been fitted. The unit really needs to be set up, for which operation an interface is required. The EEPROM chip that holds the focus data etc. is mounted on the lens unit on a small, flexible PCB that connects all the sensors and motors etc. to the main PCB. If the old EEPROM is transplanted on to the new lens unit you will probably find that, as in this case, all will be well. There's no servicing information for the components mounted on the lens assembly, so setting up is at best an educated guess!

When we subsequently replaced a lens unit in a similar Sanyo model we found that transplanting the old EEPROM was again successful.



Jack Armstrong

WORKSHOP

Maspro ST8

I don't see many of these receivers, but two arrived in the same week. One displayed a permanent "no signal" message on every channel. The other one was dead.

The "no signal" fault was caused by the tuner module – it's easy when you have two identical receivers to compare! As the importers want a silly price for a replacement, I'm looking for an alternative. The Sharp tuner used in early Pace PRD800 receivers is almost identical, but has three fewer pins and doesn't work in the ST8. If I can't find something, I'll send the faulty tuner to MCES (phone 0161 746 8037) in Manchester for repair.

The dead receiver was repaired using Satkit 25. I ordered it from SatCure's internet site – www.netcentral.co.uk/satcure/

All Greek to Me!

With the seemingly continual changing of Greek and Cypriot channels, some installers have become increasingly confused about how to get as many English and Greek stations as possible. At one point you had to have three separate LNBS on

a 1m dish! At least one station is present in the 'high band' above 12GHz.

An installer brought me his problem. He'd been using a universal LNB, an enhanced LNB and a standard LNB, with a Global ADX and a Global tone inserter. Please don't ask me how it all worked! But after several satisfactory installations one, at our local chip shop, didn't work. The 22kHz tone switch wouldn't let the tone through to switch the universal LNB to high-band operation.

After a number of phone calls we discovered that a 22kHz switch, unless otherwise ordered, prevents the tone going through to the LNB – except for a few that might have left the factory with bad connections to the relevant capacitor. This particular installer had apparently been using faulty units until now. His new batch wasn't faulty – but no longer worked as far as he was concerned.

Anyway, this is the answer. If you want the 22kHz tone to switch the LNB, open the tone switch metal box and look for the small (and only) capacitor. It hangs over the edge of the board. Simply cut it off. If you don't want the tone to pass, ensure that the capacitor is soldered in place firmly.

My grateful thanks to Mike Hancox of Satellite Scene who solved this problem. If you are Greek and want to watch Greek and Cypriot transmissions, Mike will happily install your system. You can reach him on satscene@onto.co.uk

A Pace SS9000

This old, 60-channel receiver came from a local TV repairer. His fault report said "blank screen with what look like flyback lines on it". When I checked the receiver I found that the picture from the decoder scart connector was OK (but flickering of course). Every other output produced a blank raster. The "flyback lines" occurred because the TV set, without a proper PAL signal, lost sync.

Using my old 20MHz scope, I soon traced the cause of the problem to the video amplifier U21. This is a very unusual condition. It's so

unusual for this chip to fail that I have dozens of them on scrap boards, so finding a replacement was no problem.

Pace D100

"PSU ticking" said the fault report with this D2-MAC decoder. I suspected the electrolytic capacitors in the power supply and, as I didn't want a loud bang when I applied mains power, I checked them all in situ with my Capacitor Wizard.

C142 (22µF), C144 and C145 (both 10µF) all produced ESR readings above 10Ω, which is clearly unacceptable! The large electrolytics on the secondary side of the circuit all produced readings of less than 1Ω, so I left them alone. Once the small electrolytics had been replaced with shiny new 105°C types the decoder produced, in conjunction with my old SS9200 test-bed receiver and with the dish aligned at 0.8° west of south, perfect pictures.

Scart Leads

My mail box always seems to be full of enquiries from readers with picture faults. Many of these problems arise from the use of incorrect scart leads. A scart lead used with an external D2-MAC decoder needs to be as short as possible. It's often a good idea to pay the extra and buy the best lead you can find at a Hi-Fi shop. The video wires should be individually screened.

A scart lead used to connect a satellite receiver to a TV set should have the minimum number of wires possible. A nine-wire lead is usually adequate, but you should disconnect the wire at pin 19 (TV end only) otherwise ghosting or patterning can occur should the TV set send out a signal on that wire.

Pace SS9200

This receiver had the usual symptoms associated with old electrolytic capacitors. When I had replaced all those that come in Relkit-2 it worked all right. Once the receiver had cooled down I tested it again (as you all do, I'm sure) before returning it to the customer. The darned picture was just a mess of coloured

lines! It was a strange effect: looked as if there was a decoder fault, but there wasn't a decoder. It was as if each line had been chopped into two or three sections then shifted left or right (not rotated). It's hard to describe a mess of coloured lines in words.

The effect would clear after a minute or so, but the picture would now and again jump or show horizontal pulling or cogging, like one-dimensional pincushion distortion. These are all signs of sync problems of course. It took a lot of freezer and patience to trace the cause of the fault to C184 (100µF, 16V), which is next to the TEA2029C sync separator chip.

Fidelity SRD750

"Have a look at this?"

The speaker was about seven foot tall. In his huge fingers he held what might have been an Amstrad satellite receiver. I say might have been because the cover showed signs of distortion – melted might be a more accurate description.

"What was it – I mean what model is it?"

"Fidelity SRD750 – Chernobyl class" he replied.

"Hmm. I see what you mean. Got it in a nice warm Hi-Fi cabinet?"

"Yep."

"On top of a video?"

"Yep."

"It's pizzafied."

"Yep. Thought so. Thanks." He turned towards the door.

"Just a moment! Can I interest you in a nice, reliable, refurbished Pace PRD800?"

"Nah. I can get Sky to install a complete new system for fifty quid."

"New, eh! What model?"

"Not sure. SVS-something or other maybe?"

"Ah well, see you in thirteen months. 'Bye."

I confess that our environmentally-concerned society puzzles me. On the one hand we sort through bottles, cans and newspapers for recycling. On the other we dispose of electronic equipment every year or two in favour of newer units that are generally even less reliable than the previous ones.

I can see this going even further with digital TV. Unless it's a simple power supply fault, we will have to discard the mother board

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

jack@netcentral.co.uk

One model per message – state make/model and fault symptoms. If you have no e-mail facilities you can write to him c/o Television, Room L302, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Please enclose two first-class stamps.

and replace it with another one. The possibility of repair will not be an option unless you are one of those well-funded workshops that can afford specialised equipment.

On second thoughts, it could actually work out all right for us. Digital satellite receivers are expected to have a production cost of some £400. They will be sold at a subsidised £200. But the replacement cost could be a lot higher. It will be interesting to see if Sky can come up with "fifty quid" replacements.

Test Case 428

For the umpteenth time that day the Sharp VCM24 VCR on the soak test bench auto-rewound the short test tape, having reached the end of the programme. For the umpteenth time Sage started the play cycle again. It was the machine's third visit to the workshop: on the two previous occasions it had been returned to Mrs Potts, its owner, after running faultlessly for several days. Sage and Mrs Potts were getting irritable with each other. In Mrs Potts' lounge the machine would often stop after running for a few minutes in record or play, but in Sage's workshop its behaviour had been impeccable.

Then, to Sage's surprise, the machine clicked, whirred and shut down – a couple of minutes into the tape. Sage pressed the play key. The Sharp threaded up, played for about five seconds, then stopped again. Blimey, here it was actually doing its thing and there was no test equipment hooked up to it! It's a mid-mount machine, which is a more difficult type to work on than the older types, especially when there's a fault like this: the deck cannot be run while physically separated from the electronics, and there's only limited access to the underside of the one-piece PCB through the holes in the bottom of the cabinet.

Sage removed the bottom screening plate and connected an oscilloscope to the one relevant point where access was possible, the take-up reel sensor. Naturally the machine now behaved itself again. Sage watched the AC-coupled pulses bounce up and down on the spare scope's screen for three more days before the fault put in another appearance. Two things were then noted: that the reel-sensor pulses were present right up to the moment when the deck shut down, and that rewind was not affected, only the forward modes were.

The next step was to remove the deck and PCB from the cabinet, bolt them back together, fit solder stubs to relevant test points then, somehow, get the outfit to remain physically stable while at right-angles to the bench, so that it could be monitored while running. Bring back the older designs, all is forgiven! This was somehow managed without getting a shock from the now-exposed power supply section and without the whole assembly toppling over.

It took several days of further testing to establish that the supply voltages were all present when the fault occurred, and that the drum flip-flop (SW25), the FG feeds (drum and capstan) and the supply-reel rotation pulses were all present at the microcontroller chip's input pins. This chip is responsible for the servo and timer functions as well as the syscon operation. What was certain was that the microcontroller chip was issuing the shut-down command. Its oscillators ran normally at all times, and voltages at its supply and reset pins 63, 74 and 20 remained stable at 5V. A second, ancient scope was brought into action to prove that the tape-end sensors were playing no part in the mischief. They weren't: their lines, checked at pins 71 and 72 of the microcontroller chip, remained high before, during and after the mystery shutdowns.

The microcontroller chip wasn't the culprit: this was proved by further checking. In retrospect the two factors noted when the fault put in its second appearance were the most significant. It's a pity that Sage didn't know the machine and its design better! Where did the actual cause of this horribly intermittent fault lie? On the deck, or in the electronics? For the solution, turn to page 749.



It's internet this, internet that wherever you look. So what's in it for you, what equipment do you need and how do you get started?

Peter Marlow explains it all

Using the Internet

The internet is a phenomenon: who would have predicted that a system which started as a network of US military computers in the Sixties would take the world by storm in the late Nineties? Not a day goes by without the media containing some story or other about 'cyberspace', the world wide web or the internet. So you can't fail to ask yourself whether there is anything in it for you?

The internet is now a huge, interlinked network of millions of computers in different countries across the world. Hence the word internet. The connections are akin to a spider's web, hence world wide web, though it has to be said that a spider's web is actually more organised! You can access the internet through an Internet Service

Provider (ISP) which you can dial up from your own PC over the telephone. More about ISPs later.

Web Sites

The computers linked by the internet are called web sites. They can store massive amounts of information, ranging from academic data to government papers, the BBC news, airline timetables and Tesco's stock range – almost anything in fact. Rather more than teletext! And it's mostly free except for a modest monthly charge from your ISP and the cost of local calls.

To help you through the maze of information there are powerful but easy to use search sites, to which you can direct your queries. Almost all web sites contain links to other ones. You can be consulting a UK

site then click on a link to a US site, getting a more or less instantaneous response. There are no passwords to worry about, just the occasional visitor's book to 'sign'.

You can send electronic mail (e-mail) to anyone in the world. If they don't have an e-mail address you can e-mail their local post office and pay a small fee for a letter to be delivered by 'snail mail'. You can even make voice phone calls abroad for the price of a local call. You can order software, books and CDs over the internet, even make flight and holiday bookings.

You can join a special interest newsgroup or play some on-line games. It all sounds too good to be true, doesn't it? There is a down side as well, as we shall see later, but not much of one.

Addresses

Web sites have their own unique address or 'uniform resource locator' (URL). It starts <http://> to indicate to the network the kind of connection you want to make. You will then see www which means world wide web, followed by a dot and a company name. Then there's another dot and, for a UK commercial organisation, co.uk, or com for an international or US company. There are other postscripts such as org for a non profit-making organisation and net for an ISP. New ones are constantly being created to satisfy the insatiable demand – quite a trade in names is developing.

This address is usually enough to get you in the 'front door', to the home page or index. Notice that the internet uses front slashes (/) rather than the backslash (\) we are used to with MS-DOS – this is because of the internet's origin in the world of Unix computing. Internet URLs can be very long and almost impossible to remember, but there is a move to simplify names.

E-mail addresses are even simpler. It could simply be

peter@tvnet.com, as long as this is unique. The @ symbol is important: it defines the computer (called the domain) where the e-mail letter box exists. But unlike letter post you don't get your mail delivered to your home – you have to go on-line and fetch it from your 'post box'. It is nevertheless so quick and easy that e-mail could replace the conventional answerphone.

You can attach documents or pictures to your e-mail, and many people think that this will eventually kill off the fax machine. Meanwhile there are 'gateways' that enable you to send e-mail to a fax machine, a pager or even a mobile telephone.

How it can help you

OK I hear you say, it all sounds very interesting – a bit like amateur radio – but how can it help my business? The first thing to remember is that the internet is very dynamic. Many companies already have an internet presence, and many more are joining daily. Web sites can change dramatically over time, usually for the good, providing increased content.

Company web sites tend, at present, to be used for marketing rather than support – after all, it's a cheap way of advertising. Examples are Hitachi (<http://www.hitachi-eu.com>) and Toshiba

(<http://www.toshiba.co.uk>), whose sites do nevertheless contain useful information on new products. The Philips site (<http://www-us2.philips.com/audiovideo/>) is much better: it contains much useful technical information and component data sheets (<http://www-us2.semiconductors.philips.com/>). Texas Instruments also offers a semiconductor data search (<http://www.ti.com>): it allows you to download the data sheets in their original format, using Adobe Acrobat Reader. This software is available free of charge from <http://adobe.com>.

Some companies are harder to find, and don't seem to follow the standard format of company name followed by .co.uk or .com. They have to be looked for at a search site such as <http://www.yahoo.co.uk>, using the resident 'search engine'. These include Bang and Olufsen at <http://www.xs4all.nl/~beoschip/index.html>, which is well worth a look, and Amstrad which is now at <http://web.ukonline.co.uk/cliff.laws/on/manuals>. This site appears to be privately run, but contains useful links to other sites.

Ordering

Some sites have sophisticated on-line ordering facilities, such as Satellite Solutions at <http://www.satsol.co.uk>. The large suppliers are represented by RS Components at <http://www.rs-components.co.uk> (the on-line catalogue is actually at <http://rswww.com>). This site offers secure ordering, and you have to register even to browse. Incidentally the expected site address (rs.com) did not produce the right results. Farnell has a site at <http://www.farnell.com/uk/index.html> with a rapid order facility. Another site to look at is SatCure at <http://www.netcentral.co.uk/satcure/>, which is refreshingly simple and straightforward and enables satellite and other spare parts to be ordered. CPC has a site at <http://www.cpc.co.uk>, with an on-line catalogue and part finder to be made available soon.

Selling over the internet is a growth industry, but people are often reluctant to give their credit card number for fear of interception and unauthorised use. I believe that it's no worse, probably better, than giving your card number over the telephone. Some sites are now offering secure ordering however – as mentioned above – where the card details are encrypted.

Incidentally some e-mail systems can offer what's called Pretty Good Privacy.

Varied Information

For reference purposes UK Electrical Direct's site at <http://www.uked.com> offers an on-line directory of supply companies with links to their web sites. For a full list of Reed Business Information magazines look at <http://www.reedbusiness.com>. *Electronics Weekly* has its own web site at <http://www.electronicweekly.co.uk/>. It offers a 'mail-back' headline service called Hyperactive. The SoftCopy website offers a ten-year on-line index to *Television* and *Electronics World*, with *Electronics World* at <http://www.softcopy.co.uk>.

A useful e-mail facility is listed in Satellite Workshop each month: Jack Armstrong offers to diagnose satellite receiver faults for free at jack@netcentral.co.uk.

The above has been just a snapshot of what's already out there. Go looking and you'll find lots more. There is also some dubious material, but software is available to plug into a browser to protect young web surfers.

Equipment Required

So how do you get connected to the internet? You will need an Apple Mac 68040 or a PC with a 486 processor running windows 3.1, Windows 95 or NT, also a modem. This should operate at 33kbits/sec, though 56kbits/sec units are available. In practice, because of the quality of the phone lines, you will not connect at greater than 28.8kbits/sec – unless you are close to an exchange.

Once you get on the internet you will soon find that you need a second telephone line. BT and Cable & Wireless have special ISDN line offers which a small business might find worth considering. ISDN is a digital service that provides operation at 128kbits/sec and allows several machines to share the same line. A satellite link is also available, but is quite expensive to start up. It does however claim to give four times the speed of ISDN – call DirectPC on 0800 731 9302 or look at the company's web site at <http://www.easat.co.uk>. There are even plans to provide an internet service via the domestic electricity supply lines.

The ISP

Once you have a PC and a modem you will have to sign up with an internet service provider. There are over 200 to choose from. It's such a competitive field that most of them will give you a month free.

Buy a copy of one of the computer magazines and load one of the free discs. You will get an e-mail address and software, plus an internet browser. Some space will be allocated for you to set up your own web site.

You could hop from ISP to ISP and get free access for many months, but your e-mail address and web URL would change with every move.

The internet browser will be either Microsoft Internet Explorer or Netscape. Browsers are like a wordprocessor without the input capability. You enter the address or URL of the site you want to go to in a box at the top of the screen.

The browser allows you to record bookmarks and favourite sites.

E-mail software may be integrated with the browser, but will have an inbox and an outbox and a text editor to create new e-mail. It will also tell you if you have any new mail to collect.

World Wide Wait

Once you are on the internet you will find out why the web is sometimes referred to as the world wide wait. Congestion occurs at times, particularly during the evenings after 7pm and at the weekends. It seems to take ages to find sites, let alone download any software. Sites that use lots of graphics take a long time to download and are particularly frustrating.

Things are gradually improving, but remember that you are not paying for any of the long-distance connections, only the local end, so

don't complain too loudly. There are ways of keeping your on-line costs at a minimum. You can for example prepare your e-mails off-line, then dial up your ISP to send them and receive any that are waiting for you all in one go.

Some web sites send little programmes called "applets" to your computer. They are written in a much-hyped language called Java. Most are harmless, producing just animated graphics or allowing the user to feed in data. They disappear when you move to the next site. Some stay on your computer however, supposedly to record your preferences next time you visit the site. They are called 'cookies', and represent an insidious and intrusive aspect of the web. It could also be a virus-writer's paradise. Fortunately the latest web browsers warn you when this is about to happen.

Your Own Web Site

You can set up your own web site to advertise – a number of *Television* advertisers already do. You could also use it to pass on up-to-date information and offer customer support. This would, I imagine, be particularly useful for say satellite TV dealers. The web space provided by your ISP can be used, or you can register a name and have a company act as host for you. You could even set up your own server, with 24-hour internet connection, but this means serious money.

Most ISPs provide basic software to enable you to design and upload web pages. Very good commercial packages exist, such as Hot Metal Pro and Microsoft Front Page 98. Check with your ISP or host company which of these are compatible with their computer. The beauty of web advertising is that it is instant: once you have uploaded your page it's there for the world to see! You can add counters to see how many people have visited your site.

Web Watch

We plan to provide periodic 'web-watch' updates on items of interest to readers. The sites listed in this article all have links at the SoftCopy web site <http://www.softcopy.co.uk>. Readers are invited to send details of any interesting web sites they come across to the author peter.marlow@softcopy.co.uk. Table 1 lists web sites relevant to this article and *Television*.

Table 1: Some relevant web sites.

Company	Address
Adobe	http://www.adobe.com
Amstrad	http://web.ukonline.co.uk/cliff.lawson/manuals
Bang and Olufsen	http://www.xs4all.nl/~beoschip/index.html
CPC	http://www.cpc.co.uk
Electronics Weekly	http://www.electronicsweekly.co.uk/
E-mail address for new sightings	peter.marlow@softcopy.co.uk
Farnell	http://www.farnell.com/uk/index.html
Hitachi	http://www.hitachi-eu.com
Jack Armstrong (Satellite Workshop)	jack@netcentral.co.uk
Philips	http://www-us2.philips.com/audiovideo/
Philips Semiconductors	http://www-us2.semiconductors.philips.com/
Reed Business Information	http://www.reedbusiness.com
RS Components	http://www.rs-components.co.uk
RS Components catalogue	http://rswww.com
Satellite Solutions	http://www.satsol.co.uk
SatCure	http://www.netcentral.co.uk/satcure/
SoftCopy	http://www.softcopy.co.uk
Texas Instruments	http://www.ti.com
Toshiba	http://www.toshiba.co.uk
UK Electrical Direct	http://www.uked.com
Yahoo search engine	http://www.yahoo.co.uk

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PORTABLE X RAY MACHINE PLANS Easy to construct plans on a simple and cheap way to build a home X-ray machine! Effective device, X-ray sealed assemblies, can be used for experimental purposes. Not a toy or for minors! £6/set. Ref F/XP1.

TELEKINETIC ENHANCER PLANS Mystify and amaze your friends by creating motion with no known apparent means or cause. Uses no electrical or mechanical connections, no special gimmicks yet produces positive motion and effect. Excellent for science projects, magic shows, party demonstrations or serious research & development of this strange and amazing psychic phenomenon. £4/set Ref F/TK1.

ELECTRONIC HYPNOSIS PLANS & DATA This data shows several ways to put subjects under your control. Included is a full volume reference text and several construction plans that when assembled can produce highly effective stimuli. This material must be used cautiously. It is for use as entertainment at parties etc only, by those experienced in its use. £15/set. Ref F/EH2.

GRAVITYGENERATOR PLANS This unique plan demonstrates a simple electrical phenomena that produces an anti-gravity effect. You can actually build a small mock spaceship out of simple materials and without any visible means- cause it to levitate. £10/set Ref F/GRA1.

WORLDS SMALLEST TESLA COIL/LIGHTENING DISPLAY GLOBE PLANS Produces up to 750,000 volts of discharge, experiment with extraordinary HV effects, 'Plasma in a jar', St Elmo's fire, Corona, excellent science project or conversation piece. £5/set Ref F/BTC1/LG5.

COPPER VAPOUR LASER PLANS Produces 100mw of visible green light. High coherency and spectral quality similar to Argon laser but easier and less costly to build yet far more efficient. This particular design was developed at the Atomic Energy Commission of NEGEV in Israel. £10/set Ref F/CVL1.

VOICE SCRAMBLER PLANS Miniature solid state system turns speech sound into indecipherable noise that cannot be understood without a second matching unit. Use on telephone to prevent third party listening and bugging. £6/set Ref F/VSS.

PULSED TV JOKER PLANS Little hand held device utilises pulse techniques that will completely disrupt TV picture and sound! works on FM too! DISCRETION ADVISED. £8/set Ref F/TJ5.

BODYHEAT TELESCOPE PLANS Highly directional long range device uses recent technology to detect the presence of living bodies, warm and hot spots, heat leaks etc. Intended for security, law enforcement, research and development, etc. Excellent security device or very interesting science project. £8/set Ref F/BHT1.

BURNING, CUTTING CO2 LASER PLANS Projects an invisible beam of heat capable of burning and melting materials over a considerable distance. This laser is one of the most efficient, converting 10% input power into useful output. Not only is this device a workhorse in welding, cutting and heat processing materials but it is also a likely candidate as an effective directed energy beam weapon against missiles, aircraft, ground-to-ground, etc. Particle beams may very well utilize a laser of this type to blast a channel in the atmosphere for a high energy stream of neutrons or other particles. The device is easily applicable to burning and etching wood, cutting, plastics, textiles etc £12/set Ref F/LC7.

DYNAMO FLASHLIGHT Interesting concept, no batteries needed just squeeze the trigger for instant light apparently even works under water in an emergency although we haven't tried it yet! £6.99 ref SC152

ULTRASONIC BLASTER PLANS Laboratory source of sonic shock waves. Blow holes in metal, produce 'cold' steam, atomize liquids. Many cleaning uses for PC boards, jewellery, coins, small parts etc. £6/set Ref F/ULB1.

ANTI DOG FORCE FIELD PLANS Highly effective circuit produces time variable pulses of acoustical energy that dogs cannot tolerate £6/set Ref F/DOG2

LASER BOUNCE LISTENER SYSTEM PLANS Allows you to hear sounds from a premises without gaining access. £12/set Ref F/LLIST1

PHASOR BLAST WAVE PISTOL SERIES PLANS Handheld, has large transducer and battery capacity with external controls. £6/set Ref F/PSP4

INFINITY TRANSMITTER PLANS Telephone line grabber/room monitor. The ultimate in home/office security and safety! simple to use! Call your home or office phone, push a secret tone on your telephone to access either: A) On premises sound and voices or B) Existing conversation with break-in capability for emergency messages. £7 Ref F/TELEGRAB

BUG DETECTOR PLANS Is that someone getting the goods on you? Easy to construct device locates any hidden source of radio energy! Sniffs out and finds bugs and other sources of bothersome interference. Detects low, high and UHF frequencies. £5/set Ref F/BD1.

ELECTROMAGNETIC GUN PLANS Projects a metal object a considerable distance- requires adult supervision £5 ref F/EML2.

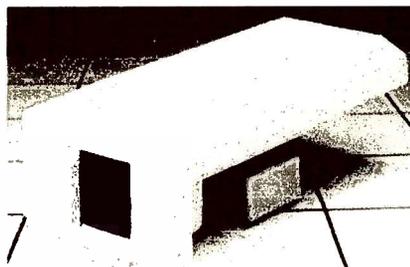
ELECTRIC MAN PLANS, SHOCK PEOPLE WITH THE TOUCH OF YOUR HAND! £5/set Ref F/EMA1.

SOLAR POWERED WIND UP RADIOS BACK IN! These FM/AM radios have a solar panel and a hand operated charger! £17.95 ref SOLRAD

PARABOLIC DISH MICROPHONE PLANS Listen to distant sounds and voices, open windows, sound sources in 'hard to get' or

hostile premises. Uses satellite technology to gather distant sounds and focus them to our ultra sensitive electronics. Plans also show an optional wireless link system. £8/set ref F/PM5

2 FOR 1 MULTIFUNCTIONAL HIGH FREQUENCY AND HIGH DC VOLTAGE, SOLID STATE TESLA COIL AND VARIABLE 100,000 VDC OUTPUT GENERATOR PLANS Operates on 9-12vdc, many possible experiments. £10 Ref F/HVM7/ TCL4.



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AIR RIFLES .22 As used by the Chinese army for training purposes, so there is a lot about! £39.95 REF EFT8. 500 pellets £4.50 ref EF80.

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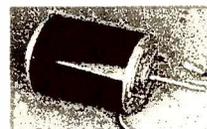
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12 - 24v operation, probably about 1/4 horse power, body measures 100m x 75mm with a 60mm x 5mm output shaft with a machined flat on it. Fixing is simple using the two threaded bolts protruding from the front



£22ea REF mot4

What a Life!

"Ello Mr Bullneck" said a gravelly voice. I turned round and saw an odd cove who looked like Les Dawson in drag. He placed a Matsui 20T1 on the counter.

"Things ain't quite what they seem, dear" he rasped.

"Aren't they then?" I said, giving him a sidelong look.

"This thing here keeps ticking" he went on.

"Not a bomb, surely!" I exclaimed.

"Nah, nah. 'E's a telly all right dear. But 'e's a Grundig in hysguise."

"Right" I said, reaching for a job card. "Name please."

"Lotus" he growled. I wrote down Dawson.

When he'd departed I took the set to the bench, removed the back and found a Grundig G1000 chassis inside. When power was applied there

was no standby light, in fact there were no signs of life apart from a faint ticking. I switched off and scanned the chassis, looking for dry-joints, but couldn't see any. So I disconnected the line output transistor's collector connection and connected a 100W bulb between this point and chassis. When I switched on again the bulb lit. So the power supply was OK and the line output stage suspect. Time to switch off and carry out cold checks on the semiconductor devices in the stage.

As the line output transistor tested OK I began to check the diodes, starting with the larger ones – they can usually be reckoned to live more dangerous lives. When I got to the BY133 efficiency diode D304 there was a dead short. We didn't have one in stock, so I tried a BY127. When I switched on again the set sprang to life.

Brother Terry

Then Brother Terry came in with an old toaster. "Can you fix this for poor old Doris Prattle?" he asked.

"Sorry, no can do" I replied.

"Oh. Well, I've brought along my neighbour's Sony television too. It's gone mental" he said.

The set was a KVC2122U, which is fitted with the AE1C chassis. Steven put it on the bench and we soon discovered that Terry was right. After working normally for a moment the sound blasted loudly then cut out. The picture flickered, the field cramped and then the picture disappeared, leaving a brilliant raster. Next it reappeared, expanded away and the field scanning collapsed. Finally the set grunted and died.

When we opened up the set we saw that there were dry-joints in all sections of the chassis. Steven undertook the resoldering. He had to attend to poor joints on the vertically-mounted sub-panels as well as the main PCB. This restored operation, but there was signal instability. So Steven removed the tuner and IF cans and

did some resoldering in these as well. When he'd finally finished the set produced excellent results.

Incidentally whenever you get one of these sets it's advisable to check R522, which is in the HT preset (RV501) network. It's a tiny 100k Ω , 0.25W resistor that tends to go high in value. When this happens the HT rises. The power supply is quite complex, using a master-slave IC control system. The master regulation part is contained in the TEA2028B chip IC501, along with the line and field generator circuits.

Davey Ruggles

An ancient lorry full of junk rolled up. Davey Ruggles jumped out, oozing contentment. He's a grafting Romany who always seems to be on the losing end of things.

"My luck's in this time Don, I think." He had with him an immaculate colour set the like of which I'd never seen before. It claimed to be a Beko Model 19221 and was dead.

"Given to me by number 36" he said. "Nice people. Said there wasn't much wrong but wouldn't take a penny for it. The kids would like a telly again. Our set blew up just before Christmas." He left the Beko with us and went over to the Co-op.

When we opened the set up we found that the mains fuse, FU101, had blown. So did a replacement. When we investigated further we saw some very bad dry-joints in the power supply section. Resoldering them cured the trouble. The results were good too.

"Poor fellow" I said. "Let's put the set back in his cab and say it was nothing." Steven took it out, along with a few tapes from his video library which he closed down a while back.

Mr Ng's Bush

Our next caller was Mr Ng. He's one who never looses.

"I'm owning a television set which is very, very bad to me" he said soft-



"Things ain't quite what they seem, dear" he rasped.

ly. He smiled, showing us two dozen front teeth.

"Goodness gracious me, what is being the trouble?" I asked.

He got a passer-by to bring in the set, which was a Bush 2714 (11AK03 chassis). It was stuck in standby.

Paul had a go at this one. He first checked the print side of the chassis to see if any of the fusible resistor leads – they are long and untrimmed – were shorting to the rectifier diodes. They weren't. So he checked the BU506D line output transistor which was very leaky. "That'll be it" he said after fitting a replacement. But the set was still stuck in standby. His smile faded. Then he moved over to the line driver stage, where the 3.9k Ω , 4W feed resistor R603 was open-circuit.

Steven suggested checking the BC639 driver transistor TR601 as well. "It was the cause of the trouble last time I had one of these sets in – the transistor was dead short."

Paul found that the same thing had happened with this set. Once replacements had been fitted the set worked well enough.

"Oh dear oh dear" said Mr Ng when he called for his set. "It is being my unlucky day. My car was having a puncture and the man was wanting two pounds to mend it. And a very, very nasty traffic warden is reporting me for parking it. Everybody is wanting my money, and I'm not liking it." He showed us his teeth again.

"Well, the set won't cost you much" smiled Steven. "Fifteen pounds."

Mr Ng gasped and his teeth disappeared. "Can't you be taking ten?" he asked.

"Fifteen" smiled Steven.

"Twelve?" asked Mr Ng.

"Fifteen" said Steven, still smiling.

"Shall we be saying fourteen?"

Steven smiled even more sweetly. "Fifteen" he breathed.

Mr Ng took out a huge, embossed wallet and peeled three fivers from a fat wad of notes.

"I am paying you very, very much, and this is not good. I should be paying you only five pounds" Mr Ng concluded.

Mrs Runner

Mrs Runner came in with her son Clarence, who is of slight build. "Hello, Mr Billhook" she trilled, "Clarence's camera won't work, will it Clarence?"

Clarence began to open his mouth. "The cassette housing won't shut, will it Clarence?" she piped. Clarence raised his face ready to speak, but she cut in again. "It switches on all right, and he sees a picture in the viewfind-

er, don't you Clarence?" The boy managed a silent gasp of air.

"I don't know why he won't speak up, Mr Billhook, "just like his father, I'm sure."

When they'd gone Steven opened the camcorder, a Sharp VLC790H. There was no mechanical operation. It's one of the best for ease of servicing. The deck and lens assembly are simple to remove. You then see a pair of double-sided PCBs sandwiched together and secured to the bottom of the deck.

The cause of the trouble was quite obvious once the boards had been separated. C951 (220 μ F, 6.3V) had leaked badly over the PCB, corroding a section of the print. Steven cleaned off the corrosion, fitted a new capacitor and bridged the print. Then he noticed that another electrolytic, C3302 (10 μ F, 16V), was also leaking. Fortunately no damage had occurred this time. So he did some more cleaning up and fitted a replacement. On test the camcorder now worked well.

They came to collect it shortly after. "We're ever so grateful to you for doing it so quickly Mr Billhook, aren't we Clarence?" she sang. Clarence raised his chin. "Tell Mr. Billhook how pleased you are, Clarence." This time Clarence managed a tiny squeak before she cut in again.

"I dunno. He's very a very disappointing boy, Mr Billhook. Just won't say a word. Can't understand him. Come on, Clarence."

Another Sony

Mrs Ruff came in with her lodger, Old Pukey. "It's me telly, Mr Bugbear" she rasped. "Seems to be doing whatever 'e likes. Go an' bring 'im in, you" she said, jerking her thumb at Old Pukey.

He staggered in with a Sony KVD2512U. When they'd gone we pulled it on to the bench and tried it. The problems were intermittent: sometimes the picture disappeared; sometimes the on-screen graphics went as well; at other times all we would see were a lot of peculiar on-screen display symbols.

When we opened it up we found that the troubles could be instigated by tapping the tuner/IF PCB (board A). It often suffers from dry-joints, but this time we couldn't see any. So we concentrated on the tuner, and found that even the gentlest of taps had a dramatic effect. Steven opened it and carefully resoldered every joint. That cleared the problems.

Though expensive, the models that use the AE1 series chassis seem to give poor results. Grainy pictures,

poor convergence and poor picture geometry are often seen with the ones we come across, and readjustment doesn't help much.

Mitsubishi Problem

Mr McTurdey had a problem with his Mitsubishi Model CT2525. "'Tis hab-solutely dead, Sorr. Hardly works at all."

I looked at him, then at the set. After taking details I waved him out.

When I looked inside I found that the 2SD1887 chopper transistor Q901 was short-circuit. D909, a 3V zener diode (type RD3-0FB2) that's in series with it, was open-circuit. R910, which is in parallel with D909, and the 4.7 Ω surge limiter resistor R902 were also open-circuit.

I noticed a crop of dry-joints in the power supply, and surmised that they could well have been the basic cause of the blow-up – Mr McTurdey mentioned that there had been intermittent operation for some months before the final failure.

Back in Spain

It was when we returned to Spain that Greeneyes became a car thief. We had a call from Maisie who lives over her restaurant-bar in a nearby town. Her huge Hitachi set, Model C2846N, was operating intermittently.

Like so many in Spain we use an old Panda car as a runabout. I scooped a few tools into it and Greeneyes drove us to Maisie's place.

After a few minutes her set cut out and went to standby. Then it came on again, popped, flashed the Nicam signal and died again. I soon found that the 12V regulator chip was dry-jointed. Resoldering it cured the trouble.

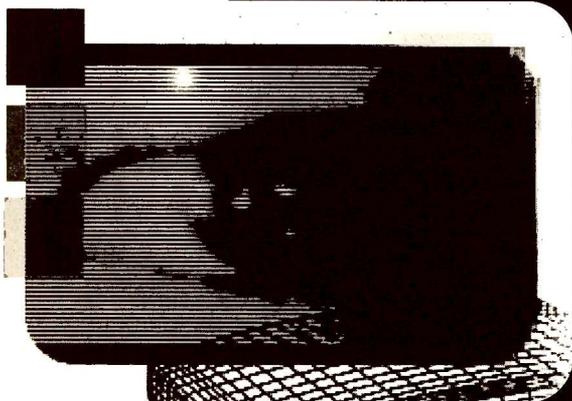
On the way back we parked at a shopping parade to make a couple of purchases. Then we jumped back into the car and started it up. A drunken Englishman tottered from a bar and started shouting and waving his arms. "Let's get going" Greeneyes said, "he's paralytic."

Then Greeneyes noticed that the steering wheel was without its glove thing, and I noticed that the car was even untidier than usual. Suddenly we both realised that it wasn't our car at all. It was the drunk's. It was the same, sun-faded colour as ours, and as old and worn. But it was his, not ours!

Greeneyes drove back and we clambered out. I forced a laugh. "Ha ha ha, thought it was ours, mix up, sorry, that's ours there."

"They're shteating my car" the drunk continued to shout.

Awkward. Everyone else, apart from the drunk, thought it a great joke.



Reports from
Philip Blundell, AMIEelec
Ian Field
Stephen Leatherbarrow
Mike Leach
C.J. Guy
A.J. Roberts
Pete Gurney, LCGI and
Michael Maurice

Ferguson ICC9 Chassis

One of these sets (Model D59F) was stuck in standby. Use of the remote control unit had no effect, neither did temporarily disconnecting the bubble keypad. The power supply voltages were all correct.

Attention was therefore turned to the microcontroller chip IR01. It's supply voltage was correct and its oscillator was running. But the reset pin was permanently at 2V instead of the 4.9V quoted in the manual. Transistor TR90 was conducting when it should have been off, while the latching pair TR85/87 should have been switched on but wasn't. Cold checks showed that TR85 was faulty – it had a 50Ω base-emitter leak. To be on the safe side I fitted a new BC848B (TR85) and BC858B (TR87). **P.B.**

Philips 52ZY3535/25G (Anubis B AA Chassis)

This set was in the shop demo mode. For those of you who have not seen this, the word "demo" is displayed and the set displays all the menus and features in sequence. I couldn't find his feature in the service manual, but a few minutes spent playing with the front controls revealed the way to remove it. Switch on the mains supply with the volume – and the programme + buttons held down. Repeat this procedure to bring the mode on again. **P.B.**

Hitachi C28-P745VT

After a couple of hours this set,

TV Fault Finding

which is fitted with a Salora chassis, developed a field fault. The lower half of the field scan remained OK, but the upper half was squashed up into a one-inch band just above the centre of the screen. Scope checks showed that the drive to the TDA8172 field output chip was OK, but the output was very odd. The waveform at pin 6 (flyback boost supply) was also wrong. The flyback boost diode D571 had developed high forward resistance. **P.B.**

Ferguson ICC9 Chassis

After ten minutes or so the vision and sound went off, leaving a blank raster. The menus still appeared if, for example, the volume was adjusted. There was a video output at pin 6 of the IF module. It went as far as transistor TX16, where it was lost. TX16's emitter voltage was low but the path to the positive rail (it's a pnp transistor) is rather involved. It includes the 4052 switching chip IX01, where pins 3 and 4 should be at 2.4V DC but were low in the fault condition.

Several components could have been the cause of this low voltage. Replacing TX09 (BC858B) restored the voltage and brought back the picture. **P.B.**

Goodmans 1450T (Onwa Chassis)

The cause of no results was a small, 4.7nF, 500V disc ceramic capacitor that's connected in parallel with the mains bridge rectifier's reservoir capacitor. It had been arcing and had begun to disintegrate. The 4.7Ω, 5W surge limiter resistor provided circuit protection, not the mains fuse. There are two more of these tiny disc ceramics, on the AC side of the bridge rectifier.

These capacitors are a fraction of the size of Y-rated equivalents, and have no markings other than

value and voltage. It would be best, from the safety point of view, to replace all three with a more suitable type whenever one of these sets comes in for service.

Don't forget to check the two small electrolytics in the chopper circuit. There are numerous versions of this basic design, with different value capacitors in these positions. There have been references to this problem before in these pages. Suffice it to say that the replacements should have the same capacitance value as the ones removed. The helpline engineers suggest the use of capacitors rated at 105°C and also an upgraded the voltage rating. **I.F.**

Philips G90AE Chassis

The symptoms were no sound and F7 in the display. The picture was normal, and the fault corrected itself after about fifteen minutes. I've seen this many times before and have previously been able to cure it by replacing the TMP47C434N-3555 microcontroller chip IC7720 and/or the EEPROM. Not this time however.

Localised heating and freezing would instigate or clear the fault, but a particular cause couldn't be established. A check on the 5V supply produced a reading of 4.85V. I traced the supply back to a point near its source, where the reading was 5.05V. Linking these two points provided a 'cure'.

The actual source is the 5V regulator in the chopper circuit. There's a 22μF smoothing capacitor here, C2661. A replacement boosted the supply to the micro, providing a final cure. **S.L.**

Panasonic Euro 1 Chassis

Compression of the top two inches of the field scan was the symptom displayed by this set. Failure of the TDA8175 field output chip IC561

was the cause and is not uncommon. Panasonic has produced a kit to deal with the problem, part no. TZS5EK001. It consists of the chip and an MA2100 diode (D568). Remove link B51 and fit the diode in this position, with its cathode to the left as you look into the back of the set. S.L.

BPL KLR9402-01

This set produced only a standby light. I didn't have a service manual, so it was going to be a print-following foray. There were outputs at all the rectifiers in the chopper circuit, but there was no supply at the line driver stage. This supply appears to be switched via Q551A and Q552. I found that the set worked when this latter transistor was switched on by artificial means. Its base feed comes from the microcontroller chip via R793 (4.7k Ω), which was open-circuit. S.L.

Ferguson TX98 Chassis

There was no control of the analogue functions (volume, contrast, colour, brightness) either via the remote control handset or the front panel controls. The cause was the MC14411P DA converter chip IC9. S.L.

Ferguson ICC5 Chassis

This chassis has an unusual thyristor field output circuit. The symptom with one of these sets was compression of the first four inches or so of the field scan. In addition the verticals in this area were horizontally displaced in sympathy with the video signal.

In the past we've come across unusual effects that were caused by CL22 and RL22, but they were blameless on this occasion. Use of freezer almost anywhere in the field/line output stage would temporarily clear the symptoms. The cause turned out to be CL52 (1,000 μ F), which is the reservoir capacitor for the 23V supply. S.L.

Amstrad CTV2200

Field collapse was the not unusual fault with this set. Probably a simple case of fitting a TDA3654 field output chip and a modification kit and all would be well. As many engineers know however, this is not a perfect solution: you tend to find that the height, bias and added potentiometer require delicate adjustment.

But I digress. The cause of this particular horizontal white line was failure of R838 (10 Ω safety). It

feeds pin 12 of the LA7800 time-base generator chip, which produces the field drive signal at pin 6. This can be a misleading fault. If there's no feedback from the field output stage the chip won't produce a field drive output, leading to a chicken-and-egg situation. S.L.

Hitachi C28300

The symptoms produced by this widescreen set were very confusing. If the set was switched on from cold it would run indefinitely with no problems. If it was switched on when warm it was still OK. But if it was switched on from cold, allowed to warm up for twenty minutes, put into standby via the remote control unit for twenty minutes, then powered up again using the remote control unit the set would come on with no luminance. I tried the whole process on two successive days and each time the same thing happened.

Scope checks carried out along the rather complex luminance signal path narrowed down the source of the trouble to the 16:9 compression circuit, which is a sub-panel on the main chassis. The culprit turned out to be the SAA4981 chip IC1300. After fitting the replacement I tested the set for several days and all was well. M.L.

Hitachi C1410R

This set suffered from slight tuning drift. After a while the station would drift a bit, as if the set needed fine tuning for an optimum picture. It was sensitive to heat around the ZTK33 tuning voltage stabiliser, and also capacitors CF16/17/18, but replacing these items made little difference to the symptom. After some head-scratching and a few more squirts from the freezer can the cause of the trouble was pinpointed: the BC858C transistor VL08 in the AFC circuitry. It's a surface-mounted device. M.L.

Samsung CI5070AN

Talk about missing the obvious! That's just what I did however – even telly men are human! This set produced only a high-pitched whistle (pulsing) that came from the line output stage. But almost everything seemed to be OK. The 17V and 5V supplies were correct, and the HT measured 123.5V (it should be 125V). So I assumed that the power supply was OK and spent a lot of time replacing items in the line output stage, all to no avail.

Eventually I started all over again, at the power supply, and dis-

covered that there was only 241V across the mains bridge rectifier's reservoir capacitor instead of the 330V or so one would expect. Yes, the capacitor was duff. It's back to batteries and bulbs for me for a while! M.L.

Hitachi C2118T

After carrying out a power supply repair I found that the HT was very low at only 26V. With the line output stage disconnected the HT rose to 148V. When a 60W bulb was connected across the power supply's HT output as a dummy load the voltage again fell to 26V. To cut a long story short, the culprit turned out to be D905 (MPG06J) which, when checked with a meter, proved to be leaky. It provides, with C906, the feedback voltage for the error detector stage. When a replacement had been fitted I had the full 110V on load. M.L.

Boots 1417R

Flyback and teletext lines were visible at the top of the picture. The culprit was R307 (10 Ω , 2W) which had risen in value to about 50 Ω . I have also had this fault with some Matsui models that use a similar chassis. C.J.G.

Philips CP90 Chassis

"Picture takes a long time to appear" the report said. Easy I thought, it's the HT electrolytics. But no, not this time. In fact a blank raster was visible when the setting of the first anode preset was advanced, and after about five minutes the picture would suddenly appear.

A lot of searching eventually led us to the culprit, which was C2265 (0.1 μ F). It decouples pin 24 of the TDA3561A colour decoder chip IC7260. When checked it produced a reading of about 5k Ω . Pin 24 of the chip is connected to the burst detector circuit. C.J.G.

Thomson TX80 Chassis

This set came to us from another dealer who said it destroyed the S2000 line output transistor about once a month. A replacement brought the set back to life, but after a few minutes it became quite hot. The problem was cured by replacing its 100 μ F, 35V base drive coupling capacitor CP08. C.J.G.

Pye 25KX1201

This 10in. portable produced a terrible picture with green streaks all over it. I found that the green gun's cut-off preset on the CRT base

panel was open-circuit. An excellent picture was present once a replacement had been fitted and set up. It's worth resoldering all the earthing links on the component side of the PCB, as these can cause some very odd intermittent faults. **C.J.G.**

Panasonic Alpha 2W Chassis

The red content of the picture was smeary and the setting of the red cut-off and drive controls was critical. The cause was very unusual: the peaking coil in the red output transistor's load circuit had become a resistor with a value of around 50k Ω ! It's on the tube base panel. **C.J.G.**

Amstrad CTV1410

The volume was at maximum, the graphics remained on-screen permanently and the set wouldn't tune; though it would select channels that had already been tuned in. All this was caused, not unexpectedly, by the MN1220 EEPROM. When we checked we found that the Amstrad version costs about £30 while the Alba version, which has exactly the same program in it, costs around £14. Guess which one we ordered! **C.J.G.**

Ferguson ICC5 Chassis

This set tripped three times then died. It wasn't for any of the usual reasons however. We tried many things, including the line output transformer. TL17 (BC548B) in the trip circuit turned out to be leaky emitter-to-base. **C.J.G.**

Panasonic TX2482

This saga started off with line foldover. I went to the customer's house where, as usual, the set was in a dark corner with difficult access. I nevertheless managed to resolder a few dry-joints, after which the set seemed to be OK.

A few days later I received a call to say that the set had produced the same symptom and was now making a squealing noise. The obvious thing to do was to take it back to the workshop, where I found that there were dry-joints around the line driver transformer.

I removed it, cleaned its pins then refitted it, expecting the set to work. But the 2SD1441 line output transistor had suffered. When I fitted a replacement the EHT rustled up then immediately died with a squeal. The new transistor had failed. After carrying out more checks I decided that the line output transformer was suspect. A new line output transistor

and transformer at last restored normal operation. **A.J.R.**

Minoka MK1498N

I'd never seen one of these sets before. It's a 14in. portable with Nicam, Fasttext, a full scart facility and phono connections as well. The set was dead apart from a buzz at switch-on. Some checks revealed that there was no line drive, but without a circuit diagram I had to do things the hard way.

It soon became apparent that all the important things are performed on a daughter board which is edge-mounted on the main panel and has three large ITT chips on it. Akura provide an excellent technical back-up on Minoka models, so I made a call to the company. A very helpful man (thanks Donald!) suggested a few key points to check. The 5V supply was correct but the voltage at pin R (reset) on the daughter board was low at about 2.8V instead of 5V. When pin R was disconnected the voltage returned to 5V, so the fault was on the daughter board. I found that pin R is connected to all the chips on the board. When pin 23 of IC701 (video processing) was unsoldered the set started up (without video), proving where the fault lay.

Akura provides a board exchange service at a reasonable cost. When I obtained and fitted a replacement board there was an excellent picture. **A.J.R.**

Philips 22CE2267 (2A Chassis)

There had been a power supply blow up. After repairing this I found that the back-up battery had also failed. Once this had been replaced and everything had been set up all seemed to be well. When I gave the customer a call he asked whether I'd found the cause of the brightness fault. So I put the set on soak test and after some hours the brightness went down.

It couldn't be restored using the remote control unit, but use of the front button brought it back. When I removed my finger from the button however the brightness went back down again. It's not uncommon for the front keyboard to cause this trouble: you can prove it by disconnecting the flexi-cable. The set then worked perfectly, with remote control. A new keyboard completed the repair. **A.J.R.**

Osaki CTV20T (Fidelity ZX3000 Chassis)

This set had a blank raster with fly-back lines. Sound was normal. A

scope check at pin 7 of the TDA3562 colour decoder chip showed that the sandcastle pulses were missing. The cause turned out to be R406 (100k Ω) which was open-circuit. It supplies feedback pulses from the line output stage. **A.J.R.**

Philips G90AE Chassis

There was a cogging effect down the sides of the picture. This made viewing a strain, and subtitles almost impossible to make out. The 47 μ F, 160V HT reservoir capacitor C2630 was the cause – it was open-circuit. I find it advisable to replace the 47 μ F, 160V smoothing capacitor C2631 as well. It runs quite hot, being mounted against a heatsink. **A.J.R.**

Grundig ST70-400

The complaint was intermittent failure to start up and no remote control operation. Initially it seemed that there might be a microcontroller problem. But the cause turned out to be much more simple. I noticed that when the fault occurred the standby light went out. Checking around in this area I found two 7W resistors, R617 (10.7k Ω) and R616 (6.8k Ω), which were both dry-jointed. They feed the remote control IR block and the standby circuit respectively. Resoldering cured the faults. **P.G.**

Thorn CT5122 (Samsung Chassis)

The customer's complaint was "no volume". In fact the sound could be turned up, but only for about a quarter of the range. I suspected a software lock, which turned out to be the case.

The chassis used in this set is a variation of a Samsung one. The same procedure is good for both. To remove the lock you need the original remote control unit – many pattern one's don't have the required buttons. Select either volume up or down at the receiver and, while the on-screen bar graph is being displayed, press the remote control unit's -/- key. I assume that either the customer had inadvertently locked the set or the settings had become corrupted. **P.G.**

Tatung D Chassis

One of these sets produced sound and a bright green raster. A check at the green cathode showed that the voltage was low, as expected. TR931 (BC547) in the green output stage was then found to be open-circuit at every pin. But the fault was still present when a replacement had

been fitted, and the new transistor was getting hot. A check on its 100k Ω bias resistor R932 produced a reading of almost 850k Ω . A new resistor (0.6W, 2%) cured the fault, and for good measure the bias resistors (R912 and R922) in the red and blue output stages were also replaced – checks showed that they were going high in value. **P.G.**

Sanyo CBP2145

The line output transistor had gone short-circuit because the output transformer was faulty. Once replacements had been fitted the set performed reasonably well despite its age. When the set was switched on from cold however the power supply refused to start up. There was HT at the chopper transistor but little else. The usual causes of this are C307 (4.7 μ F) and the start-up resistors R308/9 (180k Ω). They were all OK, though the start-up voltage was less than one would expect. Voltage checks anywhere in the control circuit would get the set going until the following day.

The cause of the fault was eventually traced, by substitution, to an unmeasurable leak within the power

supply optocoupler D331. It's used for standby control, and the leak was just enough to prevent start-up. **P.G.**

Orion 14VT

Intermittent sound, flashing on the picture and crackle were the complaints with this portable. It took several hours on soak test for the fault to appear. The symptoms were all related, the cause being poor soldering at the audio output transformer T351. As the audio output stage is fed from the HT line, there was interference because of arcing.

On inspection, the pins of the transformer were found to have traces of lacquer on them. A good clean and resolder cured the problem. **P.G.**

Philips GR2.1 Chassis

This set produced a raster of sorts and the green LED was flashing. The manual says that a flashing green LED indicates a microcontroller fault. This was a red herring however. The HT was low when connected to the line output stage, but correct when a bulb was connected as a substitute load. So you might have expected a line output

stage fault, and the transformer looked to be the most likely suspect. But a replacement made no difference. I then did what I should have done in the first place and checked the protection circuit in the power supply. As it was in operation, I decided to try disabling it. The result was smoke from the audio output chip. When this item had been replaced the set worked normally. **M.M.**

Hitachi C2848TN

This Dolby Surround set produced a picture but no sound. Checks showed that the separate audio power supply was tripping. The tripping continued when both audio output chips had been removed. Further checks brought me to D9112 which was short-circuit. **M.M.**

Sony AE1A-C Chassis

The field scan coupling capacitor C531 (680 μ F, 25V) is the cause of many field faults with these sets. Non-linearity is usually the first symptom. Sony now supplies a 680 μ F replacement rated at 50V, 105°, part no. 1-111-123-11. **M.M.**

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HELP WANTED

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

Wanted: Original stand for a Thomson 81DXC69DLU 32in. widescreen TV, new or secondhand. Phone 01634 832 526 daytime or 01322 559 157 evenings (Dartford, Kent) and ask for Andy.

Wanted: Video drum for the Philips VR2324/Pye 23VR33 or a complete V2000 type VCR with good head. Brian Nockolds, Moorlands South, Belstone, Okehampton, Devon EX20 1QZ. 01837 840 184, fax 01837 840 884.

Wanted: Circuit diagram for the Cambridge Audio P40 amplifier; circuit diagram and tuning data for the Mende S216W table radio; floppy disc drive for the Dell NL25 lap-top PC - prepared to break complete one for spares but FDD must be working. W. Milne, 20 Graham Road, Wimbledon, London SW19 3SR. 0181 543 9542.

Wanted: Focus potentiometer for the ITT Model CB9504T - or a potentiometer with 20MΩ resistance and ability to handle high voltage. Colin Willmott, 18 Lime Grove, Alton, Hants GU34 2AF. 01420 87 193.

Wanted: Service sheets/manuals for the following radio cassette recorders: Triumph RR3010, Philips 22AR584/15. F.R. Moss, 6 Rosemary Lane, Leintwardine, Craven Arms, Shropshire SY7 0LP. 01547 540 465.

Wanted: Circuit diagram for the Sharp R-8H50(B)T microwave oven, including the control panel PCB (FA203DR). Brian Long, Longster, Smerral, Latheron, Caithness KW5 6DW. 01593 741 249.

Wanted: MAC PCB for the Amstrad SRD600 PAL/MAC satellite receiver. Geoff Upton, 10 Sycamore Close, Hull HU5 5FD.

Wanted: User instructions for the Sharp VCA5011HM and Matsui VX990 VCRs. Also circuit diagram and/or manual for the Toshiba SAV10 stereo receiver. Photocopies OK. T. Steel, 185 Charter Road, Chippenham, Wilts SN15 2RF.

Wanted: Any circuit diagrams/Trader service sheets for valve and transistor radios. Also help with standards conversion for a Bush Model T76C. Thomas McGhee, 8 Linlithgow Place, Kingoodie, Dundee DD2 5DG. 01382 562 796.

Wanted: Control panel assembly, working or faulty, for the Ferguson TV Models

51/59/66H5. Also a control flap for the Panasonic NVG10 VCR. Allan Crathorne, 2 Harden Close, Walsall WS3 1BU. 01922 492 088 (between 2100-2300).

Wanted/for disposal: Need teletext board for the Ferguson ICC9 chassis. Have for disposal a number of LOPTs. W. Simmons, 24 Standhill Crescent, New Lodge, Barnsley, S. Yorkshire S71 1SU. 01226 238 204.

Wanted: SN76730N chip or equivalent for the Panasonic Model TC2031, also a mains transformer (QLP0722A or QLP0564A) for the Panasonic RS260US cassette deck. H. Mode, 24 Steven Court, Egerton Road South, Manchester M21 0XH.

Wanted: Service manual or circuit diagram for the BT 202B answering machine (also known as the Robin). B.C. Polkinghorne, 92 Maplefield, Park Street, St. Albans, Herts AL2 2BH. 01727 872 983.

Wanted: Service manual or circuit diagram for the Epson VP100PS LC video projector Model E1001, or layout showing and identifying the presets. T. Bamford, 42 Heanor Road, Smalley, Derbyshire DE7 6DW. Fax 01332 882 324.

Wanted: Service manual, circuit diagram and user's manual for the 5001 counter-timer made by Continental Specialists, and the same items for the Philips V6150 stereo video tuner. Photocopies OK. B.R. McLeod, 8 Cunningham Road, Horndean, Portsmouth PO8 9LT. 01705 597 941.

Wanted: Circuit diagrams for the following computer monitors: Philips 3CM980/05T; Elonex CDS4586; Dell VC2E (manufactured Nov. 1991); ICL 14814/001 (July 1992). F.O. Tester, 31 Longsands Road, St. Neots, Cambridgeshire PE19 1SS.

For sale: Newnes *Radio and TV Servicing* volumes dated 1953-54, 1965-66, 1967 to 1970 (three volumes), 1971-72, 1975-76 and 1982-83. Offers please about £4 each plus carriage. David Forfar, 65 Ormskirk Road, Old Skelmersdale, Lancs WN8 8TR. 01695 735 132.

Wanted: H-Stat unit, part no. 1.228.11, for the Sony Model KV27XRU. This item is mounted on the CRT shield. A.G. Chamberlain, 62 St. Lukes Road, Bournemouth BH3 7LU. 01202 521 990.

Wanted: Complete capstan drive motor or M52440ASP chip for the Saisho VR3400/Matsui VX3000. Also SA2006AE capstan drive chip for the Hitachi VT520E. Robert McCormack, 21 Knockenagh Walk, Newtownabbey, Co. Antrim, N. Ireland. 01232 854 792. Or e-mail robert@soundservice.demon.co.uk

Wanted: Any Philips test equipment, spares or whole instruments, in particular spares for the PM3267 100MHz oscilloscope. Laurence Cope, 69 Corondale Road, Weston-super-Mare, Somerset BS22 8PY. 01934 415 441 (evenings).

Wanted: Circuit diagram for the Grundig Como radiogram (made about 1968). Photocopy OK. W. Hamilton, The Riggs, Whiting Bay, Isle of Arran KA27 8QL. 01770 700 296.

Wanted: User manual for the JVC GX78E camera, also a circuit diagram if possible. P.M. Rae, 158 Blackberry Lane, Four Oaks, Sutton Coldfield B74 4JJ. 0121 303 1953.

Wanted: VCU2100A chip for the digiborder in an ITT Digivision TV. Ray Dolphin, 30 Golden Cross Road, Rochford, Essex SS4 3DG. 01702 545 984.

Wanted: Loan of manual for the Aiwa ADR650 three-head cassette deck. Mechanism is inoperative. No click from the degaussing relay, some LEDs dim, nothing obviously amiss with the power supply. Any suggestions? Nicholas Arnold, 17 Fairway, Merrow, Guildford GU1 2XQ. 01483 573 491.

Wanted: Loan of service manual for the Barco Vision II CRT projector. Clive Patey, 44 Crandley Court, Deptford, London SE8 5SA. 0181 692 8129.

Wanted: Photographs, information, drawings, recollections etc. on the BBC Children's Television caravan (large enclosed vehicle), circa late Fifties, also Lime Grove Studios, Shepherds Bush, including demolition in the Nineties. For research projects. Richard Hawkins, Fox Cottage, 19B Brodrick Avenue, Gosport, Hants PO12 2EN.

Wanted: Where can I obtain a 64µsec PAL delay line suitable for use with the V7021 PAL-RGB decoder chip (manufactured by Sony)? Jim Anderson, 35 Orchard Way,

Continued on page 731

TRANSISTORS/LINEAR ICs

Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price	Part	Price		
BC107	8p	BD434	30p	BU126	65p	BUV48AF	325p	MJ4502	300p	4N35	50p	LINEAR ICs	AN6340	600p	BA335	55p	BA7004	200p	
BC108	8p	BD435	31p	BU128	125p	BUV48C	250p	MJ10012	300p			AN6341	200p	BA338	80p	BA7007	200p		
BC109	8p	BD436	30p	BU133	125p	BUV50	250p	MJ11015	250p			AN6342	325p	BA340	75p	BA7021	180p		
BC140	10p	BD437	28p	BU137	150p	BUV61	1000p	MJ11016	300p	RECTIFIER DIODES	AN210	165p	AN6344	440p	BA343	60p	BA7022	350p	
BC141	20p	BD438	36p	BU180	100p	BUV70	200p	MJ11032	800p			AN211	150p	AN6345	400p	BA336	175p	BA7025L	100p
BC142	20p	BD439	40p	BU184	100p	BUV90	175p	MJ11033	800p	BY127	8p	AN217P	95p	AN6346	350p	BA301	80p	BA7107	475p
BC143	20p	BD440	40p	BU204	65p	BUV93	375p	MJ15003	250p	BY133	40p	AN228	280p	AN6350	610p	BA402	50p	BA7252S	150p
BC147	8p	BD441	40p	BU205	70p	BUW11A	200p	MJ15004	300p	BY164	35p	AN252	150p	AN6356	300p	BA514	160p	BA7604N	100p
BC149	8p	BD533	50p	BU207	150p	BUW12	125p	MJ15016	350p	BY179	35p	AN259	230p	AN6359	500p	BA516	150p	BA7751LS	150p
BC158	8p	BD534	38p	BU208	70p	BUW12A	150p	MJ15022	400p	BY208	15p	AN271	250p	AN6360	320p	BA518	150p	BA7752	250p
BC160	30p	BD535	38p	BU208	70p	BUW12A	150p	MJ15022	400p	BY214	11p	AN274	250p	AN6362	400p	BA521	100p	BA7755	150p
BC171	10p	BD536	38p	BU208A	75p	BUW12F	250p	MJ15023	400p	BY227	19p	AN277B	400p	AN6367NK	400p	BA524	240p	BA7767AS	155p
BC172	10p	BD537	38p	BU208AB	200p	BUW13A	200p	MJ15024	400p	BY228	15p	AN278	60p	AN6368	275p	BA527	95p	BA15218	60p
BC177	14p	BD538	40p	BU208B	200p	BUW32A	500p	MJ15025	700p	BY228	15p	AN301	60p	AN6368	275p	BA532	100p	CA3140E	38p
BC178	14p	BD643	50p	BU209	100p	BUW48	550p	MJE340	25p	BY228	15p	AN302	650p	AN6367	480p	BA534	220p	CA3140S	35p
BC179	14p	BD645	50p	BU209	100p	BUW49	550p	MJE350	80p	BY299	18p	AN303	250p	AN6367	480p	BA536	150p	CN83A	60p
BC182	7p	BD647	50p	BU225	120p	BUW50	400p	MJE350	80p	BY329-1200	150p	AN304	250p	AN6367	480p	BA546	160p	CN83A	80p
BC182L	7p	BD649	50p	BU226	120p	BUW81A	150p	MJE2955T	65p	BY448	20p	AN303	250p	AN6367	480p	BA546	160p	CX136	600p
BC183	7p	BD675	40p	BU312	90p	BUW85	85p	MJE205T	75p	BY448	20p	AN304	250p	AN6367	480p	BA546	160p	CX139A	750p
BC184	7p	BD677	38p	BU326A	75p	BUX10	150p	MJE13004	100p	BYT13-1000	30p	AN315	210p	AN6367	480p	BA546	160p	CX141	75p
BC184L	7p	BD678	40p	BU406	60p	BUX11	200p	MJE13005	60p	BYV96E	25p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC212	7p	BD679	40p	BU406D	85p	BUX12	150p	MJE13007	100p	BYV96E	25p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC212L	7p	BD680	40p	BU407	55p	BUX20	350p	MJE13009	100p	BYX10	15p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC213	7p	BD681	40p	BU407D	75p	BUX21	450p	MJE15028	200p	BYX55/600	25p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC213L	7p	BD682	45p	BU408	60p	BUX22	450p	MJE15029	200p	IN4002	25p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC214	7p	BD705	50p	BU408D	75p	BUX23	900p	MJE15030	200p	IN4003	3p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC214L	7p	BD707	50p	BU409	85p	BUX37	220p	MJE15031	400p	IN4004	3p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC237	7p	BD709	50p	BU412	175p	BUX39	450p	MJE18004	125p	IN4005	3p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC238	7p	BD711	50p	BU413	175p	BUX40	210p	MJE18004	125p	IN4006	3p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC300	20p	BD826	50p	BU414B	250p	BUX41	200p	OC29	350p	IN4006	3p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC301	20p	BD828	50p	BU415A	170p	BUX42	220p	OC29	350p	IN4006	3p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC302	20p	BD839	55p	BU433	125p	BUX48A	150p	OC35	350p	IN4006	3p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC303	20p	BD839	55p	BU500	100p	BUX55	80p	OC36	250p	IN4006	3p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC304	25p	BD899	50p	BU500D	125p	BUX80	180p	S2000AF	90p	IN5402	8p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC327	7p	BD977	50p	BU505	90p	BUX81	160p	S2055A	175p	IN5404	8p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC328	7p	BD977	50p	BU505D	90p	BUX84	50p	S2055AF	175p	IN5405	8p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC337	7p	BD977	50p	BU505DF	90p	BUX85	50p	S2530A	100p	IN5405	8p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC338	7p	BD977	50p	BU505DF	90p	BUX85	50p	S2530A	100p	IN5405	8p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC441	28p	BDX47	60p	BU505D	70p	BUX87	50p	TIP29A	22p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC446	18p	BDX46C	75p	BU505DF	100p	BUX98A	350p	TIP29E	25p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC477	18p	BDX62C	150p	BU508A	60p	BUZ71	75p	TIP29E	25p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC516	22p	BDX63C	175p	BU508AF	60p	BUZ71AF	100p	TIP30	25p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC537	25p	BDX64C	175p	BU508APH	60p	BUZ72	100p	TIP30A	25p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC545	8p	BDX66C	175p	BU508DF	85p	BUZ73A	150p	TIP31C	24p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC548	8p	BDX67C	175p	BU508DR	130p	BUZ73AF	60p	TIP32	27p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC549	8p	BDX71	70p	BU508V	110p	BUZ76A	110p	TIP32A	21p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC550	8p	BDX77	175p	BU508VF	100p	BUZ80	135p	TIP32C	28p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC556	8p	BDX87C	175p	BU526	75p	BUZ80AF	200p	TIP32C	28p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC557	8p	BDX88C	175p	BU536	100p	BUZ83	200p	TIP33	30p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC558	8p	BDX92A	50p	BU546	125p	BUZ90A	180p	TIP34	65p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC559	8p	BDW93	50p	BU603	125p	BUZ91A	260p	TIP34C	65p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC560	8p	BDW94	50p	BU603D	225p	BY448	20p	TIP35C	65p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC569	20p	BDY29	225p	BU603D	225p	BYT11	110p	TIP36	65p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BC640	20p	BDY58	500p	BU705	130p	IRF120	225p	TIP41	22p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BCV33	200p	BDY90	125p	BU705DF	175p	IRF140	550p	TIP42A	22p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BCV34	200p	BDY92	100p	BU706F	150p	IRF230	550p	TIP42C	22p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BCV70	16p	BF137	35p	BU724A	100p	IRF240	425p	TIP47	40p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BCV71	16p	BF187	30p	BU801	70p	IRF250	60p	TIP48	40p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BCV72	16p	BF181	30p	BU806	60p	IRF250	60p	TIP48	40p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BD115	30p	BF183	20p	BU807	60p	IRF340	325p	TIP51	80p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BD124P	50p	BF195	7p	BU807F	75p	IRF350	375p	TIP52	80p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BD131	25p	BF199	20p	BU808DF	210p	IRF450	650p	TIP54	80p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BD132	25p	BF210	16p	BU810	110p	IRF510	120p	TIP102	70p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BD133	25p	BF225	30p	BU824	120p	IRF530	120p	TIP105	65p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BD135	20p	BF240	25p	BU826	120p	IRF540	120p	TIP106	65p	IN5407	12p	AN316	210p	AN6367	480p	BA546	160p	CX150B	325p
BD136	20p	BF245	25p	BU826A	120p	IRF540	120p	TIP107	65p	IN5407	12p	AN316							

PINCH ROLLERS

Model	Price	Model	Price	Model	Price	Model	Price	Model	Price
AKAI		FVHP615 , 618, 620, 622, 710, 711, 715, 716, 720, 721, 722, 725, 730		BR5600 , 605, 747, 777, 920, 925	140p	NS7000	140p	681, 682, 684, 685, 693,	
VS10, VS9300, VS9500, VS9700, VS9800, VSP100, VSP77	140p	FVHP810, 830, 840	140p	HR510	140p	ORION		VC699, 700, 770, 779, 780, 781, 7810, 782, 782MM2, 7822, 783,	
V51, VS2, VS3, VS4, VS5, VS6, VS8, VS9, VS12, VS15	140p	FVHP905, 906, 907, 908, 910, 911, 915, 916, 918, 970, 975, 980, 990, FVHP 5000, 5005, 5150, 5075, 5100	140p	BP5000, HRD110, 111, 120, 220, 225, 455	1100p	VH1, VH2	140p	VC785, 786, 787, 793, 800, 7810, 7822, VCT72, VCF63, VCB33, VCA 100, 102, 104, 131, 140, 170, 202, 203, 211, 234, 303, 501, 502, VCA602, 5011, VCD801, 802, 851, 852, 881, 882, VCM73, VCT73, VCT72,	
VS105, 112, 115, 116, 120, 125, 126, 155, 165, 205, 220, 240, 244, 245, VS224, 248, 250, 512, VS515, 516, VSX9	140p	FVHD230, 250, 270, 370, 2000D, FVHP3, 210, 250, 300, 310, 1100		PINCH ROLLER ASSEMBLY		VC150, 180, VH3, 33, 200, 201, 205, 212, 250, 254, 288, 300, 303, 312, VH404, 555, 700, 704, 712, 770, 780, 844, 900, 900, 904, 9030, 3312	140p	VC850, VCB310, VCA103, 103, 105, 106, 211, 211, 244, 254, 33, 35, 36, VCA37, 39, 40, 42, 454, 46, 47, 48, 50, 505, 51, 52, 53, 54, 55, 57, 58, 505,	
VS201, 301, 303, 304, 603, 606, 607, VSP8, VSP82, VPS8, VP82	140p	FVHP1200, 1250, 130, 132, 1340, 1340, 1400, 1410, 1440, 1500, 200, 200		HRD470, 510, 520, 521, 522, 525, 527, 560, 600, 610, 620, 637, 641, HRD650, 720, 830, 840, 910, HRJ205, HR5800	350p	VHF2A, VP2948	140p	VCA60, 605, 615, 62, 63, 67, 68, 1031, 11613, VCB311, 320, VCB597, VCD805, 806, 810, 815, VCB810, 81, 865, 910, VCS 1000, VCT310, VCT470, 610, VCT 1314, 5133, VCR790	140p
VS125, VS155, VS165, VS220, VS240, VS250, VS512	140p	FVHP320410, 420, 430, 440, 445, 470, 475, VSP2905, 495, 2905	140p	PINCH ROLLER ASSEMBLY		COMB 15000, 16000, HV03, LVH50, NEVH, NEVHM, NEVHML	140p	VCA10, 30G, 60, 103, 105, 106, 111, 113, 131, 211, 244, 254, 33, 35, 36,	
VS223, 23, 25, 35, 37, 38, 53, 66, 75, 422, 425, 426, 427, 462, 465, 467, VS485, 765, 766, 767, 768, 865, 867, 965, 967, VS477, VSA650	140p	FVHD140, FVHD40, FVHD55, FVHP1, FVHP10, FVHP20	140p	GOLDSTAR		VP230RC, VCP VH04, 30, 103, 300, 358, 360, 362, 400, 416, 512, VH530, 532, 535, 536, 600, 630, 635, 640, 666, 730, 735, 744, 774, 790	140p	VCA37, 39, 40, 42, 454, 46, 47, 48, 50, 505, 51, 52, 53, 54, 55, 57, 58, 505,	
VSF10, 11, 12, 15, 180, 190, 200, 210, 220, 221, 222, 230, 240, 30, 33	140p	FVHP1200, 1250, 130, 132, 1340, 1340, 1400, 1410, 1440, 1500, 200, 200		GHV51, 1221, 1232, 1233, 1240, 1241, 1242, 1243, 1244, 1245, 1246, 140p		VH1060, 1070, VH1100, 1120, 1204, 1440, 1500, 1660, 1800, 2004, VH2151, 2308, 22042400, 2500, 2600, 2700, VH2960, 2970, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4030, 5020	140p	VCA340, 43, 47, 50, 60, 605, 615, VCD806, 815, VCB80, 81, 83, 85,	
VSF320, 4, 500, 550, VSP88, VSR100, VSX400, 450, 470	140p	GHV181, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430		GHV1240, 1241, 1242, 1248, 1290, 1291, 1295, 1296, 1382, 1383		VH2150, 2900, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4030, 5020	140p	VCA440, 43, 47, 50, 60, 605, 615, VCD806, 815, VCB80, 81, 83, 85,	
VSF260, 261, 262, 265, 270, 274, 275, 280, 330, 340, 350, 410, 420, 430	140p	GHV181, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430		GHV1240, 1241, 1242, 1248, 1290, 1291, 1295, 1296, 1382, 1383		VH2150, 2900, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4030, 5020	140p	VCA440, 43, 47, 50, 60, 605, 615, VCD806, 815, VCB80, 81, 83, 85,	
VSF441, 440, 450, 455, 480, 490, 497, 510, 560, 580, 590, 599, 600	140p	GHV181, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430		GHV1240, 1241, 1242, 1248, 1290, 1291, 1295, 1296, 1382, 1383		VH2150, 2900, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4030, 5020	140p	VCA440, 43, 47, 50, 60, 605, 615, VCD806, 815, VCB80, 81, 83, 85,	
VSF520, 21, 23, 24, 25, 30, 33, 34, 35, 51, 54, 55, 60, 64, 65, 70, 73, 74, 75	140p	GHV181, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430		GHV1240, 1241, 1242, 1248, 1290, 1291, 1295, 1296, 1382, 1383		VH2150, 2900, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4030, 5020	140p	VCA440, 43, 47, 50, 60, 605, 615, VCD806, 815, VCB80, 81, 83, 85,	
VSP110, VSX560, VSX580	140p	GHV181, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430		GHV1240, 1241, 1242, 1248, 1290, 1291, 1295, 1296, 1382, 1383		VH2150, 2900, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4030, 5020	140p	VCA440, 43, 47, 50, 60, 605, 615, VCD806, 815, VCB80, 81, 83, 85,	
VS170, 20, 22, 23, 24, 25, 26, 27, 35, 37, 38, 53, 55, VSA77	775p	GHV181, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430		GHV1240, 1241, 1242, 1248, 1290, 1291, 1295, 1296, 1382, 1383		VH2150, 2900, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4030, 5020	140p	VCA440, 43, 47, 50, 60, 605, 615, VCD806, 815, VCB80, 81, 83, 85,	
PINCH ROLLER ASSEMBLY		GHV181, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430		GHV1240, 1241, 1242, 1248, 1290, 1291, 1295, 1296, 1382, 1383		VH2150, 2900, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4030, 5020	140p	VCA440, 43, 47, 50, 60, 605, 615, VCD806, 815, VCB80, 81, 83, 85,	
VS422, 425, 426, 427, 462, 465, 467, 485, 498, 765, 766, 767, 768, 865,		GHV181, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430		GHV1240, 1241, 1242, 1248, 1290, 1291, 1295, 1296, 1382, 1383		VH2150, 2900, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4030, 5020	140p	VCA440, 43, 47, 50, 60, 605, 615, VCD806, 815, VCB80, 81, 83, 85,	
867, 965, 967, VSA650, VSF10, 11, 12, 14, 15, 180, 190, 200, 210, 220		GHV181, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430		GHV1240, 1241, 1242, 1248, 1290, 1291, 1295, 1296, 1382, 1383		VH2150, 2900, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4030, 5020	140p	VCA440, 43, 47, 50, 60, 605, 615, VCD806, 815, VCB80, 81, 83, 85,	
321, 222, 230, 240, 30, 300, 301, 310, 320, 33, 330, 4, 500, 510, 600,		GHV181, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430		GHV1240, 1241, 1242, 1248, 1290, 1291, 1295, 1296, 1382, 1383		VH2150, 2900, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4030, 5020	140p	VCA440, 43, 47, 50, 60, 605, 615, VCD806, 815, VCB80, 81, 83, 85,	
VSR110, VSX100, 400, 450, 470	800p	GHV181, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430		GHV1240, 1241, 1242, 1248, 1290, 1291, 1295, 1296, 1382, 1383		VH2150, 2900, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4030, 5020	140p	VCA440, 43, 47, 50, 60, 605, 615, VCD806, 815, VCB80, 81, 83, 85,	
PINCH ROLLER ASSEMBLY		GHV181, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430		GHV1240, 1241, 1242, 1248, 1290, 1291, 1295, 1296, 1382, 1383		VH2150, 2900, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4030, 5020	140p	VCA440, 43, 47, 50, 60, 605, 615, VCD806, 815, VCB80, 81, 83, 85,	
VS599	140p	GHV181, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430		GHV1240, 1241, 1242, 1248, 1290, 1291, 1295, 1296, 1382, 1383		VH2150, 2900, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4030, 5020	140p	VCA440, 43, 47, 50, 60, 605, 615, VCD806, 815, VCB80, 81, 83, 85,	
ALBA		GHV181, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430		GHV1240, 1241, 1242, 1248, 1290, 1291, 1295, 1296, 1382, 1383		VH2150, 2900, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4030, 5020	140p	VCA440, 43, 47, 50, 60, 605, 615, VCD806, 815, VCB80, 81, 83, 85,	
VCR3000X, VCR4000	140p	GHV181, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430		GHV1240, 1241, 1242, 1248, 1290, 1291, 1295, 1296, 1382, 1383		VH2150, 2900, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4030, 5020	140p	VCA440, 43, 47, 50, 60, 605, 615, VCD806, 815, VCB80, 81, 83, 85,	
VCR5000, VCR6000	140p	GHV181, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430		GHV1240, 1241, 1242, 1248, 1290, 1291, 1295, 1296, 1382, 1383		VH2150, 2900, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4030, 5020	140p	VCA440, 43, 47, 50, 60, 605, 615, VCD806, 815, VCB80, 81, 83, 85,	
VCR161, VCR222	140p	GHV181, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430		GHV1240, 1241, 1242, 1248, 1290, 1291, 1295, 1296, 1382, 1383		VH2150, 2900, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4030, 5020	140p	VCA440, 43, 47, 50, 60, 605, 615, VCD806, 815, VCB80, 81, 83, 85,	
VCR7000, VCR7800, VCR8000, VCR8800	140p	GHV181, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430		GHV1240, 1241, 1242, 1248, 1290, 1291, 1295, 1296, 1382, 1383		VH2150, 2900, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4030, 5020	140p	VCA440, 43, 47, 50, 60, 605, 615, VCD806, 815, VCB80, 81, 83, 85,	
VT10	140p	GHV181, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430		GHV1240, 1241, 1242, 1248, 1290, 1291, 1295, 1296, 1382, 1383		VH2150, 2900, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4030, 5020	140p	VCA440, 43, 47, 50, 60, 605, 615, VCD806, 815, VCB80, 81, 83, 85,	
AMSTRAD		GHV181, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430		GHV1240, 1241, 1242, 1248, 1290, 1291, 1295, 1296, 1382, 1383		VH2150, 2900, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4030, 5020	140p	VCA440, 43, 47, 50, 60, 605, 615, VCD806, 815, VCB80, 81, 83, 85,	
VC1000, 2000, 4500, 4600, 4700, 5200, 6000, 6100, 6200, 8600,		GHV181, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430		GHV1240, 1241, 1242, 1248, 1290, 1291, 1295, 1296, 1382, 1383		VH2150, 2900, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4030, 5020	140p	VCA440, 43, 47, 50, 60, 605, 615, VCD806, 815, VCB80, 81, 83, 85,	
VC8602, 8603, 8604, 8700, 8704, 8714, 8800, 8804, 9000, 9005,		GHV181, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430		GHV1240, 1241, 1242, 1248, 1290, 1291, 1295, 1296, 1382, 1383		VH2150, 2900, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4030, 5020	140p	VCA440, 43, 47, 50, 60, 605, 615, VCD806, 815, VCB80, 81, 83, 85,	
VCR9244, 9340, DD8900, 8904, TVR1, 2, 3, 4	140p	GHV181, 1900, 2145, 3000, 3010, 4400, 4410, 51, 8000, 8200, GHV8210, 8215, 8430		GHV1240, 1241, 1242, 1248, 1290, 1291, 1295, 1296, 1382, 1383		VH2150, 2900, 3050, VH3060, 4000, 4008, 4010, 4012, 4015, 4015, 4020, 4030, 5020	140p	VCA440, 43, 47, 50, 60, 605, 615, VCD806, 815, VCB80, 81, 83, 85,	
VCR7000	140p	GHV181, 1900, 2145, 3000, 30							

VIDEO SERVICE KITS

<p>AMSTRAD VCR700 <i>Contents</i> BELT SET, PINCH ROLLER, REEL IDLER, VIDEO LAMP Order Code: SK41</p> <p style="text-align: right;">£5.50</p>	<p>HITACHI VT11/VT33 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK08</p> <p style="text-align: right;">£5.00</p>	<p>NV600/NV688 <i>Contents</i> BELT SET, PINCH ROLLER, PLAY IDLER, FF/REW IDLER, TENSION BAND Order Code: SK25</p> <p style="text-align: right;">£12.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, PLAY IDLER TYRE, FF/REW IDLER TYRE Order Code: SK26</p> <p style="text-align: right;">£6.00</p>
<p>FERGUSON & JVC 3V42/43 HR0455/HR0725 <i>Contents</i> BELT SET, PINCH ROLLER, CLUTCH MECHANISM, TENSION BAND Order Code: SK37</p> <p style="text-align: right;">£16.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, SUPPLY CLUTCH, TAKE UP CLUTCH Order Code: SK38</p> <p style="text-align: right;">£9.00</p>	<p>VT11/VT33 <i>Contents</i> BELT SET, T/U/P REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, FF/REW IDLER, CLUTCH PLATE, TENSION BAND Order Code: SK45</p> <p style="text-align: right;">£13.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, FF/REW IDLER TYRE, T/U/P REEL TABLE TYRE Order Code: SK46</p> <p style="text-align: right;">£3.75</p>	<p>NV730/NV770 <i>Contents</i> SLOT IN BELT, LOADING BELT, PINCH ROLLER, IDLER UNIT, TENSION BAND Order Code: SK19</p> <p style="text-align: right;">£5.50</p> <p style="text-align: right;"><i>Economy Kit Contents</i> SLOT IN BELT, LOADING BELT, PINCH ROLLER, IDLER TYRE Order Code: SK20</p> <p style="text-align: right;">£3.00</p>
<p>3V58/59/64/65 HRD170/180/210/230/300/320/370/400/430/530/700/750 HRS5000 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER ARM, TENSION BAND Order Code: SK44</p> <p style="text-align: right;">£7.00</p>	<p>VT52/61/62/63/64/65/85/86/640 <i>Contents</i> BELT SET, PINCH ROLLER, FF/REW ARM, CLUTCH PLATE, TENSION BAND Order Code: SK49</p> <p style="text-align: right;">£14.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, FF/REW IDLER Order Code: SK50</p> <p style="text-align: right;">£3.00</p>	<p>NV370/NV380/480/630/780/830/850/AG2100PK/AG2200PK <i>Contents</i> BELT SET, PINCH ROLLER, IDLER, TENSION BAND Order Code: SK21</p> <p style="text-align: right;">£5.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK22</p> <p style="text-align: right;">£2.75</p>
<p>3V29/3V30 HR7200/7300/7350 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK05</p> <p style="text-align: right;">£5.00</p>	<p>VT400/405/410/13/14/15/18/420/25/26/28/430/31/35/48/450/498/510/520/25/26/530/35/36/540/545/46/48/57/07/575/580/85/88 <i>Contents</i> TIMING BELT, PINCH ROLLER, FF/REW ARM, CLUTCH BASE, TENSION BAND Order Code: SK52</p> <p style="text-align: right;">£9.75</p>	<p>NV777/NV788 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER UNIT, TENSION BAND Order Code: SK17</p> <p style="text-align: right;">£6.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK18</p> <p style="text-align: right;">£4.00</p>
<p>3V35/36, 38/39/49 HRD110/111/120/225 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK04</p> <p style="text-align: right;">£5.00</p>	<p>VT100/110/111/113/115/118/120/125/128/130/135/138/145/150/175/220/225/250/255/258/260/VTL30 <i>Contents</i> BELT SET, PINCH ROLLER, FF/REW ARM, CLUTCH PLATE, TENSION BAND Order Code: SK51</p> <p style="text-align: right;">£14.00</p>	<p>SHARP VC381 <i>Contents</i> BELT SET, PINCH ROLLER, REEL IDLER, TENSION BAND, VIDEO LAMP Order Code: SK47</p> <p style="text-align: right;">£8.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, REEL IDLER TYRE Order Code: SK48</p> <p style="text-align: right;">£3.25</p>
<p>3V31/3V42 HR7600/7610/7650/7655 <i>Contents</i> BELT SET, T/U REEL TABLE TYRE, PINCH ROLLER, REEL IDLER, T/U CLUTCH, T/U IDLER, TENSION BAND, VIDEO LAMP Order Code: SK33</p> <p style="text-align: right;">£11.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, T/U REEL TABLE TYRE, PINCH ROLLER, REEL IDLER TYRE, T/U IDLER TYRE, T/U CLUTCH Order Code: SK34</p> <p style="text-align: right;">£5.00</p>	<p>PANASONIC NV2000/NV2010/NV7000/NV7200/NV7800 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK03</p> <p style="text-align: right;">£5.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRES Order Code: SK02</p> <p style="text-align: right;">£5.00</p>	<p>VC500/VC571/VC582/VC583/VC584/VC5F3 <i>Contents</i> BELT SET, PINCH ROLLER, REEL IDLER, TENSION BAND Order Code: SK60</p> <p style="text-align: right;">£9.50</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, REEL IDLER Order Code: SK61</p> <p style="text-align: right;">£5.00</p>
<p>3V35/36/38/39/49 HRD110/111/120/121/225 <i>Contents</i> BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, T/U CLUTCH, T/U IDLER, REEL IDLER, TENSION BAND Order Code: SK35</p> <p style="text-align: right;">£10.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, T/U CLUTCH, T/U IDLER TYRE, REEL IDLER TYRE Order Code: SK36</p> <p style="text-align: right;">£5.50</p>	<p>NV300/NV330/NV333/NV340/NV366 <i>Contents</i> BELT SET, PINCH ROLLER, TENSION BAND, IDLER TYRE Order Code: SK01</p> <p style="text-align: right;">£5.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE, PULLEY TYRE Order Code: SK14</p> <p style="text-align: right;">£3.50</p>	<p>VC781/VC7810/VC7822/VC785/VC786/VC793/VC800/VCA100/VCA102/VCA104/VCA202 <i>Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT, TENSION BAND Order Code: SK64</p> <p style="text-align: right;">£13.50</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT TYRE Order Code: SK65</p> <p style="text-align: right;">£3.75</p>
<p>3V29/3V30 HR07200/7300/7350 <i>Contents</i> BELT SET, T/U REEL TABLE TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, REEL IDLER, T/U CLUTCH, T/U IDLER, TENSION BAND, VIDEO LAMP Order Code: SK31</p> <p style="text-align: right;">£10.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, T/U REEL IDLER TYRE, SUPPLY REEL TABLE TYRE, PINCH ROLLER, REEL IDLE TYRE, T/U IDLER TYRE, T/U CLUTCH Order Code: SK32</p> <p style="text-align: right;">£5.00</p>	<p>NV2000/NV2010 <i>Contents</i> BELT SET, PINCH ROLLER, FF IDLER, PLAY IDLER, TENSION BAND, VIDEO LAMP Order Code: SK13</p> <p style="text-align: right;">£6.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE, PULLEY TYRE Order Code: SK14</p> <p style="text-align: right;">£3.50</p>	<p>VC681/VC682/VC684/VC685/VC693/VC699/VC6F3/VC700 <i>Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT, TENSION BAND Order Code: SK62</p> <p style="text-align: right;">£13.50</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT TYRE Order Code: SK63</p> <p style="text-align: right;">£5.00</p>
<p>3V44/45/48/53/54/55/57 HRP50/HRD140/150/158/160 HRD250/257/565/566/755 <i>Contents</i> BELT SET, PINCH ROLLER, CLUTCH MECHANISM, TENSION BAND Order Code: SK39</p> <p style="text-align: right;">£15.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER Order Code: SK40</p> <p style="text-align: right;">£9.50</p>	<p>NV7000/NV7200/NV7800 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER UNIT, PLAY IDLER, TENSION BAND Order Code: SK11</p> <p style="text-align: right;">£8.50</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE, CLUTCH TYRE Order Code: SK12</p> <p style="text-align: right;">£3.25</p>	<p>VC881/VC882/VC884/VC885/VC893/VC899/VC8F3/VC700 <i>Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT, TENSION BAND Order Code: SK62</p> <p style="text-align: right;">£13.50</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT TYRE Order Code: SK63</p> <p style="text-align: right;">£5.00</p>
<p>FISHER FVHP905/906/907/908/910/911/916/918 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER, GEAR IDLER UNIT, TENSION BAND Order Code: SK57</p> <p style="text-align: right;">£13.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK58</p> <p style="text-align: right;">£5.00</p>	<p>NV300/NV330/NV333/NV340/NV366 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER UNIT, PLAY IDLER, TENSION BAND Order Code: SK15</p> <p style="text-align: right;">£7.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE, PLAY IDLER Order Code: SK16</p> <p style="text-align: right;">£3.25</p>	<p>VC781/VC7810/VC7822/VC785/VC786/VC793/VC800/VCA100/VCA102/VCA104/VCA202 <i>Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT, TENSION BAND Order Code: SK64</p> <p style="text-align: right;">£13.50</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT TYRE Order Code: SK65</p> <p style="text-align: right;">£3.75</p>
<p>FVHP615/618/620/622/710/711/715/716/720/721/722/725/730/830/840 <i>Contents</i> BELT SET, PINCH ROLLER, IDLER, GEAR IDLER UNIT, TENSION BAND Order Code: SK68</p> <p style="text-align: right;">£11.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK69</p> <p style="text-align: right;">£3.00</p>	<p>NV67/NV69/NV610/NV611/NV612/NV614/NV615/NV616/NV618/NV630/NV6120/NV6130/NV6400/NV465 (PX/AC)/AG1810 (P/K) <i>Contents</i> LOADING BELT, CAPSTAN BELT, PINCH ROLLER, IDLER TENSION BAND Order Code: SK27</p> <p style="text-align: right;">£6.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> LOADING BELT, CAPSTAN BELT, PINCH ROLLER, IDLER TYRE Order Code: SK28</p> <p style="text-align: right;">£3.00</p>	<p>VC781/VC7810/VC7822/VC785/VC786/VC793/VC800/VCA100/VCA102/VCA104/VCA202 <i>Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT, TENSION BAND Order Code: SK64</p> <p style="text-align: right;">£13.50</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT TYRE Order Code: SK65</p> <p style="text-align: right;">£3.75</p>
<p>FERGUSON & J.V.C. 3V38, 3V39, 8943, 8944, 8951, 3V35, 3V36, 3V49, HRD 110, 111, 120, 121, 225 3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V57, 8945, 8947, 8948, HRD 140, 141, 150, 157, 158, 160, 250, HRD257, 455, 565, 566, 725, 755, 8948, 8950, FV10B, 12L, 13H, 14T, 20B, 21R, 22L, 26, 39S, HRD230, 430, 530 3V58, 3V59, 3V64, 3V65, FV11R, 8950, 8951, HRD170, HRD180, HRD370</p> <p style="text-align: right;">CH01</p> <p style="text-align: right;">2800p</p> <p style="text-align: right;">CH02</p> <p style="text-align: right;">2800p</p> <p style="text-align: right;">CH03</p> <p style="text-align: right;">2800p</p> <p style="text-align: right;">CH04</p> <p style="text-align: right;">2800p</p>	<p>NV230/250/260/280/430/450/460/470/650/810/890/AG1200PK/AG1500PK <i>Contents</i> BELT SET, PINCH ROLLER, IDLER, TENSION BAND Order Code: SK23</p> <p style="text-align: right;">£6.00</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, IDLER TYRE Order Code: SK24</p> <p style="text-align: right;">£3.25</p>	<p>VC781/VC7810/VC7822/VC785/VC786/VC793/VC800/VCA100/VCA102/VCA104/VCA202 <i>Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT, TENSION BAND Order Code: SK64</p> <p style="text-align: right;">£13.50</p> <p style="text-align: right;"><i>Economy Kit Contents</i> BELT SET, PINCH ROLLER, REEL DRIVE UNIT TYRE Order Code: SK65</p> <p style="text-align: right;">£3.75</p>

FOR MORE DETAILS OF OVER 500 TYPES OF SERVICE KITS . . . PLEASE RING US!

SERVICE KIT & UPGRADE FOR ONWA TV CHASSIS

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

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

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

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

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

ORDER CODE : ONWAKIT PRICE: 1200p

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

REPLACEMENT VIDEO CASSETTE HOUSINGS

Name	Models	Code	Price	Name	Models	Code	Price	Name	Models	Code	Price
AKAI	VS35, VS53, VS55, VS56, VS75	CH18	3200p	FV31R	HRD515, 520, 527, 540, 550, 580, 600, 610, 620, 660, 670, HRD830, 840, 850, 860, 4050, 6600, FV37H, HRD540, 580, 830, 860, 910, 960, HRD970, HRD X20,	CH19	4300p	VCA103, 103GV, 106, 106GVM, 254GVM		CH23	2500p
GRANADA	VHSOP1, VHSYJ2	CH05	1100p	FERGUSON	FV57H	CH27	2400p	VCS211, 244, 5055, 605, VCB230, VCD806G, 810G, VCT212, 310, 410G, 610		CH24	2500p
GOLOSTAR	GHV1290P, 1291P, 1295P, 9400, 73401, GSE1295P, GSE1891P, 20001Q, 20051Q, VCP4200, 4300, 4301, 4305, VCP4306, 4311, 4315, 4316, 4320, 4321, 4325	CH25	2000p	I.T.T.	VR3605, VR3905	CH01	2800p	VR2970		CH02	2800p
	GHV51, 1221, 1232, 1240, 1241, 1242, 1244, 1246, 1248, GHV8000, 8200	CH26	2900p		VR3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948	CH02	2800p	V320, 321, 323, 326, 4200, 4300		CH01	2800p
FERGUSON & J.V.C.	3V38, 3V39, 8943, 8944, 8951, 3V35, 3V36, 3V49, HRD 110, 111, 120, 121, 225	CH01	2800p		VR3916, 3926, 3946, 3948, 3976, 3986, 3995, 3997, 6948	CH02	2800p	V342, 343, 352, 353, 360, 364, 368, 4210, 4230, 4260, 4400, V5500, 6000, 8540		CH02	2800p
	3V42, 3V43, 3V44, 3V45, 3V48, 3V53, 3V54, 3V55, 3V57, 8945, 8947, 8948, HRD 140, 141, 150, 157, 158, 160, 250, HRD257, 455, 565, 566, 725, 755, 8948, 8950, FV10B, 12L, 13H, 14T, 20B, 21R, 22L, 26, 39S, HRD230, 430, 530	CH02	2800p	NATIONAL PANASONIC	NV730	CH06	4300p	V55, V57		CH01	2800p
	3V58, 3V59, 3V64, 3V65, FV11R, 8950, 8951, HRD170, HRD180, HRD370	CH03	2800p	N.E.C.	N830EG, N831EG, N831EG, N832, N833EG, N895	CH01	2800p	V65, V66		CH02	2800p
		CH04	2800p	PHILIPS	CASSETTE LIFT ASSEMBLY (66120366)	CH02	2800p				
					DV186, 190, 286, 471, 562, 761, VR6180, 6182, 6185, 6285, VR6290, 6291, 6293, 6362, 6367, 6393, 6467, 6468, 6470, VR6561, 6670, 6780, 6761, 6870, 6970	CH05	1100p				
					VR6443, VR6448, 49SB6	CH22	2900p				
					VCA100, VCH851, VCH852	CH24	2500p				
						CH22	2900p				

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AMSTRAD MOD KIT

☆☆

* FITS :

* VCR 4500, 4600, 4700, 5200, TVR 1,2,3

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PRICE : £2.25 + VAT each

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MODE SWITCH

NV2000, 2010, 7000, 7200, 7800 (VSS0048)	
NV230, 260, 430, 810, 870, 2300, 4300 (VSS0110)	£3.50
NV830 (VSS0091)	£2.25
NV300, 333, 340, 366, 688, 777, 778 (VSS0060)	£2.10
NV300, 333, 340, 366, 688, 777, 778 (VSS0060)	£3.75
NVG21, 25, NVH65, NVD80 (VSS0175A)	£2.00

AUDIO CONTROL HEADS

AMSTRAD ORIGINAL NO: 150751
 Used on: AMSTRAD TVR1, 2, 3, VCR4600, 4600MKII, 4700, FUNAI VS2, VCR4600, 4800, 5200, 5800, 6600, VIP3000, 5000
 Also fits: FIDELITY, FUNAI, HINARI, PROLINE, SCHNEIDER, TOWADA, UNIVERSUM **ORDER CODE: AH01 PRICE: 1350p**

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

Replacement Audio Control Video Sound Head for National Panasonic

PART NUMBER	MODELS	PRICE
VBR 0091	NV67 etc	875p
VBR0050	NV300, NV340 etc	875p
VBR0061	NV777 etc	875p
VBR0103A	NV250, NV450 etc	625p
VBR0125		625p

VIDEO TOOLS

VIDEO CLEANING STICKS

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

VIDEO MAINTENANCE TOOLS

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

UNIVERSAL HEAD EXTRACTOR

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

VCR ALIGNMENT KIT

CONTAINS: SET OF 7 HEAD & TAPE PATH ALIGNERS

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

SET OF 8 ALLEN KEYS

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

3 REVERSIBLE SCREWDRIVERS
SPRING HOOK

CIRCLIP PLIERS
MICRO SCREWDRIVER

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

TRANSPARENT REPAIR/ADJUSTMENT CASSETTE

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

Order code: TOOL 23, Price 500p

BACK UP BATTERIES

PHILIPS

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

Price: 70p

Price: 135p

FERGUSON

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

Price: 90p

Price: 150p

SATELLITES

MAKE & MODEL	CODE	PRICE
PACE PRD800, PRD900	SATPSU1	600p
PACE SS9000, 9200, 9010, 9210, 9220	SATPSU2	550p
AMSTRAD SRD510, SRD520	SATPSU3	600p
AMSTRAD SRD500	SATPSU4	600p
AMSTRAD SRX340, SRX345, SRX350	SATPSU5	600p
PACE D100/150	SATPSU6	650p
CHURCHILL D2MAC	SATPSU7	650p
PACE MSS100	SATPSU8	730p

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

SATELLITE TUNERS

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

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

SWITCH MODE TRANSFORMERS

PACE 9000
 ORDER CODE: PACE9000 PRICE: 800p

PRD800/PRD900
 ORDER CODE: PRD800 PRICE: 550p

SATMETER

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

Through operation with satellite RX powering the LNB.

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

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

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

* Max. input signal: -10 DBM

ORDER CODE: TOOL22 PRICE: 8500p

REPLACEMENT TV SWITCHES

GRUNDIG

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

PHILIPS

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

SONY

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

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

SONY

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

SONY 2 PIN FUNCTION SWITCH

Order Code: SW9 Price: 35p

FUSES

CURRENT RATING	TIME LAG (20mm)		QUICK BLOW (20mm)	
	ORDER CODE	PRICE	ORDER CODE	PRICE
100mA	FUSE36	75p	FUSE37	60p
160mA	FUSE01	75p	FUSE17	60p
250mA	FUSE02	75p	FUSE18	60p
3.15mA	FUSE03	75p	FUSE19	60p
400mA	FUSE04	75p	FUSE20	60p
500mA	FUSE05	75p	FUSE21	60p
630mA	FUSE06	75p	FUSE22	60p
800mA	FUSE07	60p	FUSE23	60p
1A	FUSE08	60p	FUSE24	60p
1.25A	FUSE09	60p	FUSE25	60p
1.6A	FUSE10	60p	FUSE26	60p
2A	FUSE11	50p	FUSE27	60p
2.5A	FUSE12	50p	FUSE28	60p
3.15A	FUSE13	55p	FUSE29	50p
4A	FUSE14	55p	FUSE30	50p
5A	FUSE15	60p	FUSE31	50p
6.3A	FUSE16	60p	FUSE32	50p

CERAMIC PLUG TOP

CURRENT RATING	ORDER CODE	PRICE
3A	FUSE33	100p
5A	FUSE34	100p
13A	FUSE35	100p

32 mm CERAMIC SLOW BLOW

CURRENT RATING	ORDER CODE	PRICE
8A	FUSE44	185p
10A	FUSE45	185p
15A	FUSE46	185p
20A	FUSE47	210p

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

20mm CERAMIC TIME LAG

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

38mm CERAMIC TIME LAG

CURRENT RATING	ORDER CODE	PRICE
10A	FUSE48	825p

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

VOLTAGE TESTER

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

SPRING HOOK

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

FAULT FINDING / COMPARISON BOOKS

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

TELEVISION Edition 6

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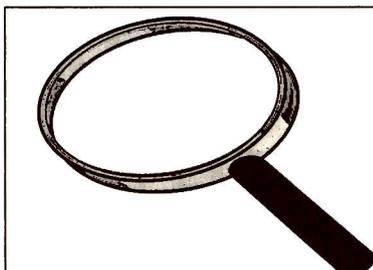
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XCAP1, CKL7, CKL8, CKLCS0P, CXZ58, DXM740, DXM75, DXM76, DXM77, LCX50, LCX7, LCX8G, LCXAP1, XC002, XC004, XC005, XC777	KSS210B	2000p
XP31, XP33, XP55, XP80G	KSS220A	2500p
XP6, XP7	KSS331A	3400p
AKAI		
CD73, DC93	KSS151A	1900p
CD25, CD26, CD27, CD32, CD36, CD37, CD52, CD55, CD57, CD650, CD670, CD68, CD750, CD79, CDM480, CDM600, CDM670, CDM770, CDM959, MX550, MX570, MX650, MX670, MX750, MX950	KSS210A	1800p
DENON		
DCD1500II, DCD1520, DCD15350	KSS151A	1900p
DCD1400, DCD600, DCD800	KSS152A	1600p
DCD1420, DCD520, DCD610, DCD620, DCD660, DCD810, DCD820, DCD860, DCD910, DCD920	KSS210A	1800p
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CDP65	KSS331A	3400p
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CDRADIO CASSETTE, MINI SYSTEMS - MODEL S 1990-1992	OPTIMA4S	5000p
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RDX42, DPC72, DPC77, DPC80, DPC92	KSS220A	2500p
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DPC321, DPC521, DPC631, DPC631K, DPC721, DPC731	KSS331A	3400p
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N32, N90M, PD101, PD201, PD32, PD41, PD450M, PD4700, PD52PD5700, PD651, PD6500, PD6700, PD7700, PD8700, PD970, PDCP20M, PDCP20T, PDJ400T, PDJ500T, PDJ800M, PDJ900M, PDM430, PDM450, PDM550, PDM650, PDM750, PDM901, PDP110T, PDP270T, PDP910M, PDP910M, PDS301, PDS301, PDS701G, PDS901, PD310, PD310, PDZ, PDZ570T, PDZ74T, PDZ84M, PDZ970M, PXA1349, S1260T, S1360T, S303CDM, S303CDT, S505DM, S505DT, S707DM, S707DM, S909DM, S909T, XCF410M, XCF410T, XZD54T, XZD55T, XZD64M, XZD64T, XRP310, XRP320	PEA1030	4400p
PDM400, PDM410, PDM500, PDM510, PDM600, PDM610, PDM700, PDM710, PDM730, PDT303, PDT403, PDT503, PDX940M, PDX950M, PDZ560T, PDZ72T, PDZ73T, PDZ81M, PDZ82M, PDZ83M, PDZ960M, XZD53T, XZD54T, XZD55T, XZD62, XZD62M, XZD630, XZD630, XZD630	PWY1009	4800p
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RCD1200, RCD1300, RCD1350, RCD1600, RCD2600, RCD990, RCD995, SCM6900	SOH90T4N	3600p
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DCD12, PART NO. 6450055968	645005	3700p
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SHARP		
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QT-90CD, QT-60CD, QT80CD, PART NO. RCTRHB124AFZZ	RH8124AF	2900p
DXR-840B, PART NO. RCTRHB130AFZZ	RH8130AF	2900p
CDS360E, 360H, 370, 450HE, CMS150CDH, CMSR400CDH, CP150, CPR400, CPS360, 370. PART NO. RCTRHB136AFZZ	RH8136AF	4500p
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KSS151A	KSS151A	3500p
KSS151A	KSS151A	1900p
KSS210A	KSS210A	1800p
KSS210B	KSS210B	2000p
KSS220A	KSS220A	2500p
KSS331A	KSS331A	3400p
KSS360A	KSS360A	2600p
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RCV 37 B	RC891	650p	A5088470	RC902	650p	TC2200	RC204	650p	32 CHANNEL	RC140	650p
V25A	RC896	650p	A518612	RC903	650p	VS00357/NV730	RC202	650p	RM613	RC141	650p
DECCA			SCL002	RC904	650p	TNQ1621	RC203	650p	RM632, RM636	RC160	600p
RC70	RC894	650p	C2096	RC905	650p	PHILIPS			TATUNG		
FISHER			A511940	RC906	650p	RC5002,5154	RC134	650p	FXA	RC877	650p
RC905B	RC879	650p	656502H	RC1920	650p	KT3 NON TEXT	RC135	650p	RC70	RC883	650p
GRANADA			ITT			69117032	RC178	650p	FX70 FASTTEXT	RC894	650p
UNIVERSAL TEXT	RC309	650p	IFB13, 14, 15	RC143	650p	69117194	RC180	650p	TELEFUNKEN		
MK4 TEXT, 70155G, 70115G, 70133G	RC880	650p	FS4	RC148	650p	RC5991-UNIV	RC300	550p	FB632	RC632ST	650p
95288E	RC882	650p	RG305	RC305	650p	RC38	RC301	650p	FB639	RC639	650p
94490D	RC884	650p	RG306	RC306	650p	KT3 TEXT	RC5301	650p	THORN/FERGUSON		
GRUNDIG			FS9/1-10/1	RC307	650p	RC5352	RC5352	650p	3V35-42	RC342	600p
TP160E	RC107	650p	VSS RUK	RC308	650p	RC5375	RC5375	650p	3V31-32	RC344	650p
TP200, TP300	RC380	650p	VS4-1	RC308	650p	RC5 STANDARD	RC300	550p	3V57-58	RC628	650p
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TP621	RC612	650p	MATSUI			86173	RC882	650p	3V55, FV11	RC783	650p
TP630, TP650	RC650	650p	010270601	RC889	650p	SANYO			TX100 FASTTEXT	RC789	650p
TP666	RC660	650p	VX770	RC892	650p	RC218, RC222, RC228, RC238	RC140	650p	TX100 ST, FASTTEXT	RC789	650p
TP661	RC661	650p	NOKIA			JXGE	RC878	650p	PROFESSIONAL	RC790	650p
HITACHI			SATELLITE	RC550	650p	JXDE	RC884	650p	TOSHIBA		
CLE800-CLE830	RC140	650p	ORION			VHR2300	RC890	650p	CT937	RC950	650p
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AKAI			2424583	LOT44	1050p	4515 01 24	LOT137	1800p	TLF 14521 F	LOT39	1850p	094-01021/0.6	LOT59	1400p	1-439-303-32	LOT94	1300p
45150344	LOT56	1650p	2423201	LOT79	1800p	4515 01 46	LOT136	1800p	TLF 14567 F	LOT39	1850p	094-01027/0.0	LOT186	1825p	1-439-311-00	LOT95	1550p
101-214017-03	LOT278	1300p	2432461	LOT169	1500p	4515 03 01	LOT169	1500p	TLF 14568 F	LOT40	1500p	094-01038/0.7	LOT245	1900p	1-439-311-11	LOT95	1550p
101-220005-03A	LOT72	1600p	2432611	LOT80	1800p	4515 03 02	LOT180	1550p	TLF 14584 F	LOT41	2000p	094-01052/0.8	LOT186	1825p	1-439-311-13	LOT95	1550p
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D 058/37	LOT56	1850p	2432981	LOT37	1200p	4515 03 06	LOT168	1550p	TLF 70012	LOT78	1500p	610.018.6637	LOT215	1800p	1-439-331-22	LOT96	1550p
D 059/37	LOT200	1400p	2432981	LOT37	1200p	4515 03 08	LOT22	1250p	TLF 70012 F	LOT78	1500p				1-439-331-41	LOT98	1550p
D 069/37	LOT56	1850p	2432982	LOT37	1200p	4515 03 09	LOT178	1500p	TLF 70012A	LOT78	1500p				1-439-332-00	LOT99	1600p
FCM 2015 AL	LOT78	1600p	2433011	LOT171	1650p	4515 03 10	LOT168	1550p	TLF 70018	LOT274	1550p				1-439-332-11	LOT99	1600p
FERGUSON			2433012	LOT171	1650p	4515 03 13	LOT30	1250p	TLF 70018 F	LOT274	1550p				1-439-332-21	LOT100	1500p
00 D-3-508-001	LOT38	1250p	2433014	LOT171	1650p	4515 03 14	LOT174	1400p	TLF 70161	LOT278	1300p				1-439-332-42	LOT100	1500p
00 D-3-508-002	LOT38	1250p	2433212	LOT168	1500p	4515 03 15	LOT22	1250p	TLF 70162	LOT278	1300p				1-439-332-52	LOT101	1450p
00 D-3-508-003	LOT276	1400p	2433291	LOT172	1350p	4515 03 18	LOT192	1550p	TLF 70162A	LOT272	1600p				1-439-333-00	LOT100	1500p
00 D-3-515-001 PL1	LOT276	1400p	2433301	LOT246	1600p	4515 03 19	LOT30	1250p	TLF 70162B	LOT272	1600p				1-439-333-11	LOT100	1500p
00 D-4-208-001	LOT79	1600p	2433441	LOT188	1900p	4515 03 20	LOT190	1650p	TLF 70162G	LOT272	1600p				1-439-333-12	LOT100	1500p
00 D-4-208-002	LOT79	1600p	2433442	LOT191	1600p	4515 03 22	LOT196	1550p	TLF 77001 B	LOT274	1550p				1-439-333-13	LOT100	1500p
00 D-4-235-001	LOT240	1250p	2433451	LOT81	1350p	4515 03 24	LOT194	1550p	PHILIPS						1-439-333-14	LOT100	1500p
00 D-4-235-002 HTI	LOT81	1350p	2433452	LOT82	1250p	4515 03 25	LOT22	1250p	4822 140 10142	LOT142	1800p				1-439-333-15	LOT100	1500p
00 D-4-235-00201G	LOT81	1350p	2433453	LOT82	1250p	4515 03 28	LOT198	1550p	4822 140 10145	LOT134	1450p				1-439-333-16	LOT100	1500p
00 D-4-260-004 HTI	LOT38	1250p	2433455	LOT234	1600p	4515 03 28	LOT27	1450p	4822 140 10146	LOT112	1700p				1-439-333-17	LOT100	1500p
00 H-0-701-2400	LOT182	1450p	2433521	LOT85	1600p	4515 03 29	LOT193	1550p	4822 140 10151	LOT102	1700p				1-439-333-18	LOT100	1500p
06 D-3-083-001	LOT82	1250p	2433581	LOT22	1250p	4515 03 30	LOT179	1550p	4822 140 10161	LOT103	1250p				1-439-333-19	LOT100	1500p
06 D-3-083-002	LOT82	1250p	2433721	LOT83	1400p	4515 03 31	LOT207	1550p	4822 140 10171	LOT104	1500p				1-439-333-20	LOT100	1500p
06 D-3-084-001	LOT23	1400p	2433751	LOT01	1300p	4515 03 34	LOT58	1850p	4822 140 10176	LOT114	1150p				1-439-333-21	LOT100	1500p
06 D-3-087-001	LOT23	1400p	2433752	LOT250	1350p	4515 03 35	LOT193	1550p	4822 140 10184	LOT105	1500p				1-439-333-22	LOT100	1500p
06 D-3-088-001	LOT84	1450p	2433752	LOT23	1400p	4515 03 38	LOT27	1450p	4822 140 10198	LOT116	1600p				1-439-333-23	LOT100	1500p
06 D-3-093-001	LOT204	1600p	2433891	LOT23	1400p	4515 03 40	LOT200	1400p	4822 140 10201	LOT104	1500p				1-439-333-24	LOT100	1500p
06 D-3-095-001	LOT87	1000p	2433892	LOT23	1400p	4515 03 41	LOT200	1400p	4822 140 10202	LOT118	1550p				1-439-333-25	LOT100	1500p
06 D-3-095-002	LOT87	1000p	2433893	LOT23	1400p	4515 03 43	LOT198	1550p	4822 140 10246	LOT111	1500p				1-439-333-26	LOT100	1500p
06 D-333-512-001	LOT204	1600p	2433895	LOT33	1000p	4515 03 44	LOT58	1850p	4822 140 10247	LOT105	1500p				1-439-333-27	LOT100	1500p
FETX 100 90 DEG	LOT04	1500p	2434002	LOT200	1400p	4515 03 46	LOT201	1550p	4822 140 10254	LOT107	1450p				1-439-333-28	LOT100	1500p
FETX 90 WHITE	LOT06	1600p	2434141	LOT33	1000p	4515 03 50	LOT27	1450p	4822 140 10263	LOT117	1550p				1-439-333-29	LOT100	1500p
FETX 100 100 DEG	LOT34	1500p	2434141	LOT33	1000p	4515 03 51	LOT27	1450p	4822 140 10269	LOT210	1350p				1-439-333-30	LOT100	1500p
			2434274	LOT44	1050p	4515 03 75	LOT56	1650p	4822 140 10271	LOT208	1650p				1-439-333-31	LOT100	1500p
			2434453	LOT44	1050p	4516 16 01	LOT22	1250p	4822 140 10274	LOT123	1450p				1-439-333-32	LOT100	1500p
			2434455	LOT86	1600p	MITSUBISHI			4822 140 10282	LOT122	1300p				1-439-333-33	LOT100	1500p
			2434593	LOT234	1300p	731003	LOT51	1550p	4822 140 10283	LOT104	1500p				1-439-333-34	LOT100	1500p
			2435062	LOT44	1050p	276-16399	LOT49	1500p	4822 140 10294	LOT125	2150p				1-439-333-35	LOT100	1500p
			2435121	LOT296	1400p	334 B 07803	LOT50	1450p	4822 140 10306	LOT110	1200p				1-439-333-36	LOT100	1500p
			2435131	LOT87	1000p	334 B 078030	LOT50	1450p	4822 140 10325	LOT132	1500p				1-439-333-37	LOT100	1500p
			2435141	LOT251	1450p	334 B 08104	LOT74	1600p	4822 140 10326	LOT122	1300p				1-439-333-38	LOT100	1500p
			2435201	LOT282	1300p	334 B 08108	LOT295	1600p	4822 140 10328	LOT124	1450p				1-439-333-39	LOT100	1500p
			2435301	LOT88	1450p	334 P 18506	LOT51	1550p	4822 140 10349	LOT106	1250p				1-439-333-40	LOT100	1500p
			2435671	LOT89	1600p	334 P 18507	LOT75	1500p	4822 140 10353	LOT284	1450p				1-439-333-41	LOT100	1500p
			2436201	LOT109	1200p	5908-05008A-AA	LOT70	1500p	4822 140 10356	LOT284	1450p				1-439-333-42	LOT100	1500p
			2436202	LOT109	1200p	D 108/37	LOT49	1500p	4822 140 10367	LOT286	1400p				1-439-333-43	LOT100	1500p
			2432101-2	LOT79	1600p	DCF1577	LOT273	1700p	4822 140 10369	LOT109	1200p				1-439-333-44	LOT100	1500p
			2433451H	LOT81	1350p	DCF2077A	LOT272	1300p	4822 140 10381	LOT128	1300p				1-439-333-45	LOT100	1500p
			2433453H	LOT82	1250p	KFS 60226B	LOT279	1550p	4822 140 10384	LOT127	1550p				1-439-333-46	LOT100	1500p
			2433891H	LOT23	1400p	MSH-1FBW08	LOT78	1500p	4822 140 10395	LOT116	1600p				1-439-333-47	LOT100	1500p
			2433892G	LOT84	1450p	NIKKAI			4822 140 10406	LOT73	1150p				1-439-333-48	LOT100	1500p
			I.T.T.			BABY10	LOT67	1450p	4822 140 10421	LOT109	1200p				1-439-333-49	LOT100	1500p
			4515 01 08	LOT113	1400p	ORION			4822 140 10708	LOT103	1250p				1-439-333-50	LOT100	1500p
			4515 01 15	LOT136	1600p	3714002	LOT02	1500p							1-439-333-51	LOT100	1500p
			4515 01 16	LOT139	1675p	PANASONIC									1-439-333-52	LOT100	1500p
			4515 01 17	LOT139	1675p	TLF 14512 F	LOT39	1850p							1-439-333-53	LOT100	1500p



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Helps continued from page 718

Letchworth, Herts SG6 4RZ. 01462 484 920.

Wanted: Complete manual for the ITT Nokia Model FX6320, or possibly a chassis (Core 2 110°). Keith Patton, 1 Glenvale, Duneaney Road, Glarryford, Ballymena, Co. Antrim BT44 9QB. 01266 685 531.

Wanted: Circuit diagram for the Kenwood DPC42 portable CD player. P. Farrugia, 18 Murray Walk, Melksham, Wilts SN12 7AZ. 01225 702 340.

For disposal: Approximately 70 CD service manuals plus approximately 180 audio service manuals, all in very good condition. 48 brand new panel meters 40 x 40 x 29mm, 250µA FSD, scaled signal 0-5. 40 brand new 120 x 65 x 40mm grey ABS boxes with lids and screws. Two brand new Philips CDM2/29 assemblies (includes PCB, disc motor, laser). A large quantity of new Philips CD player hardware (PCBs, ICs, lasers etc.). Offers, or exchange for colour security camera or similar. John Teece, 51 Pine Hall Drive, Monk Bretton, Barnsley, S. Yorkshire. 01226 217 347.

Wanted: SIMMs, 72-pin with parity. Must be either 8Mb Compaq part no. 141685-001 or Kingston part no. KTC-8000/N, or 4Mb Compaq part no. 118690-001 or Kingston part no. KTC4000/N. Offer £3 per Mb. Spectroline PC110A UV EPROM/wafer erasing system with built-in timer, offer £80. Pivottelli very heavy-duty wall-mounting swivel arm for TV or monitor, black finish, with fixings, offer £30. Julian Bohan, 01522 871 926 or 0958 771 319.

Wanted: Does anyone know how to cure teletext lines with the Murphy MC6124/ Bush BC6004 (RRI sets)? A.G. Davies, 16 South Street, Crewkerne. 01460 73 348.

Wanted: Loewe Profit T28 chassis complete and/or tuner type U1100. Have for disposal back issues of *Television* 1990-94 at cost. Peter Hill, 3 Mayfair Avenue, Halifax HX4 9JH. 01422 370 338 evenings.

Wanted: Tuning panel type 14111/ICC for the Fidelity AVS2000, or the ICs on it (SL471.8827ASR and M19281.98349) or equivalents. D. Andrews, 20 Frobisher Court, Old Hall, Warrington WA5 5PQ. 01925 223 432 days, 01925 415 817 evenings.

Wanted: Circuit diagram for the Hartley CT436 double-beam scope. Bruce Adams, Vintage Radio repairs, 53 Red Leasowes Road, Halesowen, West Midlands B63 4SE. 0121 550 0019.

Wanted: User manuals for the Panasonic NV7200 and ITT VR3913 VCRs. Photocopies OK. D.J. Rockliffe, 3 Hewell Lane, Barnt Green, Nr. Birmingham B45 8NZ. 0121 445 5360.

Wanted: Working printhead and/or circuit diagram for the Canon BJC600 colour printer. J.J. Winchcombe, 34 Whitehouse Crescent, Sutton Coldfield, West Midlands B75 6ER. 0121 378 0477.

Wanted: Philips N1500 VCR in good working order. David Goodsell, 7 Gibbons Street, Ipswich, Suffolk IP1 2HL. 01473 413 223.

For sale: Twelve VHS VCRs, some in working order, £70 ono. Buyer collects. Phone 01932 565 248 (Chertsey, Surrey) after 3.30 p.m. and ask for Terry.

Wanted: Main microcontroller chip (IC001) type M50436-511SP for the Sony KV21XRTU (SX chassis). Would be interested in the chip, the main PCB or a complete set. Phone Andy Dyson on 01745 888 889.

Wanted: U-View *Television Servicing* 1987-88 volume. Also a service manual/circuit diagram for the Philips FAX3300 (photocopy OK). Joe S, c/o Petersonpark PO, 14 Yokermill Road, Glasgow G13 4PF. 0141 952 8870.

Wanted: Pre-war Emiscope 3/3 CRT to complete restoration of an HMV TV receiver. Robin Howells, Stourport, Worcs. Please leave message with friend on 01384 872 744. Distance to object.

Free: Panasonic PVM1328 combined 14in. CTV and VHS video. Imported from USA in 1994, hence NTSC/525-lines/110V only. Minor power supply fault otherwise as new. Free if collected promptly. Nicholas Arnold, 19 Bond Street, Bournville, Birmingham B30 2LB. 0121 458 1187 or 01483 573 491.

Wanted/for disposal: Require unbroken control flap for the Hitachi Model CPT2198. Have for disposal about 30 BSB receivers, some still in boxes and new. Open to offers. J. O'Neil, J.F. O'Neil Ltd., 7 Smithy Green, Ince, Wigan WN2 2AT. 01942 242 421, fax 01924 322 944.

Wanted: Tuning control panel 1-606-473-13, also teletext decoder panel with leads, for the Sony Model KV2212 (YE2 chassis). Ron Bruce, 11 New Zealand Way, Rainham, Essex RM13 8JP. 01708 558 792.

Wanted: Connection details and voltage requirements for the following boards: Apollo computer interface board REV 01 003355 (contains 298 ICs); and AB Series 2 (Sweden) basic PC motherboard NB12 117R/R7 (approximately 80 ICs). T.N. Casey, Tallaghan, Edmondstown, Ballaghaderene, Co. Roscommon, Ireland.

Wanted: Pushbutton switch unit for the Ultra FM82 AM/FM radio. H. Trindall, 103 Farebrother Street, Grimsby, Lincs DN32 0JT. 01472 358 994.

Wanted: EHT meter/probe in good condition. Justin Smith, ATV, 419 Langsett Road, Hillsborough, Sheffield S6 2LL. 0114 285 4254.

Wanted: Power supply for the Akai VS-X470EGN. A used one would do (I have the transformer). Also a circuit diagram for this PSU (photocopy OK). S. Akers, 8 Farm Road, Lakeside, Redditch, Worcs B98 8LB. 01527 456 313.

Wanted: Drum motor or complete machine for spares, Panasonic Model NVHD100B. Also working power supply for the Ferguson Model FV3 1LV. Andrew Osbourne, 2 Cedar Tree View, Elkesley, Retford, Notts DN22 8EL. 01777 838 897.

Wanted: SN76730N IC for the Panasonic Model TC2031 and a transformer (T4QLP0564A or QLP0722A) for the Panasonic RS260US cassette deck. H. Mode, 24 Steven Court, Egerton Road South, Manchester M21 0XH. 0161 862 9628 after 6 p.m.

Wanted: LA1357N IF chip for the Sanyo Model CTP3131. D. Jordan, Central Electronics, 6 Queen Street, Stirling KK8 1HN. 01786 451 230.

For disposal: Have twelve old 22in. TVs that are free to collect - Ferguson, GEC, Decca, Sony etc. Arthur Slark and Sons, 43/45 Thicketford Road, Bolton, Lancs. 01204 526 684.

Wanted: Circuit diagram/service manual, copy or loan, for the Pace PRD800 satellite receiver. Can someone tell me the value of RS23 in the Nokia SAT780. S. Outen, 2 Heol Vaughan, Burry Port, Carmarthen SA16 0HF. 01554 833 024. E-mail s.ouden2061@aol.com.

Wanted: LOPT for the Fidelity Model CTV140 (ZX3000 chassis). Need not be new as long as it works. Also two remote control units for this model and one for the ITT VR3917 VCR. M. Payne, 66 Nevinson Avenue, South Shields, Tyne and Wear NE34 8NP. 0191 536 3744.

Wanted: Service manuals for the Grundig Model T51/T56 2406 and Baird FE2423 TV sets. Photocopies OK. Ron White, 29 Nunnery Street, Castle Hedingham, Essex CO9 3ND. 01787 463 091.

Wanted: CRT base panel and tube socket for the Ferguson Model 14M2. Parts from scrap set OK. Also circuit diagram/service manual for this model - photocopy OK. Wayne Brill, 31 Parnell Road, Ipswich, Suffolk IP1 6SP. 01473 742 568.

Wanted/for disposal: Does anyone have any B&O monochrome sets they no longer require? Am having a workshop clear-out, hence Sixties mono sets, early Sony Trinitron sets, early 26in. G8, Sony VCRs (CS-9, F1 etc.), JVC HR3300EK, Hitachi CED Videodisc player and discs, etc., etc. for disposal. Small donation secures anything. Tim Jarman, 7 Cadet Way, Church Crookham, Fleet, Hants GU13 0UG. 01252 616 938.

Wanted: Instruction book and service manual for the Philips VKR6855 Explorer camcorder. Monty Alter, 18 Twyford House, Chisley Road, London N15 6PA. 0181 800 7636.

Wanted: Service manual for the Sanyo VTC6500 Betacord VCR (photocopy OK). Ron White, 29 Nunnery Street, Castle Hedingham, Essex CO9 3ND. 01787 463 091.

Wanted: Lower drum assembly, or just the drum motor stator, for the Sony SLV815UB VCR. Would be prepared to consider a complete drum assembly if the lower section is in good working order. Graham Brock, 2c Weigall Road, Lee, London SE12 8HE. 0181 318 0524 or 0973 167 035.



**Reports from
Eugene Trundle
Gerald Smith
Maurice Kerry
Ronnie Boag
Paul Hardy and
C.J. Guy**

Hitachi VTM720

This machine had suffered from a very intermittent fault – for years! It would sometimes eject a cassette immediately after insertion, or try to pull the empty cradle back in after eject. It would often behave itself for months. We finally tracked the cause of the fault down. When it occurred, the voltage at pin 65 of the syscon chip rose to about 1V instead of 5V. There was an 'invisible' dry-joint at one of the wire links that supply the pull-up resistor R759. **E.T.**

Hitachi VTF641

This machine appeared to be dead, with no deck operation and no front-panel display. The power supply seemed to be working all right, but neither microcontroller chip had a reset pulse. We found that the +5D line voltage was low at 4.6V, because of heavy electrical leakage in the capstan motor. When the deck was unplugged, the display lit up and the control system responded to commands. A new capstan motor restored normal operation.

VTM6XX series models are similar, so you could get the same problem with them. **E.T.**

Hitachi VTF550

Another intermittent front-loading fault! We had fitted new end sensors and a mode switch, but this machine continued, at rare intervals, to try to kick the FL cradle outwards at switch-on with no tape

VCR Clinic

present, or eject the cassette at the completion of front loading. It transpired that the front-loading switch S2102 would sometimes stick in its position. A replacement switch cured the fault forever! **E.T.**

Sharp VCM271

This machine wouldn't accept a tape. But if you took the top cover off it started to work. A new LED restored normal operation. **G.S.**

JVC HRD820

Playback was marred by lines on the picture while the sound was a little too fast. If the capstan was slowed by hand the speed and picture would lock and stay OK until you went to search or stop. Replacing IC401 cured the fault. **G.S.**

Sharp VCM27

This machine didn't erase the previous sound and failed to record the new sound. A check on the erase bias showed that its frequency and amplitude were too high and the waveform was generally unclear. The fault was cured by repairing the print at C623, which is connected to the base of the bias oscillator transistor. **G.S.**

Daewoo V225

This machine came in dead. Checks showed that the primary side of the chopper power supply wasn't working. The cause was the 1µF, 100V start-up capacitor C53 – a replacement restored normal operation. **G.S.**

Sharp VCM271

This machine would accept a tape then promptly eject it. Replacing the start and end sensors cured the fault. **G.S.**

GoldStar T2631

This machine didn't record the audio signal and failed to erase the previous sound track. The bias/erase oscillator wasn't running, but

started up when the full erase head was disconnected. A replacement head, part no. 523-833A, cured the fault. **M.K.**

Sharp VCM271

This machine was brought in because it was dead. Checks in the power supply showed that the output voltages were low and pulsing. Further checks revealed that Q921, a 2SB709 surface-mounted transistor, was leaky. I replaced it with a 2SB710 which cured the fault. **M.K.**

Mitsubishi HS761V/641V

One of these machines was brought in with a fully-laced tape in it. When eject was pressed the guides came back half way then returned to the fully laced position. I removed the tape manually then inserted it in the cassette housing: this produced only a forwards-backwards movement.

These machines have an optical mode control system. The cause of the trouble was the LED D5B5, whose output was low. Replacement cured the fault. We've had this fault on a number of occasions now. The part no. of the LED is 264P696010. **M.K.**

Sanyo VHR286

The customer complained that this machine lost time intermittently and that timer recordings were unreliable. I eventually found that crystal X3002, next to IC302, had a dry-joint at one lead. **M.K.**

GoldStar T161/T1631

There was no capstan servo lock. Playback of prerecorded tapes was OK, but with the machine's own recordings the picture ran through. Replacement of the audio/control head, part no. 225-371A, cured the fault. **M.K.**

Sharp VCH84

The complaint with this machine was intermittent loss of functions.

The cure was to replace the faulty gear assembly part no. NGERH1128GEZZ. **R.B.**

Toshiba V204

There was no playback or E-E picture. The cause was found to be loss of the supply to the RF modulator. Checks showed that CW001 (100µF) was faulty, a replacement curing the problem. **R.B.**

JVC HRJ246

The loading motor would run for a few seconds then the machine would switch to standby. The cause of the trouble was dry-joints at the end sensors. **R.B.**

Sanyo VHR275

This machine chewed tapes in play. Replacing the arm lever load, part no. 613-164-4762, cured the trouble. **R.B.**

Toshiba V204

This machine was dead though the power supply was ticking. Capacitor CP007 (10µF, 50V) had fallen in value – a replacement restored normal operation. **R.B.**

Panasonic NVJ35B

The main complaint, low gain via the tuner/booster unit, was cured by resoldering a number of bad joints in this module. But there was still a problem – severe patterning with the output from the modulator. This disappeared gradually when the machine had been on for a while. C9 in the power supply had fallen in value. **P.H.**

NEC PX1200R

The customer said that this machine would sometimes fail to record and, when setting timed recordings, would show "error" in the display. I also found that it would sometimes auto play a tape even though the record tab was present on the cassette. The cause of the trouble was that the contacts of the record protection switch had gone high-resistance. Replacing this item and giving the machine a 'rubber' overhaul completed the repair. **P.H.**

Nokia VR3783

This centre-deck Hi-Fi VCR would not accept a cassette. The lift was mistimed, and it looked as if someone had already had a go. I retimed the lift and replaced the front loading gear – the tension of its retaining lever had been lost, with the result that the gear moved up the shaft. The timing of the main gears was checked and found to be fine.

There were no damaged teeth. But when the VCR was powered the deck went berserk. I retimed it and operated it manually. As everything seemed to work all right the most likely suspect was the mode switch, which is buried inside the loading block. It was, with a great deal of effort, replaced. Fortunately this cured the problem. **P.H.**

Mitsubishi HSM18V (J Deck)

The mechanism had jammed. I removed the cassette and checked the deck mechanism, which was fine. The problem was being caused by the sense and drive gears on the cassette lift – they had both lost some teeth. Willow Vale do a service kit (77048KT) which cured the fault. **P.H.**

GoldStar KI14V20 (D17 deck)

A cassette was jammed in this combined TV/VCR. When it had been removed and the lift had been refitted a cassette could be inserted. But when play was selected the tape was damaged by the pinch roller as it made its way down the guide.

After watching the operation of the mechanism a few times, using a dummy cassette, I realised that the take-up arm was bent and didn't clear the pinch roller when in its correct position. A service kit (88021FA) from Willow Vale was fitted – it has the take-up arm assembly, the take-up lever and the pinch tower. There is also a kit (88100L) which has only the pinch tower and the take-up lever. A modified pinch roller assembly (88100F) was fitted to complete the repair. **P.H.**

Mitsubishi HSM54

The sound was being played back at slow speed. On investigation I found that the pinch roller wasn't engaging fully because the grease on its guide pin had gone hard. Cleaning and regreasing the guide was the only action required.

I always clean and regrease the guide pin when I get a VCR fitted with this deck. Failure to do so will lead to the pinch-roller assembly sticking on the guide pin and the cam pinch lever breaking. This item can be obtained from Willow Vale – the order code is 77890L. **P.H.**

Panasonic NVSD200

The report said that this machine intermittently locked up and displayed F03. Now the usual cause of

this is the mode switch or its connector, but not this time!

Eventually the fault did put in an appearance – after changing from reverse search to play. There was a whirring from the loading motor, but nothing happened. Then the machine shut down. When repowered it unthreaded normally. An examination of the loading motor revealed that the plastic coupling on its shaft had split. Replacement cured the problem. **C.J.G.**

Hitachi VT11/GEC V4005

The problem was intermittent loss of drum and capstan servo lock. Its cause was traced to intermittent loss of the 4.43MHz input at the servo chip. It comes from the HT3509 thick-film module on the Y/C board. A tap on this chip would instigate the fault – the 4.43MHz output at pin 27 disappeared. But the oscillator in the module didn't stop. We cured the problem by soldering a 1nF capacitor between pin 27 and the side of the crystal farthest from the pin. The owner was saved the cost of this expensive module. **C.J.G.**

GoldStar GSE1290

This machine worked perfectly but its owner complained about a very loud whistle. It came from the piezo 'buzzer' P8501, which proved to have DC leakage. As a result, the oscillator transistor Q502 was permanently biased on. **C.J.G.**

Auto Head Cleaners

Whenever you replace the head in a VCR that has one of these abruptions in it, replace the cleaning roller as well. I had one ruin a new head in a very short time, because it had become hard and abrasive. Better still, remove the thing altogether – I reckon the heads will last a whole lot longer! **C.J.G.**

Ferguson FV91L

There was no drum rotation, only a slight twitch when it attempted to start. The rotor had been pushed too far on to the shaft. If it's pushed all the way down to the bearings, it is too far away from the PCB-mounted stator when the deck is assembled to the PCB. **C.J.G.**

Philips VR203

The sound produced by this Charlie deck VCR suffered from severe wow. None of the usual problems was the cause. Idler 216 turned out to be the culprit. The bearing in this item had seized up. **C.J.G.**

Service notes on the

Mitsubishi EE3 Chassis

John Coombes describes some faults you could experience with these sets and some modifications that might be required

The EE3 chassis is used in a number of Mitsubishi CTV receivers that include AV1 in the model number, e.g. the CT21AV1B, CT25AV1B and CT28AV1B. The sets first appeared in about 1995. The following notes, based mainly on Model CT21AV1B, summarise our fault experiences to date.

No Results

This is often because the line output transistor Q552 has gone short-circuit. A modification kit (AVM5-KIT) is available to deal with the situation. It includes a number of components that may fail should Q552 have gone short-circuit. The components supplied are as follows: R713 (1k Ω – value changed during production), R726 (5.6k Ω – value changed during production), Q552 (type 2SD1556), Q901 (S2000N), R508 (value change to 3.9k Ω , 5W for CT25/CT28AV1 range models only), R991 (4.7 Ω , 10W), zener diode D909 (RD3-0FB2) and a 10 μ F, 25V capacitor which has to be added and is then known as C720. There is also a 22pF capacitor in the kit – this is used in only M5 series models (EE4 chassis).

Replace Q901, R991 and D909 only if they are faulty. R713 and R726 must be changed to the new values and C720 added in all early production receivers whether Q552 has failed or not. Note that R726 is normally unmarked: it's the 10k Ω resistor that is probably attached to the print side of the main PCB with one leg soldered to C717 and the other to pin 12 of IC701 – in later production R726 is on the component side of the board, near Q716. Fit C720 on the print side of the PCB, see Fig. 1.

Q552 may have gone short-circuit because the HT is high. If so, check whether C914 (47 μ F, 35V) is open-circuit.

No results can be caused by failure of circuit protector Z951, which should be updated from 2A to 3.15A.

The cause of the fault can also be in the feed to pin 15 of the TEA2261 chopper control chip IC901, including

the start-up resistors. Check R915 (15 Ω , 2W), R922, R901 and R902 (all 22k Ω , 2W). R902 often goes open-circuit.

If the 2AT mains fuse F991 has blown violently, the S2000N chopper transistor Q901 is probably short-circuit. In this event IC901 (TEA2261) and the TCDT1124G optocoupler PC951 should also be replaced. Check the zener diode D909 (RD3-0FB2) and the current sensing resistors R908 (0.33 Ω , 2W) and R909 (0.22 Ω , 2W) any of which could be open-circuit.

Blank Raster/No Sound

If there is a blank raster and no sound but the on-screen graphics can be displayed, check whether circuit protector Z953 (1.6A) is open-circuit. In sets that incorporate a satellite receiver (models CT21AV1BS etc.) the cause of this may be a short in the LNB feeder. In these sets Z953 has been updated to 3.15A to avoid failure because of accidental shorts – the part no. is 299P193030. Z953 must remain at 1.6A in non-satellite models.

Blank Raster/No Sound/No Graphics

Circuit protector Z953 may be open-circuit because the 2SC2236-O,Y 8V regulator transistor Q952 has failed or is dry-jointed. If so, obtain the 8VREG-KIT – this is also its part number. Change the value of R957 to 1.2k Ω and replace the RD9-1D3 zener diode D957 if faulty. After fitting the kit, check the resistance between the emitter of Q952 and chassis. The reading should be about 2k Ω . If it's incorrect, suspect IC202 (TEA6415C) and/or IC301 (MSP3410). These two chips are not included in the kit.

No Results/Green LED On

With this condition voltages are present on the secondary side of the power supply but there is no line drive. The condition may clear if the receiver is

switched off then on. There is loss of memory, e.g. no tuning data, no text. IC951 (TDA8137) will be the cause when its 5V outputs are low. Check whether C955 has been upgraded to 3,300µF, 16V (part no. 181P353000). Change C702 to 10µF, 25V (part no. 181P353020). If the set is a Dolby model, increase the value of R3D68 to 680Ω (0.25W).

It may be necessary to reprogramme the EEPROM (IC702) to restore the line drive – adjust the options and VCJ settings. The options settings are in the service manual. Adjust the VCJ settings for optimum picture performance.

Replacing C955, C702 and R3D68 as described above normally cures persistent lock-up and memory corruption. In a few rare cases the symptoms may persist. If so, change the value of R702, R213 and R214 to 1kΩ, 0.25W.

No Sound

Obviously the TDA7263 audio output chip IC351 can be the cause of this. But it can fail for an unusual reason. This is to do with the mute circuit, which includes C368, Q301, Q302, Q304 and Q305. C368 controls the voltage at the bases of the muting transistors Q301/2. At some point as it discharges, HF oscillations can occur in Q301/2. These damage IC351. To overcome the problem, remove C368: the switching of Q301/2 will then be more positive.

Intermittent no sound when switched on from standby can occur with the Dolby Models CT25AV1BD, CT25AV1BDS, CT28AV1BD and CT28AV1BDS. The

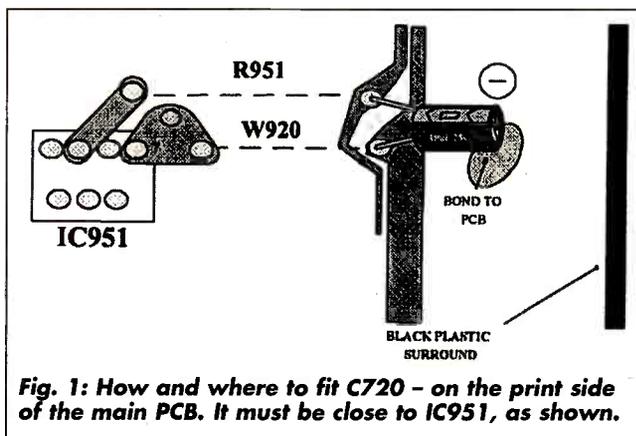


Fig. 1: How and where to fit C720 – on the print side of the main PCB. It must be close to IC951, as shown.

solution is to add a 560kΩ, 0.25W resistor across X3D1 on the print side of the Dolby PCB.

Tuning Drift

The tuner may be faulty or the µPC574 33V regulator D956 leaky – check the later by replacement. If there is tuning drift when the receiver is cold, change R736 to 15kΩ.

If still in trouble, obtain modification kit TD-EE3/4 to improve the AFT pull-in range. If necessary check the 180kΩ, 0.25W resistor in series with a 1N4148 diode whose cathode is connected to the tuner unit's 5V line. When this modification has been completed, ensure that the AFT is set to the on position. The tuning drift problem tends to occur at the higher end of the band.

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More on the

Microvitec Series 13

Stephen Moorhouse explains the operation of and the reason for the unusual line scan/EHT generator system used in this monitor chassis

In his article on servicing the Microvitec Series 13 monitor chassis (May issue) Russ Phillips refers to its "unusual" line output stage. The main reason for the development of this circuit was the need to be able to compete on a global scale in what had become a very price-sensitive section of the monitor market. In fact however the Series 13 line deflection system was a development of a previous circuit that was used for many years in earlier Microvitec designs, including the Series 7 and Series 9 generic chassis. Microvitec owns a patent for it.

Basic Concept

An essential requirement of an autoscanner monitor, i.e. one that will operate at different line frequencies, is a line deflection system that generates a substantially constant EHT and line deflection current independently of the line frequency, as well as providing suitable EW geometry correction. This means that the HT supply that powers the line output stage must be proportional to the line frequency.

This can be achieved by inserting an additional "Buck regulator" between the main chopper power supply circuit and the line output stage, see Fig. 1. This consists of a series chopper FET, an efficiency diode D, a reservoir inductor L and a smoothing capacitor C. The output voltage $V_o = V_{in} \times (T_{on}/T_h)$, where V_{in} is the HT produced by the chopper power supply, T_{on} is the on period of the pulse-width modulated drive to the Buck regulator FET and T_h is $1/f_h$.

In the Series 13 circuit the Buck regulator and line output stage circuits are combined, see Fig. 2. The line output transformer's primary winding and the scan-correction/coupling capacitor now perform two roles: in addition to their normal functions they act as the storage elements for the Buck regulator. The result is a considerable saving in material.

The use of what's called a "negative flyback" system (the line flyback pulse, produced at the junction of the line output transistor's emitter and the input to the line output transformer's primary winding, is negative-going) is a cost-effective way of carrying out this combination. By turning the line output stage upside down, drive for the n-channel FET becomes very simple as it is now "ground-referenced". Because it's connected to the flyback pulses, additional isolation is required in the line driver transformer.

Active Breathing and Class D EW Correction

The other "novel" features of the circuit are the ways in

which EW and picture breathing correction are implemented (see Figs. 4(b) and 5 on page 509 of the May issue).

Traditionally a transductor or a diode modulator is used to apply EW correction to the line scan current. Both are relatively costly, particularly in an application where a fixed raster "width" will suffice. The technique adopted here is to use the class D, pulse-width modulated FET drive to generate the EW correction for the tube in addition to its main role in controlling the EHT and line scan. An EW parabola obtained from the TDA4851 sync processor chip is fed to pins 6 and 7 of the NE555 chip IC101 that produces the drive for the FET. The NE555 is arranged as a monostable oscillator, and the parabola modifies the on time of its output. In this way the degree of EW correction applied automatically tracks with the line frequency.

The arrangement requires an integral EHT capacitor (3nF in this case) in the line output transformer. In addition to improving the short-term EHT source impedance, this capacitor prevents excessive modulation of the EHT voltage by the parabola. Otherwise there would be unacceptable geometry distortion when the CRT's beam current is high.

Since the source impedance of an EHT supply is typically 2-2.2M Ω , a 1-1.5kV EHT change is not uncommon between CRT beam current extremes - between a black and a full white screen. Without corrective action the result is unacceptable variations in the picture width. The usual technique adopted in TV sets and monitors that don't have a diode modulator is to add an anti-breathing resistor in series with the HT supply to the line output stage. The voltage drop across this resistor varies with the EHT current, providing roughly the right correction. In the Series 13 chassis this approach is implemented using active circuitry.

The voltage at the lower end of the EHT bleed resistance (typically some 500M Ω , and part of the line output transformer) is sensed to generate a limited amount of 'positive feedback' which is applied to the timing pins 6 and 7 of the monostable circuit (IC101), together with the EW correction parabola. As a result the EHT is reduced with increasing beam current, along with a corresponding reduction in the scan current. Since the picture width is proportional to the scan current and is inversely proportional to the square root of the EHT voltage, the technique produces a constant-width display.

It is worth mentioning the role of VR302 which is within the feedback loop - it's associated with IC303 (see Fig. 5, page 509, May). This potentiometer is included to ensure optimum correction: it provides compensation for the ± 20 per cent tolerance associated with the EHT bleed resis-

tance. If a replacement line output transformer has to be fitted, it will nearly always be necessary to readjust VR302. The procedure is given in the relevant Microvitec service manuals.

Conclusion

Although the line deflection system employed in the Series 13 monitor chassis is somewhat unusual, it provides an extremely cost-effective means of generating the EHT and line scan with an autosync monitor.

Finally, there were a couple of errors in the circuit diagrams in the May article. In the chopper power supply circuit (Fig. 1) TR2 is shown as type BF547B: it is in fact type BC547. This transistor is used to lock the chopper power supply's operating frequency to that of the line output stage, via an isolated winding on the line output transformer. TR2 terminates the oscillator ramp generated within the UC3842 control chip by driving pin 4 high during the line flyback, thus initiating, after a short dead time, the next cycle.

Secondly Fig. 4(b) is incorrect in that TR102's drain should be shown connected to the control pin 5 of IC101, not to the timing pins 6 and 7. TR102 implements power management by shutting down the line output stage in the absence of line sync pulses. In this condition there is no clamp pulse output from IC201 (TDA4851) to drive the NE555 F-V converter chip IC401. TR600 (on the geometry module) switches off and TR102 switches on.

Editorial note: Our apologies for these errors, which are also present in the Microvitec circuit diagram we used as the basis of our drawings. At least we showed TR102 as a FET - it's

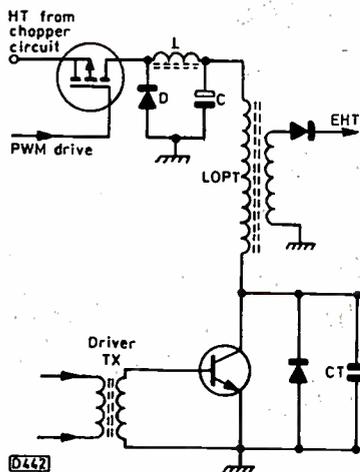


Fig. 1 (left): Use of a Buck regulator and separate line output stage to provide, with an autosync monitor, a constant EHT and line deflection current independently of the line frequency.

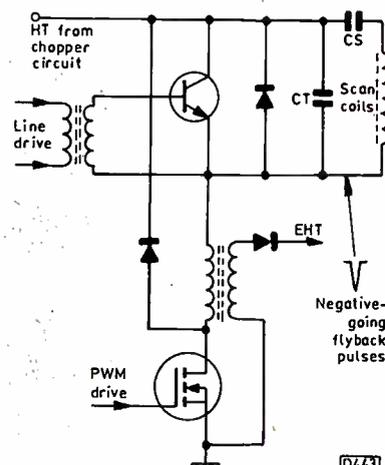
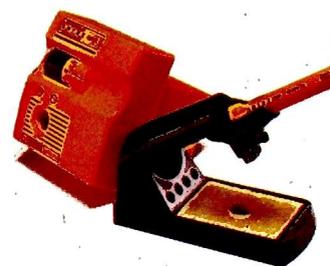


Fig. 2 (right): The arrangement used in the Microvitec Series 13 monitor chassis combines the Buck regulator and line output stage. The resultant saving in component costs is a great help in a highly price-sensitive section of the market.

shown as a bipolar transistor on the original circuit diagram. We would have spotted the incorrect transistor type had we gone by the parts list.

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ANTEX NOT JUST ANY OLD IRON

Technology at MCES

Martin Pickering pays a visit to this specialist repair company to find out how they tackle LNBs, tuners, etc

When I arrived at MCES in Davyhume, Manchester I thought I'd gatecrashed a butchers' convention. It was a hot, sunny day (unusual for Manchester!) and the staff of MCES, all wearing striped aprons, were enjoying ten minutes of fresh air in the car park.

I was greeted by Graham Dobson, the Managing Director, and John Glenton the Technical Director. They invited me to look around the workshops to see how repairs are carried out.

MCES is run like a small, family business and has a very friendly atmosphere. The firm began with tuner repairs 27 years ago. As with all repair businesses today, the profit margins are very tight and the staff have to work hard to maintain a high throughput. They do this with a level of skill and cheerfulness I've seldom found in larger companies.

The company undertakes contract repairs for companies such as Grundig Microwave Technology. It seems that the Grundig LNBs are very reliable compared with others that the firm has handled. So MCES is not repairing as many LNBs as it used to.

Mixing contract work with one-off repairs for the likes of you and me presents an interesting logistics problem,

but MCES seems to handle it with ease.

Graham Dobson explained that everything is done in batches. The Grundig stock is all kept in a completely different stores area so that there can be no mix-ups.

Tuners

When tuners are repaired they are first separated into batches of identical ones. A control sample tuner is sent down the line to ensure that the test equipment is all calibrated for that particular tuner type. Then the batch of faulty tuners is repaired and tested. The process is repeated for every variant.

I asked about customer complaints. Naturally these arise from time to time. They generally occur because a shop has sent a tuner that's not the actual cause of the reported fault.

It's not possible to fault-find to particular components with every tuner. The batch approach means that every component known from experience to cause problems in the type of tuner concerned is replaced, then joints that can be poorly made in manufacture are resoldered. Only then is each tuner tested.

By this time most faults will have been cured. So MCES does not expect to see the reported fault during test. Each tuner is finally fitted to a test jig that connects it to a real TV set, satellite receiver or VCR so that the picture it produces can be seen and the sound heard. If a customer subsequently phones to say that a tuner "is still faulty", MCES can with good reason say that it's OK!

LNBs

John Glenton had some interesting comments to make about LNBs. "Most people think you can simply drill out the rivets, prise apart the housing, solder in a new transistor then screw the LNB together again using self-tappers.

It's not as simple as that. For a start the manufacturer's specification for noise and gain variation has to be met. This can't be done when self-tapping screws are used. The company has developed various ways of taking LNBs apart without damaging them - many modern LNBs are glued together using silicone adhesive.

The front-end FETs are extremely sensitive to heat and to static electricity. So electrostatic-safe workstations

The tuner repair workshop.



are used, together with special soldering irons that have needle-point tips but can raise the temperature to an accurately set limit within seconds. John Glenton demonstrated this by placing the tip of an iron on to a tuner casing and immediately melting solder on the metal. Special low melting-point solder has to be used to fit FETs, and to achieve this the iron tips are set to about 160°C.

Once repaired, each LNB is reassembled, frequency tuned and tested. It also undergoes a water bath test to ensure that it is watertight. Even the silicone RTV sealant used is a special product from Dow Corning. As John explained, "you can't use ordinary bath sealant because it produces acetic acid that can cause serious damage inside an LNB".

Each LNB contains a tuned cavity that's usually held by screws. These have to be tightened in a set order to a specified torque. "What some people try to get away with would astonish you" John added, "we've seen some real horror stories. Amazingly, some of them worked - after a fashion!"

Other Items

MCES also excels at VCR head refurbishing. The equipment used has been installed for a long time, but is tried and tested and works extremely well. MCES is considering the purchase of a new alignment jig however, as the present one is very time consuming to set up. Since time costs money, an investment of a few tens of thousands of pounds to speed up the operation can be justified.

The one drawback with a VCR head is that it would be



The LNB repair workshop.

impractical to test it in a VCR. Instead, the inductance of each head winding is measured to ensure that they match to a very close tolerance. This measurement provides an excellent guarantee that the heads will not only function but will produce pictures free from annoying streaks.

Contact Details

You can reach MCES on 0161 746 8037, or by e-mail at sales@mc.es.co.uk. A new web site is being set up at www.mc.es.co.uk. The fax no. is 0161 746 8136.

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Alan Willcox describes a simple unit that can be used to increase the sensitivity of a digital meter so that unambiguous readings of low-resistance values can be obtained. There are other advantages for fault finding

Low- Ω Add-on Unit

I decided to develop this add-on ohmmeter because of the difficulty, when using a digital meter, of getting unambiguous readings with low-value resistors. Such resistors are used in the current sensing, supply feed and other circuit positions in modern consumer electronic equipment.

It is also useful to be able to pinpoint quickly the location of a short-circuit. When there is a short across the HT line in a TV set how many of you have, like me, juggled with the meter probe between the collector of the line output transistor, the transformer's HT pin and the HT reservoir capacitor looking for the lowest reading while taking into account the 0.5 Ω or so that's usually present, and varying, with your digital meter on the ohms range? This seems to be a common weakness with such meters, even quite expensive ones.

The problem has been addressed in these pages before on a few occasions. In the March 1992 issue Ian Rees came up with quite a novel solution: a self-contained device that measures as low as 0.1 Ω . Another approach that interested me was the circuit for a linear ohmmeter described by William E. Harrison in the December 1981 issue. This is mains-powered and uses a moving-coil movement as the indicator. I built one and found that it would also, with a good large-scale movement, provide a resolution down to 0.1 Ω . It uses two operational amplifiers to convert resistance to a related linear voltage. Anyone who is interested in this particular circuit should note that there is an error in the circuit diagram (Fig. 1 on page 83): pin 6 of IC2 should be shown connected to the common end of the three resistors associated with SW1b – as drawn, the circuit will work only on ranges 1 and 2.

Present Circuit

In this much slimmed-down version I've used the same principle of operation (thanks for the idea, William!). The power requirement is low, so a battery was chosen as a more convenient option. Stability has been much improved by the use of a precision reference voltage source: this, coupled with a digital read-out, takes the resolution down to 0.01 Ω (0.001 Ω is possible, see later). The resistance of a PCB track is thus readable and, by checking directly for shorts across suspect devices connected to the same line, you should be able to establish, by the lowest reading, which is the faulty one. In practice there are some restrictions, as we shall see.

The operational amplifier used has a short-term offset drift that amounts to an error of around 0.05 Ω maximum. Because of this, and to compensate for lead resistance, a front-panel set-zero control is included. In practice the unit quickly settles down after switch-on. Don't confuse this with any changes you might experience with your normal meter when it is used on the low-ohms range.

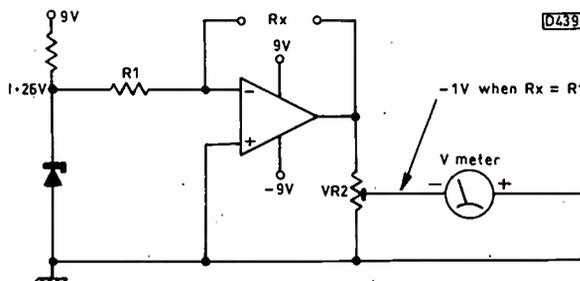
When using this add-on unit the least significant bit represents hundredths of an ohm. Use of a digital read-out is also justified on economic grounds. An inexpensive meter costs less (around £7) than a moving-coil movement. Although it will probably be poor on the ohms range it will be quite good on the voltage range.

Principle of Operation

Fig. 1 shows the basic principle of operation. R1, which is connected to the inverting input of an operational amplifier, is part of the input switch network. The resistor to be measured (Rx) is in the amplifier's feedback loop. Now if Rx is 1k Ω (Rx = R1) the amplifier will have unity gain and its output will be -1.26V. If VR2 is set at the position where -1V is fed to the meter, +1V will represent 1k Ω . If Rx is 2k Ω , the gain is -2 and a 2V reading on the meter represents 2k Ω . With Rx at 500 Ω the gain is -0.5 and so on. The meter is generally used on its 2V range, so in the example shown a full-scale reading represents 2k Ω .

To get down to really low-resistance readings we need a full-scale reading of 20 Ω . This is achieved by using a

Fig. 1: Basic principle of operation.



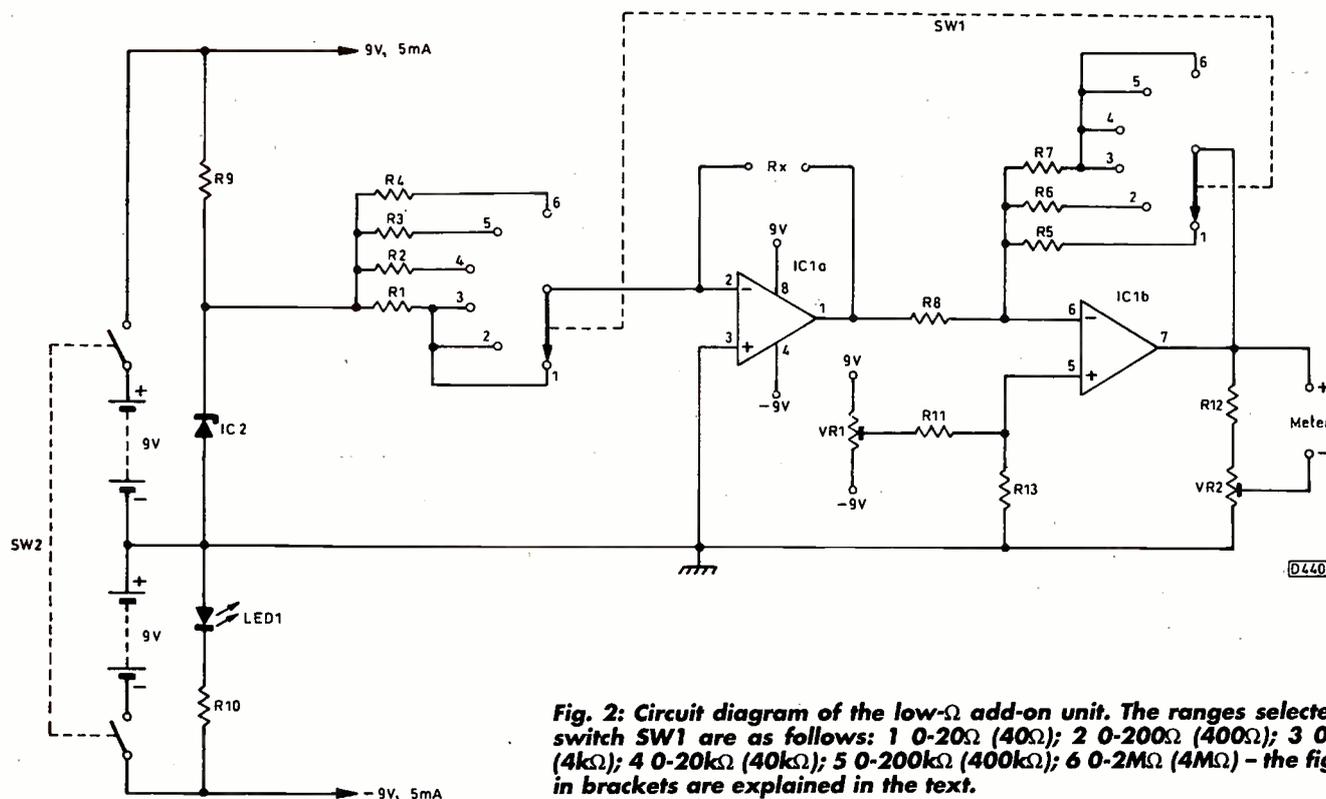


Fig. 2: Circuit diagram of the low-Ω add-on unit. The ranges selected by switch SW1 are as follows: 1 0-20Ω (40Ω); 2 0-200Ω (400Ω); 3 0-2kΩ (4kΩ); 4 0-20kΩ (40kΩ); 5 0-200kΩ (400kΩ); 6 0-2MΩ (4MΩ) - the figures in brackets are explained in the text.

second operational amplifier (in the same package) to obtain gains of 100 and 10 on ranges 1 and 2, with unity gain on the other ranges. The result is full-scale readings of 20Ω and 200Ω respectively.

Fig. 2 shows the full circuit diagram. IC2 provides the precision reference voltage for IC1a. Although switch positions 1 and 2 both use R1, the range changes because of the gain provided by IC1b as R5 or R6 is switched into circuit. IC1b's gain is unity in the other switch positions. The offset adjustment VR1 is set to give zero output at pin 7 of IC1 when the test leads are shorted across. This is really necessary only in position 1 where the gain is 100 (R5/R8).

Construction

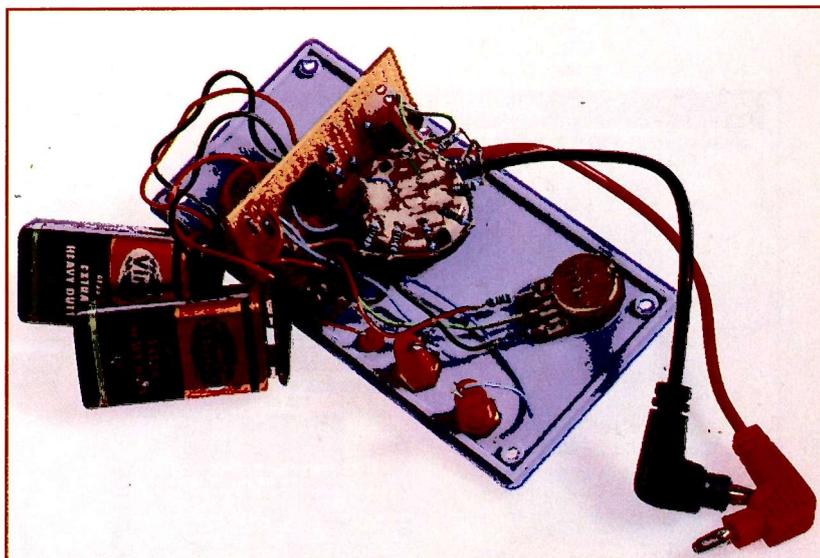
A suggested layout on stripboard is shown in Fig. 3. Make sure that R1-9 are 1 per cent tolerance metal-film resistors - the accuracy of the meter depends on them. Avoid skimping on the switch, presets, connectors and test leads. Buy new - it defeats the object otherwise. Good test leads might cost more than the rest of the components put together, but it's worthwhile in the long run.

I opted for a front-panel set-zero control for the reasons mentioned above. This control is quite sensitive. To make it less so I wired a resistor at each side of the potentiometer (minimum value 22kΩ, linear) to reduce its range. The values I ended up with were of the order of 82kΩ or so, chosen to more or less centralise the control.

Set Up and Use

Setting up is straightforward. Short the test leads together and adjust VR1 for a zero reading. Connect a good 180kΩ resistor to the terminals and adjust VR2 to produce a reading of 1800 on the display.

The multimeter is normally used on the 2V (2,000mV) range. This represents the full scale as marked on the switch. But the output from IC1 can go higher than this - to over 4V with a 9V supply. Thus if you select say the next voltage range up, resistors up to 4MΩ can be mea-



Parts list

- | | | | |
|-----|---------|--------|---|
| R1 | 1kΩ | VR1, 2 | 47kΩ min. linear horizontal presets. See note in text on VR1. |
| R2 | 10kΩ | IC1 | TL802 |
| R3 | 100kΩ | IC2 | ZN423 |
| R4 | 1MΩ | LED1 | 2mA low-current type |
| R5 | 100kΩ | SW1 | 2p, 6w |
| R6 | 10kΩ | SW2 | dp on/off |
| R7 | 1kΩ | | |
| R8 | 1kΩ | | |
| R9 | 3.9kΩ | | |
| R10 | 3.9kΩ | | |
| R11 | 820kΩ | | |
| R12 | 100kΩ | | |
| R13 | 1kΩ | | |
| All | 0.6W 1% | | |
- 0.1in. stripboard
2 PP3 batteries and connectors
Plugs, leads, case etc.

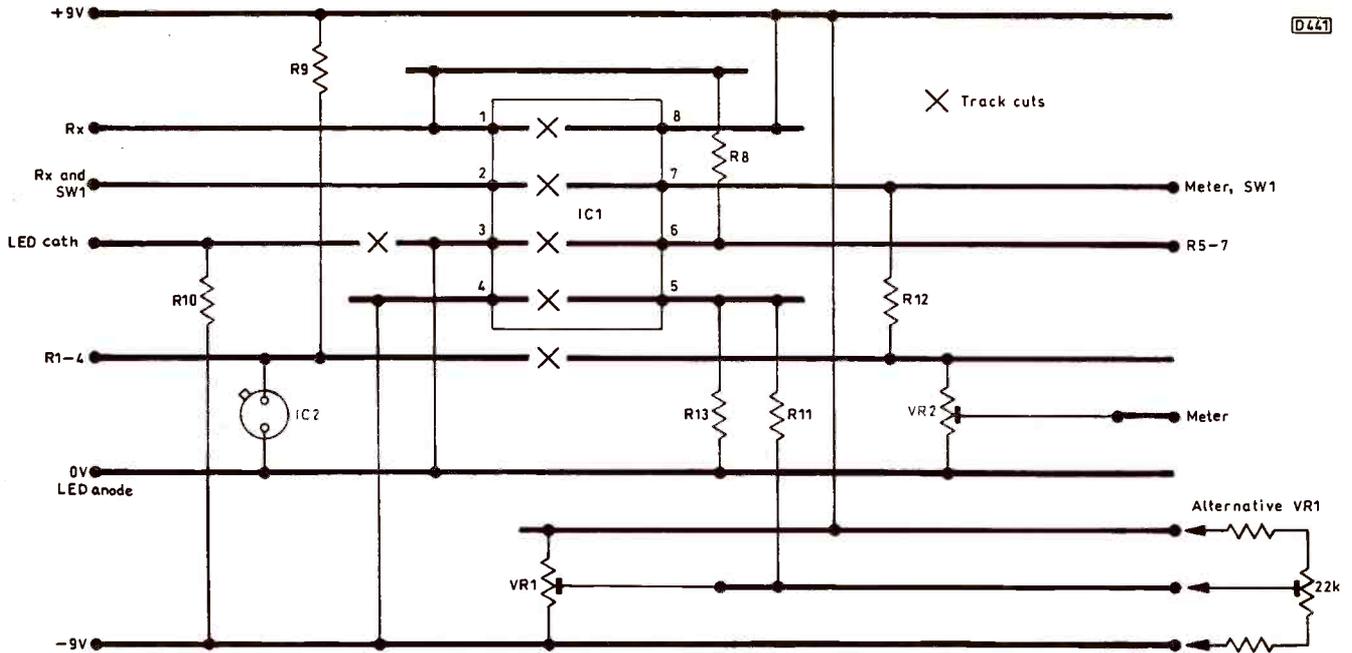


Fig. 3:
Suggested layout on 0.1in. strip-board.

sured on the 2MΩ range.

By the same token, if you select the 200mV range you can measure down to 0.001Ω. Set zero now becomes more critical. A point is reached at which the PCB track resistance can be read, getting to the stage where we can get 'colder' or 'warmer' with a leak or a short. Chokes, transformer windings, circuit protectors, low-ohm feeds

etc. are all taken into account easily. To make best use of this low-Ω feature, it's an idea to solder a set of test leads direct to the rear of the sockets. Make sure that the probes are clean and sharp.

In practice the 200kΩ range can be used to read from 1kΩ up to 200kΩ and the 2MΩ range from 10kΩ to 4MΩ.

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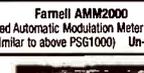
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The Pace Link Memo

The Memo box is the latest development in the Pace Link system from Kesh Electrics. Martin Pickering, B.Eng., describes its operation and use



The original Pace Link system was designed by Kesh Electrics to provide an interface, via scart connection, between Pace PRD, PSR and MSS series receivers and a PC. The software requires the use of Windows 3.1 or a later version, and is able to access the EEPROM in a Pace receiver to carry out read and write operations.

Pace Link Versions

Pace Link Pro software can communicate with almost any Pace receiver and costs £199 including VAT. The subsequent Pace Link Lite costs £49.99 but works with just one model, which you can specify.

The Pro version is obviously intended for the professional workshop whereas the Lite system is more useful to say the owner of a Model MSS508IP. The software allows "drag and drop" editing of the channel order on a computer screen as well as the facility to type in channel names, frequencies and other parameters.

Unless you are lucky enough to own a lap-top PC, it is inconvenient to take a computer system to the customer's home. So you've had to take the customer's receiver back to the workshop for reprogramming – until now.

The Memo

The Pace Link Memo is a small box with two separate interfacing leads, one to provide a computer connection and one for the receiver's scart connection. You can upload the channel information for a specific model from your PC to the Memo box, take the

Memo box to the customer's home, then download the contents to the receiver. This is really handy on those occasions when you know that the customer has messed with all the settings! It's also handy if you want to retune every channel 250MHz higher for use with an enhanced LNB. And it could save you a lot of time when you are doing a motorised installation.

The battery-powered Memo box has two minor limitations: you can't store information for more than one model at a time, and you can't upload channel information from a receiver into the box – it's strictly a one-way system, from computer to Memo box to receiver. But you can't really complain, as the unit costs just £59.99 + £2.50 postage. In addition, it comes with the very latest upgrade of the Pace Link Pro software (V1.33). This includes up-to-date channel listings for each model.

Installation and Use

Installation of the PC software is a doddle – which is praise indeed from a confirmed Macintosh user! Just follow the instructions on the label, or the accompanying sheet, and that's it.

Use of the Memo is also simple. So simple that the full instructions fit on a label on the case. I tried it with several Pace receivers and there were no problems at all. Anyone who already has the Pace Link Pro system will be delighted with this addition.

If you point your internet browser at

<http://www.pacelink.co.uk>

you will find a channel list library (click on 'support') that's continuously updated by Kesh Electrics.

Availability

The Pace Link system is supplied by Kesh Electrics (Satellite Systems) Ltd., 6-11 Main Street, Kesh, Co. Fermanagh, N. Ireland BT93 1TF. Phone 01365 631 449, fax 01365 632 003. It is not supplied by Pace.

Hugh Cocks adds: Use of the Pace Link system to program a receiver's channel order list saves a tremendous amount of time compared with setting up with a remote control unit. Now, all you need to take to the job to do this is the Memo box and the receiver connecting lead. This is connected to the relevant scart socket, which is normally the decoder one though it's the VCR one with the MSS100 and the TV one with the Prima and the MSS228 (non-VideoCrypt model).

I now normally carry a Memo box programmed with our current MSS100 channel listings, and am surprised how often I use it.

Incidentally the latest version of the Pace Link Pro software (V1.33) has just been released – it covers 42 models. A feature of this is a 250/500MHz frequency offset done on a per channel basis, to provide easy programming of older receivers with either an ADX channel shifter or a replacement 9.75GHz LNB. The cost is £199.

DX and Satellite Reception

Terrestrial DX and satellite TV reception and news. Is Band S another signal source for us? The problem of feeder matching with a wideband aerial. Roger Bunney reports

As I write this at the beginning of June the 1998 Sporadic E season has, so far, been rather a disappointment. Some SpE signals have been received, but there have not been the big openings I had hoped for. Perhaps things will improve in a couple of weeks time. Meanwhile, here's a summary of SpE reception to June 1st:

- 5/5/98 ARD (Germany) ch. E2; TVE (Spain) ch. E2.
6/5/98 Unidentified ch. E2 signals received at 0420!
12/5/98 RAI (Italy) ch. IA; Video (Italy) ch. E2.
15/5/98 RTP (Portugal) chs. E2, 3, 4; TVE E2, 3, 4; RAI IA; Video E2.
17/5/98 TVR (Romania) E2; RAI IA; Video E2; YT-1 (Ukraine) R2. Plus several other unidentified signals.
18/5/98 NRK (Norway) E2.
19/5/98 RAI IA, B; Video E2; TVA (Italy) IA; HRT (Croatia) E4; SLO-1 (Slovenia) E3; RTS-1 (Serbia) E3; SYR-2 (Syria) E2 (corner ident); LTV (Lithuania) R2. Plus unidentified signals including an Arabic one in ch. E3, possibly JTV (Jordan).
25/5/98 SVT-1 (Sweden) E2.
27/5/98 SYR-2 E2; SYR-1 E4; YT-2 R2; TVR-1 R3; RAI IA. Plus unidentified signals.
28/5/98 Video E2
29/5/98 TVE E4; HRT E4.
1/6/98 A weak FUBK test pattern was received from the SE at 0745 for fifteen minutes. It then faded.

My thanks to Peter Schubert and Garry Smith for reception reports to supplement my own loggings. In recent days there have been several sightings of programming on ch. R2 with an 'RTL' logo at the top, left-hand corner. This is so far unidentified.

Satellite Sightings

Jim Scofield (Sandown, Isle of Wight) has written in about his satellite reception. His 1m dish and universal LNB feed a Nokia 9600 digital receiver and a Strong SRT339LTP analogue receiver. Jim clearly likes sports, and mentions that most American sports can be seen each night via Intelsat K – basketball, baseball, ice hockey, football etc. Digital transmission can provide more video sources per carrier, i.e. multiplexed channels: during a recent Formula one event received via PAS-3R Jim found that one channel showed the different track positions while others were dedicated feeds for Canal +, Telepiu and DSF. There was also a spare. An analogue sighting of his on May 18th produced, via Telecom 2C (3°E), Spanish racket ball. This is apparently quite a dangerous sport.

Edmund Spicer (Littlehampton) has been tuning in to Telecom 2B at 5°W. It provides domestic programmes in the clear, enabling him to achieve conversational French for his university examinations. He mentions that the M6 subcarrier (7.25MHz at 12.522GHz vertical) has changed from an encrypted to a clear service with a rich variety of music.

The EBU feed via Eutelsat II F4 (7°E) is to go digital in early August, but SIS signals continue to be seen. May 24th produced news coverage of the troubles in Indonesia, with a test card from "EBU Jakarta". That same day saw the homecoming, at Southampton, of those in the Whitbread Round the World race. Although many of the

feeds from Ocean Village were digital, there were at least two analogue links, including Associated Press APTV via Intelsat K (21.5°W, 11.499GHz horizontal).

Again on the 24th a dramatic open-air concert was screened live via the Egyptian Space Channel from Eutelsat II F3 (16°E). It was also carried as a EBU feeder (SIS) at 7°E. The programme consisted of classical music and singing, also the presentation of awards for services to the arts. Seen early in the evening here (1800BST onwards), the event took place at the feet of the Sphynx with the Pyramids at Luxor as the backdrop – appropriately lit and with laser lights and other special effects. Well worth watching.

While monitoring the Brightstar feed via Intelsat K just before noon on the 27th I saw colour bars at sparklie level with the identification "TVN ui ans Helsinki fur die ARD". Finland is a rare visitor to this satellite. Once the uplink dish had been aligned the power increased and the sparklies almost cleared, though the signal was not at the normal level from this transponder. I was pleased to receive signals from a new satellite, Intelsat 801 (31.5°W), that same evening: there was an analogue football programme at 10.974GHz vertical. Others have spotted this new bird relaying analogue sports programming, including offerings for Sky Sports – in the clear!

It was a busy month for analogue transmissions, with the G8 conference, the Northern Ireland Referendum and the American school shootings. The BBC UKI-

231 truck provided an agricultural show feed, location not mentioned, for the Plymouth newsroom. This was on May 21st via Intelsat at 27.5°W.

Terrestrial News

Spain: The government has announced plans for digital terrestrial TV. The present analogue transmissions are to cease by the year 2010. Antena 3 and Tele 5 must have digital TV up and running by 2002, Canal + by 2003, transmitting in parallel with the present analogue services. The government estimates that by next spring fifty per cent of homes will have access to digital TV, rising to 70 per cent in 2002 and 95 per cent in 2008.

Hungary: Kids channel Nickelodeon will be available in Budapest and other main population centres this September, via MMDS transmission and cable distribution. The programmes are to be dubbed and the Hungarian Broadcasting Corporation will be responsible for commercial sales and transmission.

South Africa: A commercial service, MIDI TV, is now available: it uses the logo 'ETV'.

Cambodia: Japan has provided some \$13m in new equipment and transmission gear, including a satellite uplink for national coverage, for the TVK service, which is censored.

50MHz Amateur Band: Greece has released the 6m band for amateur radio use for "an indefinite period". Germany is also about to make the band available for amateur use – there are currently some 1,000 temporary licence holders. In Lithuania all class A licencees can use the band, which has also been made available to amateurs in Slovenia.

UK: A digital committee report recommends the closing down of analogue transmissions in 2010. Leeds-based RSL operator Ramadham Radio Leeds has been banned until February 1st after transmitting at 170W ERP instead of the allowed 10W. Asian programmer Sunrise Television has been awarded an RSL to transmit in the Ealing/Hounslow/Brent/Hillingdon area of W. London: it is expected to be on air in the autumn. Check out the FM band for BBC Radio 1 via SpE: the BBC has obtained a licence to transmit in Band II from Ibiza during the summer months this year. Isle of Wight Radio has delayed closure of its medium-wave transmitter (1,242kHz) until mid-summer, when a new VHF relay will open at Ryde: IWR currently transmits at VHF from Chillerton Down

(107MHz) and a relay at Ventnor (102MHz).

USA: Radio amateurs in Virginia are lucky: local government legislation now allows masts up to 75ft to be erected in urban areas. In rural areas the masts can reach up to 200ft.

Sweden: STV is to start a digital terrestrial TV service towards the end of the year, with SVT-1, two other channels and a 24-hour news channel.

S-band TV

A few countries use S band (2.5-2.7GHz) for TV downlinking, making this a possible source of 'DX' signals.

Several police forces have air-support units that use analogue TV downlinks at 2.36GHz from omnidirectional aerials to mobile and base units for traffic chases, surveillance etc. The ground mobiles have a two-way switch for monitoring an on-board camera or a downlink.

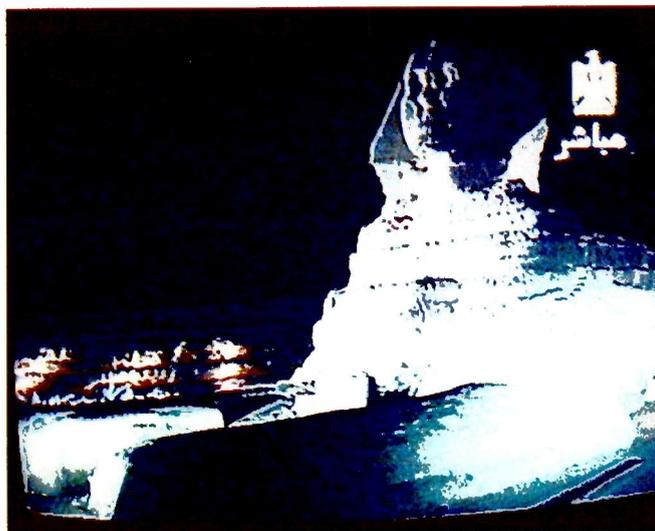
It seems that this use may soon change to 3-4GHz. Analogue transmission at 2.36GHz provides only a single downlink video channel, and there are interference problems. A move to 3-4GHz would provide two analogue or four digital channels.

S-band reception should be simple. The video is analogue, and all you require is an S-band LNB with a stub quarter-wave dipole against a ground plane on a post. You just need to know when the plane is airborne!

Satellite News

From an enthusiast's viewpoint I have to say that the Cable and Satellite Show (see report elsewhere) has changed considerably since the early days. I miss the small trader stands with bits and pieces, the pirate decoders and so on. 1998 was the year of the digital box. They were everywhere, with numerous demonstrations, some impressive and others less so. At least the second generation box seems about to arrive.

The big organisations were there in force. Sky Digital's AV presentation was impressive, with a video wall that consisted of 96 colour monitors – all exactly colour matched! If you wanted to buy a Boeing launch rocket, orders were being taken. Established dealers have long disappeared, for example Eurosat and Protel. This year Chaparral shared a stand with KTI. Raven Manufacturing displayed the Sidewinder range of dishes: the 1.4m one looked interesting – wonder if it



would work all right in Band C?

The Australian Galaxy digital pay-TV group went into receiver-ship in early May, with debts of \$A600m. As there were only 90,000 subscribers, that works out at nearly \$A6,600 each!

According to *SatFACTS* the new AV-COMM digital receiver, Model R3100 (badged, maker unknown

The Sphynx at Luxor was used as the stage for a concert of classical music and presentations broadcast by the Egyptian Space Channel. Reception was from the Brightstar transponder aboard Eutelsat II F3 at 16°E.

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Telefonica uplink live from Madrid via PAS-3R at 43°W.

but it's manufactured in Hong Kong), is the best yet for signal acquisition – weak-signal performance exceeds that of the benchmark Nokia 9600 version 5. With auto-FEC detection and 1-45MS/sec symbol rate, it gained full marks in recent tests. I'll try to establish availability in Europe.

The Russian NTV channel is to be added to the French Canal-Satellite digital service as part of the basic package. RAI (Italy) and TF1 (France) are discussing the possibility of an Italian digital service to compete with Telepiu.

The launch of Astra 2A has been delayed again and is now likely to take place towards the end of August. Hughes is apparently late with the satellite delivery and there are continuing problems with the Proton launch vehicle (following the AsiaSat-3 launch failure last December). The duff, eccentric orbit of AsiaSat-3 (now called HGS-1) has been partially corrected by 'flying' the craft around the moon and then bringing it into a new Earth orbit: a second lunar fly-around is to take place in an attempt to improve the orbital characteristics further.

MTV-Nordic started a new service to Scandinavia in mid-June, via

Sirius-2. EurasiaSat-1, a Turkish satellite in order from Aerospatiale, is to be launched into orbit at 42°E in early 2000, alongside Turksat C. It will have 32 Ku-band transponders. The holding company for EurasiaSat is to be based in Monaco, where it will be free from EU media and broadcasting regulations.

Telesat Canada's ANIK-F1 satellite is to be launched in spring 2000 at 107.3°W with 48 Ku-band and 36 C-band transponders. In a startling development in SE Asia one of the transponders aboard Apstar-1 (138°E) jammed in mid-March, cutting off a hundred paging and other services. Users were switched to other frequencies. The cause of the problem is being investigated.

Help Please

Douglas Byrne (G3KPO), who runs the Isle of Wight Radio/TV Museum, is seeking one of those plastic filter screens that produced a 'coloured' picture with a monochrome set in the early days of colour TV over thirty years ago. So, if you've got one stashed away anywhere please contact Douglas on IW 01983 567 665.

On a personal note, I've been using four Ferguson 3845 12in. sets (1690 chassis) as RF monitors for DX/satellite reception for about twenty years. During this time only one fault has ever occurred – a low-gain tuner! The receivers continue to work well, but the A31-510W tubes are now getting decidedly tired. Can anyone advise on a source of new/replacement tubes?

Aerial Matching

Ian Moody has raised the question of aerial matching. Some years ago he bought a five-element wideband aerial for DXing in Band I and was concerned about matching the output to a 75Ω coaxial downlead, which is unbalanced. He found that instead of saddle/clamping the aerial connections consisted of brass pin screw terminals (like a 13A plug): the insulator cap had two holes with spacing similar to that of 300Ω ribbon cable, which is balanced. At the time Antiference could supply a wideband 300Ω balanced ribbon to 75Ω unbalanced coaxial transformer – it was intended for matching imported FM tuners to UK aerials. Ian felt that the use of one of these would improve matters, and found that it did in fact improve signal transference noticeably throughout Band I. So things remained for five years, then the

weather interfered and the ribbon connection snapped.

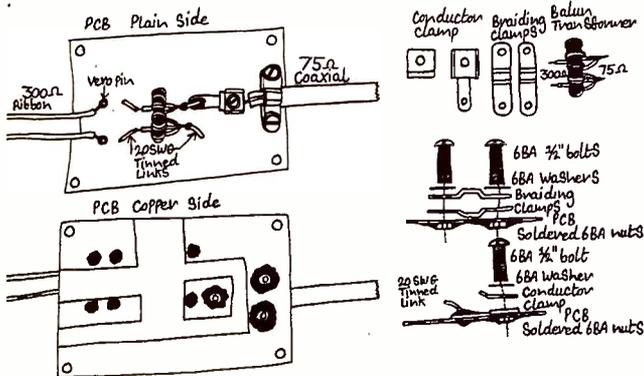
He has now constructed a new balun transformer (see Fig. 1). It's housed in a Maplin YM90X waterproof box with cable gland access which is used for the ribbon input/coaxial output. Take care to avoid ingress of water, and fit appropriate grommets. From my own experience, I would suggest adding a 'grommetted' hole on the underside to allow air movement and prevent condensation.

The balun transformer is built on a home-made PCB which is in turn supported on small bolts within the plastic box. The intention had been to use brass studding bolted on to the base of the box, and clamp or bolt this to the aerial boom. I advised against the use of brass in contact with alloy because of the electrolytic corrosion that occurs when these metals touch – plastic ties would perhaps be more suitable.

At its resonant frequency a straight dipole on its own has a centre impedance of 75Ω. With a folded dipole the impedance is 300Ω. When director and reflector elements are added to form a Yagi array the centre impedance falls. Since a folded dipole provides a four times impedance increase at the aerial terminals, it can be used with a multi-element array for impedance correction to match the 75Ω coaxial downlead – the alternative is to use a straight dipole with a matching transformer.

It is extremely difficult to maintain correct 75Ω matching over the bandwidth with a wideband Band I aerial. Ian has used a flat-response wideband transformer to match to 75Ω. The original Yagi-type aerial (WB5/FD from Aerial Techniques) uses a folded dipole to raise the centre impedance to something closer to 75Ω: use of the transformer will, I suspect, increase the impedance still more. To retain the advantage of a balanced dipole with a better match it would, I feel, be advisable to reduce the dipole/reflector spacing to say 1.25 wavelength at the 55MHz centre frequency, lowering the centre impedance in the hope of achieving a closer match. It's likely that, with the wide dipole-impedance swings you get with this type of aerial away from band centre, Ian's balun system may have improved the overall matching. Anything that provides signal improvement is to be welcomed! Any comments?

Fig. 1: Ian Moody's 300/75Ω balun transformer design for use with a wideband Band I Yagi aerial. The winding can be obtained from a ferrite Y splitter.



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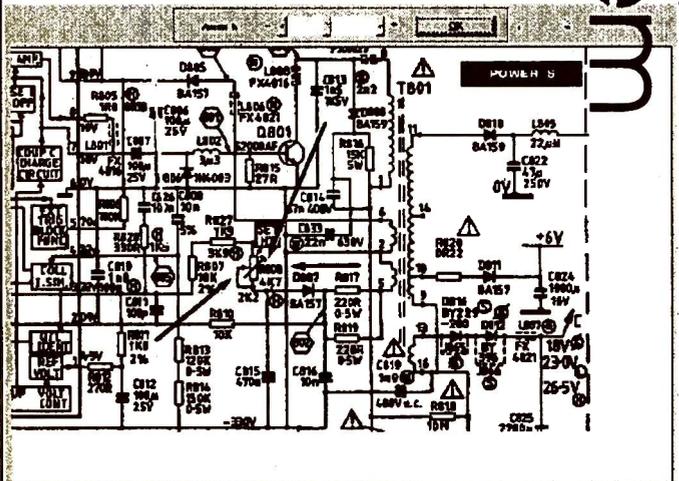
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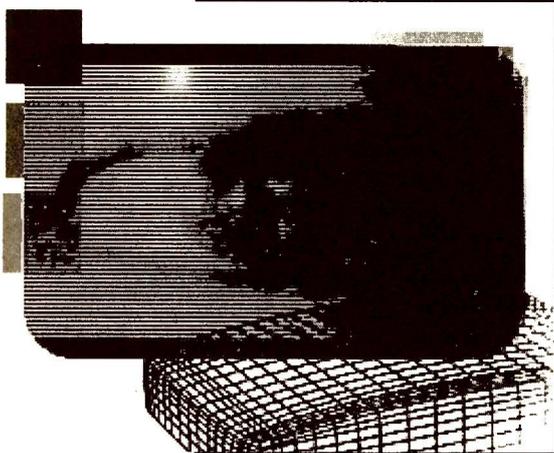
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**Reports from
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Acer 71342T

There was an intermittent sideways picture jitter. Scope checks showed that the supplies and the line drive waveform were all clean, so the cause of the fault had to be in the line output stage. It turned out to be C335 (220pF, 2kV), which was leaky. **G.M.**

Apple Performa Plus M9102Z/D

This monitor came in dead with the front LED blinking at a very fast rate. Unfortunately the short-circuit that caused the power supply tripping was the line output transformer, type AT2090/33. When I fitted a replacement I noticed that the picture was too narrow and tall. After a few seconds C2119 (100µF, 63V) fizzed and blew up. The cause was R3319 (1Ω, 0.25W fusible) which was open-circuit.

You also find this monitor badged Philips and RM-Nimbus. **G.M.**

Commodore JD144C

These monitors usually suffer from problems in the primary side of the power supply. The two most common faults are a completely dead monitor because D807 (1N4935) is leaky or short-circuit, or just squealing because D808 (1N4935) is leaky – in this event R827 (0.68Ω, 0.25W) will also fail. **G.M.**

Compaq 462

If one of these monitors comes in dead, check D927 (UG4D). This rectifier, which is on the secondary

Monitors

side of the power supply, tends to go short-circuit. In this event the power supply shuts down. The rather easier to obtain UF5408 can be used as a replacement. **G.M.**

AOC 4VLR

This monitor produced a streaky picture. The colour was poor, and the overall picture brightness seemed to fluctuate. The cause of the fault was D814 (1N4148), which is the black-level restorer diode in the red channel. It was leaky. **G.M.**

Apple M1212

These monitors usually come in dead, the cause of the fault being trivial – dry-joints at the IEC mains inlet socket! The poor quality of the soldering overall can cause problems however, so it's always advisable to give the PCB a thorough visual inspection.

Dry-joints in the primary side of the power supply can cause a blow up, killing QP1 (IRFBC40) and IP1 (TDA4605-2) with the mains fuse going open-circuit. When there are dry-joints in the line output stage, specifically at CL8 and CL10, QL1 (MJF16206) can become leaky: the result is the usual bleeping/blinking LED. Dry-joints at QL2 are often responsible for intermittent field collapse. **G.M.**

Compaq 420SC

This monitor was dead because of a power supply blow up, but there was surprisingly little damage. The TEA2019 chopper control chip IC1 had failed, taking with it R17 (2.2Ω, 0.25W), R18 (1.2Ω, 0.5W) and R21 (10Ω, 0.5W). **G.M.**

CTX 1565D

The complaint with this monitor was that the front controls didn't work. The cause was simply that the 'recall' switch was permanently on. It's at the far right on the little PCB under the CRT, looking from the front of the monitor. No damage or reason for the situation could be found. It seems that the control

can become bent with heavy-handed use, the switch then being permanently on. **R.B.**

DAN CD1764

This monitor was completely dead. Checks in the primary side of the power supply proved fruitless. When attention was turned to the secondary side I didn't have to look far. D6150, the rectifier for the 180V supply, was short-circuit. A new RGPI5M restored normal operation. **M.M.**

AST 66267

There was no picture. Everything was up and running and the voltages at the CRT base didn't look too bad. A dull green display appeared when the CRT's control grid (G1) pin was unsoldered. When the first anode control's setting was then advanced the display brightened and whitened. The display continued to recover, ending up with a flooded screen with fly-back lines.

I've had an increasing number of monitors with this fault recently. All have been easy to repair. Once the CRT's emission has recovered, a 24-hour soak test with a peak-white test pattern will stabilise the cathodes, after which the grey scale balance can be checked – none of the monitors dealt with recently required any adjustment however! **I.F.**

Royal DN1782G

"Flickering" was the complaint. On test this monitor performed a series of antics but there was no picture, flickering or otherwise. As everything except for the heater supply seemed to be alive, I fed the heaters from an external supply to see if I could get any clues. The result, scanning with no line sync, didn't help very much.

So I set about a more thorough examination and found that one of the two 1,000µF, 25V electrolytics in the 12V rectifier circuit, on the separate power supply panel, had vented. **I.F.**

Answer to Test Case 428

- see page 707 -

Mid-mount VCRs are certainly less engineer-friendly than older designs, especially in a case like this one where the deck and sensor operation had to be monitored continuously in the play mode. Having got the machine apart and running on soak test, Sage did all the right things. But they were based on a false assumption - that the take-up reel pulses, the very first thing he had checked, were OK. His AC-coupled scope checked only their presence, not their amplitude.

In fact the take-up sensor optocoupler was faulty. The voltage across the phototransistor dropped to about 2.2V instead of almost zero each time it saw darkness. This voltage is very close to the microcontroller chip's yes/no decision point. Sometimes the phototransistor's off voltage stayed even higher. The deck would then shut down, the microcontroller chip assuming that the take-up reel had stopped rotating. Why was rewind permitted? Because in this mode only the supply-reel pulses are monitored - a design quirk that's unusual and could hardly have been appreciated initially.

Two new optocouplers (D854 and D855) were fitted, because the originals would have been from the same production batch and Sage didn't want to run the risk of the other one developing a leak. Why are optocouplers, in VCR decks and in power supply circuits, so much less reliable than other semiconductor devices?

NEXT MONTH IN TELEVISION

Servicing the Panasonic NVJ40/42/45/47/F55

These VCRs use the final version of the G deck, with its improved mechanism response time. Most models feature NTSC playback and dub. Brian Storm provides servicing notes, including a list of fault codes.

Latest Panasonic Technology

Panasonic recently released details of its latest TV and video technology, including that used in DVD players. George Cole attended the technical seminars and reports back.

Squeezing STB Technology

The digital TV set-top box is miraculous when you consider the amount of AV processing carried out within a modestly sized unit. This has been made possible by advances in semiconductor technology. Noel Hurley of Advanced RISC machines explains what's involved.

Microwave Ovens - Hints and Tips

Robert Blair has been servicing microwave ovens for several years. He has some time- and money-saving tips for those who are about to venture into this field.

Servicing the JVC C14/C21ET1

These are the JVC models that use an Onwa chassis. Cliff Martin reports on his servicing experiences with them.

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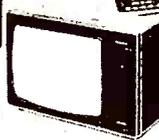
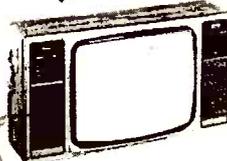
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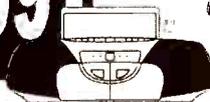
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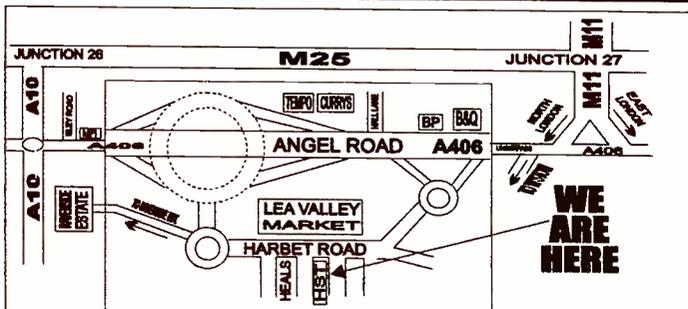
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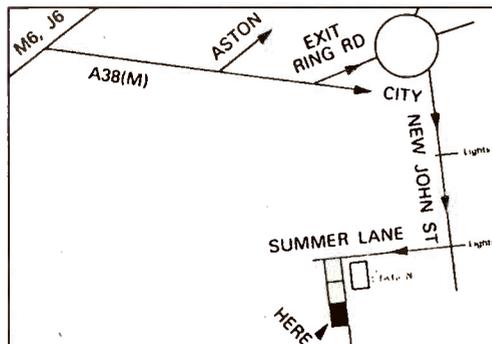
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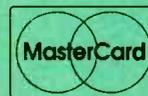
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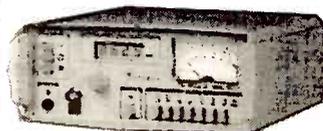
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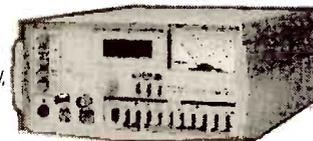
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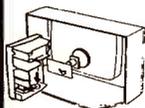
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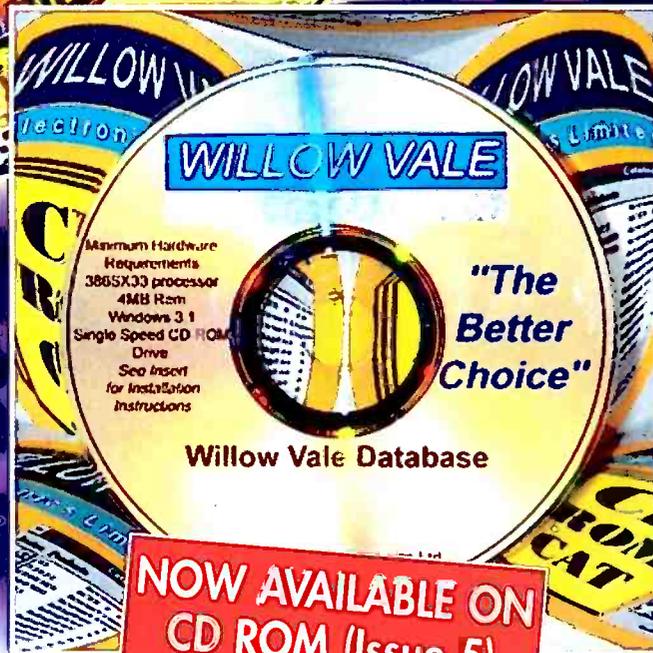
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