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The Coming of Astra

Congratulations are due to all those involved in the successful launch of the Astra TV satellite. Now for the programmes: the first Sky Television services are due to start in early February. How many will be watching when this historic (in TV terms) event occurs? How many will continue to watch? And how many for good measure? Sky begins to build a reputation? All this depends to some extent on the sales pitch. Sky is understood to be kicking off with a launch budget of more than £20m. This might seem a lot, but is not all that great when you consider that Sky is going to have to persuade viewers to adopt a wholly new method of reception and have new equipment installed, all at the customers' expense. But most present LNBs do not have the bandwidth to cover both Astra and BSB's DBS services. A dish for Astra will serve for BSB, provided the dish is steerable, which of course it can be. Thus the footprint for the initial Sky Television services. Further misunderstandings have arisen over the Carrington is decoded, re-coded in PAL form and then modulated on to a u.h.f. carrier for feeding into the aerial socket of a standard TV receiver. How much benefit is there in the successful launch of the Astra TV services from a high-power (61dBW) satellite are due to be started in the autumn, is starting off with a £60m publicity campaign. It is going to have to try, amongst other things, to persuade viewers that its MAC transmissions will be worth the extra expense. BSB has boasted that the use of a 10-9-11-7GHz band as opposed to the 11-7-12GHz band officially allocated for DBS use by the 1977 WARC, and more recently threatened with additional competition by the proposals in the government's white paper on broadcasting. BSB had to go through a lengthy vetting procedure to obtain its DBS franchise from the IBA; Sky merely took advantage of an orbital slot and section of the spectrum not otherwise committed. It's an unfair world, but this seems to be part of what the new era of deregulated broadcasting involves.

To date, Sky has had a lot of luck. Only five years ago those in the know would have considered it unthinkable to start regular broadcasting from a medium-power satellite using PAL signal encoding. Perhaps the broadcasting authorities were being unduly conservative in their view of what was feasible. But we still have to see what the quality provided by Astra's 52dBW signal will be. Will heavy rain produce excessive attenuation for example? Be that as it may, the technology has been advancing apace, making Sky's life that much easier. Inexpensive, low-noise front-end units have come along at just the right time. One wonders why it was ever thought that microwave technology was inevitably a matter of high-quality precision engineering and great expense. Simply, perhaps, because that was the case in the days when the use of DBS was restricted to applications. Very recently, however, we have been seeing signs of competition to professional application. There are now a number of companies in the UK who are looking at the possibility of using local microwave links for Astra. This would cut down on the initial capital cost of the Astra services: at present the 1981 Broadcasting Act states that viewers must buy or rent the equipment themselves. This seems very different to the situation in the USA where the government has stepped in to provide a modest dish will suffice to give perfectly adequate reception. Given a bit more development work on low-noise microwave semiconductor devices and dish size will shrink further.

As Sky's operation is about to begin, a certain amount of nervousness amongst the various competing broadcasters is becoming apparent. Various claims and counter-claims have been made, and there have been threats of litigation. There was to start off with BSB's knocking advertisement about the size of dish that would be required for Astra reception in different parts of the UK. Finally, Sky looks at the wrong footprint map, though the fact is that the coverage of the different groups of channels varies so that different results will be obtained as more channels come into use. Astra was originally planned as a pan-European rather than a UK-orientated satellite. More recently the ITV companies have been seeking ways to prevent advertisements for Sky Television and BSB appearing on their channels: at present the 1981 Broadcasting Act prevents discrimination against potential advertisers. And BSH has approached the Office of Fair Trading asking it to act under the 1987 Misleading Advertising Regulations over an advertisement that appeared in The Times and The Sunday Times. The advertisement suggested that many viewers would not benefit from the use of the MAC transmission standard.

There are one or two technical points that should perhaps be made clear. First, PAL and frequency modulation of the video signal do not go well together. This is because noise increases with frequency for a given bandwidth. Therefore, the encoding of the TV signal must be done in a way that the low-frequency components are preserved. The disadvantage of PAL is that the chrominance information is carried on the subcarrier, which is modulated on to the carrier by a process called 'interlacing'. This causes a poor colour-to-black and white image, and can lead to 'ghosting' if the carrier is not strong enough. The problem is that the subcarrier must be modulated on to the carrier by a process called 'interlacing'. This causes a poor colour-to-black and white image, and can lead to 'ghosting' if the carrier is not strong enough. The problem is that the subcarrier must be demodulated to baseband video then processed in the TV set. The disadvantages of PAL - cross-colour effects and subcarrier patterning - are reintroduced if the MAC transmission is decoded, re-coded in PAL form and then modulated on to a u.h.f. carrier for feeding into the aerial socket of a standard TV receiver. How much benefit is obtained from the undoubted advantage of MAC coding thus depends on the arrangements used at the receiving site. Further misunderstandings have arisen over the dish and LNB. A dish for Astra will serve for BSB, provided the dish is steerable, which adds to the expense. But most present LNBs do not have the bandwidth to cover both bands, and polarisation differences add to the complications. Astra uses circular polarisation, vertical or horizontal depending on channel, while BSB's DBS services are to use circular polarisation.

We had hoped to be able to include with this issue a sponsored card on the Astra satellite. The problems of getting the information and arranging for printing, especially as this issue is being produced during the Christmas/New Year holiday period, have made this impossible however. Instead, a cover-mounted promotional gift has been included. Basic information on Astra services has appeared in recent issues (see November page 46 and December page 125) while a map on page 259 this month shows the footprint for the initial Sky Television services.

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TV Fault Finding

Philips CP110 Chassis

I've had a few cases where, when the chopper transistor has failed, two of the diodes in the bridge rectifier and the chopper control chip have failed as well. In this particular case however the 210V supply rectifier had gone short-circuit. When I switched on again I was rewarded with an over-bright monochrome picture: the transistors in the green output stage had gone short-circuit and the resulting high voltage had taken R3445, R3410, D6406, T7413 and R3416. Had there been a thunder storm perhaps?

The problem with another of these sets was field foldover that varied as the chassis was flexed. No dry-joints could be seen, so attention was directed to the top of the board. The area around C2574 was most sensitive to probing and when this electrolytic was removed the cause of the problem could be seen - it had lost its electrolyte all over the board. P.B.

Grundig CUC2410 Chassis

This set had no picture as the RGB output stages weren't being driven. The anti-screen-burn circuit was coming into action though the field hadn't collapsed. A check on the field output waveform revealed that it was about half the normal size, which was reasonable as the supply was only 10V. R525 (0.33Ω) had gone high-resistance. P.B.

Philips/Pye System 4 Chassis

The customer reported that the set would go dead. Our field engineer went out and resoldered the connections to the line output transformer, but as this didn't provide a cure the set was brought into the workshop. On test we found that the set lost its picture, but not sound, every ten-fifteen minutes or so. When the fault was present there were no video waveforms at the c.r.t., nor at the outputs of the TDA3651A colour decoder chip IC7150. The latter was receiving its inputs but the sandcastle pulse was 9V with the fault present, 10V otherwise. This gave us a clue: we suspected the TDA2541 i.f. chip IC7110. Fitting a replacement made no difference how-ever. We next found that the 26V supply at pin 13 rose to 12V. The flyback booster diode D6107 between these pins was going leaky intermittently.

I've had the equivalent diode D6400 in the CTX chassis cause trouble, but in this case the symptom is field collapse, not chopping off the video. S.A.F.

Grundig 6445 (GSC200 Chassis)

This was a real Grundig snorter of a fault. The channel indicator was on but there was no sound or picture and the set was apparently tripping at a rate of about twice a second. Symptoms like these usually indicate a dry-joint, a faulty thyristor or the occasional defective capacitor, but not this time. Even the reliable line output and commuta-tor transformers were tried. As a secondary symptom we found that all the l.t. supplies were low at about 9V. This should have pointed us in the right direction but a certain amount of time was spent checking with external l.t. supplies connected. One thing we discovered was that the set worked with an external 13V supply connected to the line oscillator but went off again as soon as this supply was disconnected. Diode D637 (1N4001) which provides isolation between the start-up supply and the other l.t. supplies at switch on was open-circuit. C.A.

Philips K30 Chassis

This set was a real dinger having been messed about with in the region of the EW amplifier transistors on the mother board. I nearly gave up when I suddenly realised that the transistor markings are printed incorrectly on the panel. Inserting them the correct way round put matters right. H.MacM.

Decca 100 Chassis

Severe ringing and poor luminance looked very like a mistuned i.f. stage but we eventually found that the 47µF luminance coupling capacitor C208 on the colour decoder panel had gone very low in value. H.MacM.

Philips G11 Chassis

No sound or raster was due to no little trouble in the line generator circuit. The TDA2590Q chip had split apart, D2015 was short-circuit and C2001 (100µF) had exploded. H.MacM.

Grundig 7400

This set suffered from vertical shading on the screen. There were two vertical green bars with a bright-up on the edge, one roughly in the centre of the screen and the other towards the right-hand side. The cause of the problem was that C632 (220µF) had gone rotten. It's the reservoir capacitor for the 27V supply, which was low at 22V. The problem was made more confusing because another dealer had attempted to solve it by advancing the HS control to give 9V instead of 54V at point C on the line output transformer. This gave the impression of no EW correction, so a lot of time was wasted. M.D.

Ferguson TX100 Chassis

This was the first of these sets that has come our way. The problem was fairly simple - no red because the 100kΩ feedback resistor R609 in the red output stage had gone open-circuit. M.D.

Pye 2260 (Philips CTX-E Chassis)

This set came in dead. The mains fuse had blown and the surge limiter resistor R3291 (4-7Ω) was open-circuit. A quick check showed that the bridge rectifier had gone short-circuit negative to one a.c. leg. We replaced these parts and switched on. Result: the set tripped. Replacing the sync chip IC7375 (TDA2577) cured that but the set then had a blank raster with no sound. We found that the TDA2541 i.f. chip IC7151 had no supply at pin 11 because R3153 had gone open-circuit. Replacing this resistor restored the voltage at pin 11 but there was still no improvement. A new TDA2541 produced a ghost outline.
of snow and we next found that the video emitter-follower T7148 (BC548) was also short-circuit. Replacing this gave us more snow. R3103 which feeds 12V to the tuner was open-circuit. After this had been replaced there was a nice snowy picture with no sound. R3170 in the 12V feed to the TBA1205 intercarrier sound chip had gone open-circuit. With a replacement fitted the set worked but it was impossible to stop it searching and make it store channels. This proved to be due to the MSM5840M-63R3 microcomputer chip on the remote control panel. The customer thought that the set simply had a blown fuse. . .

Sanyo CTP6102

This oldie suffered from very intermittent field jump with occasional rolling. The problem was eventually cured by replacing the transistors in the field oscillator circuit, Q401 (2SA564) and Q402 (2SC536), although they measured perfectly.

M.D.

Pye 3030 (Philips NC3 Chassis)

Intermittent picture failure with this almost new set was traced to a dry-joint on R608 (18Ω). The screen. The cause was found as soon as the set's back cover was removed. The RGB and earth leads that run to the c.r.t. base PCB they were resting on the main panel close to the line output transformer. Just moving the leads a few centimetres away from the transformer, e.g. by hinging down the signals panel, cleared the problem.

I.B.

Sanyo CTP4100 (79P Chassis)

The picture brightness varied - it would become bright enough to produce flyback lines and poor focusing. Checks revealed that the tube's first anode supply was varying and we then noticed a glow near one end of R363 (270kΩ, 1W). This resistor forms part of the first anode supply network and was going open-circuit, causing voltage variations at one end of the first anode supply potentiometer VR361.

I.B.

Panasonic TC1475 (Z1 Chassis)

The only sign of life with this set was a whine from the switch-mode power supply. Protection diode D854 (R2G) on the 103V line was found to be short-circuit. Incidentally this diode isn't listed in the parts list - the part number is just R2G. Another diode was fitted and the set was run up on a variac. At around 145V input the set worked fine.

M.D.

Ferguson TX10 Chassis

The problem with this set was a faint vertical white line approximately four inches from the left-hand side of the screen. The cause was found as soon as the set's back cover was removed. The RGB and earth leads that run from the right side end of the upright signals panel to the c.r.t. base panel were incorrectly routed. Instead of being clipped along the upper edge of the signals panel before going to the c.r.t. base PCB they were resting on the main panel close to the line output transformer. Just moving the leads a few centimetres away from the transformer, e.g. by hinging down the signals panel, cleared the problem.

I.B.

Sony KV1400

This set would work for about twenty minutes then go dead. We found that the power supply protection circuit was coming into operation - in the fault condition Q652 and Q651 were both on. The set was switched off to deactivate the protection and a voltmeter was connected to the base of Q652. When we switched on the voltage was correct at approximately -0.3V but after a few minutes it started to rise slowly until it reached about 2V when Q652 switched on and shut down the power supply. The protection circuit comes into operation when the voltages in the line output stage are excessive. Sensing is via the 18V zener diode D653. The problem was that this device was leaky.

I.B.

Thorn 9000 Chassis

The power supply was tripping and the two beam limiter resistors R724/5 were overheating - the classic signs of tripler failure. So a new tripler was fitted, along with a couple of new resistors, and the set was tried again. This time the power supply stopped tripping, the sound returned and the c.r.t.'s heaters lit up, indicating correct timebase operation. R725 once again overheated however, due to a high negative voltage from the clipper diode in the tripler via R724. The line output transformer had to be replaced because of interwinding leakage between the e.h.t. overwinding and the other coil on the same bobbin.

C.D.

Nikkai BG001

With a dead set you might find the fuse open-circuit or intact. If the set starts up with heavy tripping when the Avo 8 (on a.c.) is connected to the cathode of Q811 or the junction of R812/3 and continues to do this we've found that either R812 or R813 is open-circuit - the manual for sets sold in Ireland may read R812 and R828 or just R883.

In one case the raster shrunk by an inch all round then went dim with the h.t. down at about 80V. Q815 was open-circuit.

J.R.A.

Hitachi CPT2626

This set suffered from an intermittently snowy picture. Tapping the tuner indicated that it had a dry-joint, so a new one was fitted. Within a few seconds the set went into standby by R717 in the 12V rail open-circuit. Another tuner was tried, with a new R717, and while fitting this we noticed that the row of wire links near the tuner in fact passed partly below it: one end of one of them had popped up a bit while desoldering the tuner so that it shorted to the tuner's body when the new unit was fitted - why do these things happen to us?!

This was not the end of the story however. We now had a whistle on sound, pitched at about middle C. It appeared only at the mid-range of the volume rocker bar and the rotary analogue control had no effect on it. The big can of microfarads was applied to all rails in the audio and i.f. areas with no effect (don't forget to switch off, discharge, connect and switch on each time!). We then found that the whistle wobbled while changing channels with the remote control unit, and that volume up/down raised and lowered the pitch. Adding microfarads to the remote control receiver panel did nothing. Increasing the value of C428 which decouples the d.c. volume control voltage from 4-7μF to 47μF provided an 80 per cent cure, so we settled for 100μF. The set had to be sent out before we could scope across C428 to see the frequency and waveform coming from the control panel. Can anyone add to this?

J.R.A.
Letters

VINTAGE TV

Those who read Jeffrey Borin's interesting articles on running vintage TV receivers might like to know that the old 405-line transmitters from the Isle of Wight stations were given to our Wireless Museum, together with the standard converters and ancillary equipment. The small (?) 1kW standby transmitter is now back in working order and could be put on air at the touch of a button. I must hasten to add that we have no intention of carrying out such a dastardly deed however - despite having been granted the special exhibition callsign GB3WM ...

Douglas Byrne, G3KPO,
Hon. Curator, C.E.M. Trust,
The Wireless Museum, Arreton Manor, I.O.W.

MAKING IT PAY

I feel that I must reply to Mr. McHugh's letter in the December issue. If he is as well qualified to carry out repair work as he says, he's clearly working for one of the "rip-off" merchants - only in this case it's he who is being ripped off. He should realise that his employer, who is clearly not having any problem making a living or staying in business, is banking £108 a day clear as a result of the work that Mr. McHugh is doing for him.

I've been on my own for two years now and have had no problem at all in making a very good living. I agree wholeheartedly with those other readers who have said that specialist workshops and high skill qualifications are the way to make money and stay ahead of the game these days. I applied for government grants and took on industrial premises in an enterprise zone, then used my contacts built up over many years to start getting work in.

If Mr. McHugh wants to try it and has belief in his abilities he will find that many independent workshops are grossly overloaded and are only too pleased to farm out some of their overflow to a skilled engineer. They will often send the lad round with the repairs to ensure that the maximum time is spent at the bench doing their work. Payment for work of this nature is usually immediate, and an added bonus is no direct contract with Joe Public.

If Mr. McHugh wants to get some quality work in he should look to the computer market. Many computers are owned by industry and often all they're interested in is getting their machines back up and running, cost not being the prime factor. Video monitors go wrong with alarming regularity, and when all is said and done they are only stripped out TV sets. Believe me, there's little industry expertise in this field. Most digital engineers run a mile when high-voltage analogue circuitry is at fault, preferring to return monitors either to the manufacturers or to specialist workshops like mine.

CD players, cordless telephones and telephone answering machines are other areas where there is little servicing expertise. Try getting any of these repaired and see how many shops will turn you away. All these shops are potential customers for Mr. McHugh, as they would rather take in the repair than turn away the customer and risk losing his future custom.

In conclusion, it's not necessary to exist on £108 a week. Get in there yourself, do a good job at a sensible and reasonable price - and start to live. You'll probably find it a good deal easier than you think to get into and stay in business - if you really are good. If you can live on £108 a week, that's all you need to make at first not to notice the difference - except that you may find yourself a little more tired and rather more fulfilled!

G. R. Darby, Proprietor Monitech,
Earls Barton, Northampton

TRIPPING PHILIPS KT3

The cause of the permanently tripping Philips KT3 chassis (Service Bureau, December) is almost certainly that the mains bridge rectifier's reservoir capacitor C1460a (200µF) has gone open-circuit. I've had two sets recently with this same fault.

Ron Purfitt,
Melksham, Wils.

ORACLE PUZZLES

After successfully solving the ITV Oracle Televox enigma (Letters October-November) can readers offer any ideas about pages 701-3, 713-5, 719 and 799?

C. Russell,
London NW2

HELP WANTED

Can anyone supply a service sheet/circuit diagram for the Steepletone monochrome TV plus a.m./f.m. radio receiver Model STVR45? The set was made in Taiwan.

F. C. Bailey,
2 Elmridge, Leigh, Lancs WN7 1HN.

Can anyone supply an audio chip that no longer seems to be available, type TDA1004A?

D. O'Brien,
420 Mourne Road, Drimmnagh, Dublin 12, Ireland.

Despite trying several sources I have been unable to obtain a TDA1004 i.c. Can anyone help with this?

G. A. H. Geary,
30 Burbages Lane, Longford, Coventry.

VIEW FROM ZIMBABWE

In this former outpost of the Empire one of the highlights of the month is the arrival of the magazine from the "old country". As I was a small, independent dealer in the UK in the 405-line era I particularly enjoy the letters pages. I find that many of the problems encountered by dealers and servicemen in the fifties still seem to be very much the same today and satisfactory solutions as far off as ever.

I must take issue with R. A. Holmes (August) on the subject of monochrome receiver prices. No 9in. set cost as much as £100 in the early fifties. Pye produced an excellent "Dark Screen" table model for 39 guineas (retail prices were than always quoted in guineas and were strictly controlled). Incidentally it was a serviceman's delight: after unscrewing just two bolts the chassis and tube slid out of the cabinet as one unit. By 1959 the first of the 17in. 110° "Slimline" models - built down to a price rather than up to a standard - cost about 60 guineas. Retail price maintenance was soon to be swept away and...
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with it many of the smaller dealers who could no longer compete with the bulk order buying power of the high street multiples. Soon afterwards I thought it wise to get out, while my head was still above water, and search for greener pastures.

Here in Zimbabwe a twenty-year old, well-preserved monochrome set with doors and legs (referred to here as a "cabinet model") sells for the equivalent of £200-£250. A line output valve for this sort of set, if you are lucky enough to find someone able to sell you one, costs about £16. A good G8 changes hands for about £500. New, large screen black-and-white cabinet models (if and when available) cost about the same. All new colour TV sets and VCRs have to be privately imported under licence by those fortunate enough to have external funds. I hope to be visiting the UK before long. If any reader knows of a supply of PL504s, PY88s, DY86s, PCL805s and TBA240s at competitive prices I'd be delighted to hear from him. H. J. Atwood, 3 Van Praagh Avenue, P.O. Belvedere, Harare, Zimbabwe.

Teletopics

**SATELLITE TV**

Once again the main news this month is provided by satellite TV developments. As you will all know by now, Astra has been successfully put into orbit: initial transmissions are due to start on January 20th and the first four Sky Television services are due to start on February 5th. The Disney Channel will commence operations in the spring and there is to be a sixth Sky Television channel which will be devoted to classic films, documentaries and arts programmes. This channel is provisionally known as Sky Arts and Education; it will be financed by advertising and corporate sponsorship and is due to come on air later in the year.

Sky Movies has signed agreements with Warner Brothers and Orion Pictures. The deal with Warner provides exclusive use of all future films over a five-year period plus substantial access to the Warner library. It also includes material from Lorimar Pictures and Television. The deal with Orion covers major releases plus pay-TV and basic rights to 167 other films in the Orion catalogue for a period of four years. The two Sky Television pay-TV channels, Sky Movies and The Disney Channel, are to use a scrambling system known as Palcrypt which has been jointly developed by Thomson and News Data Security Products Ltd. It uses the line cut and rotate method, with digitisation of the picture elements, and is exactly the same as the system proposed for use with MAC-packet systems and approved by the EBU. Thomson will be building the initial decoders and the system will subsequently be made available to other manufacturers under licence, enabling them to integrate the decoder circuitry within receivers.

Plessey is to supply microwave gallium-arsenide field-effect transistors for use in the TVRO system that is to be produced by Sir Clive Sinclair's company Cambridge Computer (see Teletopics, December). An order worth £3-4m for two million transistors has been placed and the TVRO systems are expected to be available from March. Further collaboration between Plessey and Cambridge Computer is aimed at producing a range of microwave gallium-arsenide chips for TVRO system use next year. Other Plessey TVRO system components will include a SAWF and a silicon decoder chip.

BSB, which already has agreements with Columbia, Cannon, MGA/UA and Warner Brothers, has entered into an agreement worth some £170m with Paramount Pictures and MCA/Universal, covering a total of around 650 feature films from the two US studios. BSB now has rights to show over 1,750 feature films during a five-year period. It's reputed to have paid around £400m for these rights. The Virgin Group's stake in BSB has been bought by the Australian Bond Corporation, which is best known in the UK for its Castlemaine lager, increasing Bond's interest in BSB from 22.47 to 33.7 per cent. The Virgin Group, which was one of BSB's founder members, is to concentrate on programme making and providing services to the television sector.

The sad saga of SuperChannel, which is at present in receivership, continues. Creditors are to be offered payment of a quarter of what they are owed. The Italian Beta Television company, which has a 55 per cent stake, has agreed to finance the channel until February.

ESPN, the US satellite TV sports channel, has increased its interest in Screensport from 3.5 to 25 per cent by buying part of the W.H. Smith Television stake. Screensport is moving to Astra with an extended 24-hour a day service.

There are to be at least six Eutelsat II second-generation, medium-power satellites. The first is scheduled for
launch in the spring of next year, at 13°E. A further four satellites will be launched at six-monthly intervals at 7°E, 10°E, 16°E and 36°E. The sixth satellite, expected to be in operation in early 1992, will be designed to meet Turkish requirements.

ITT Nokia has introduced a range of satellite receiving equipment and TV sets. The SAT1100 set-top unit is preprogrammed for the Astra transmissions and is MAC extendable. Features include an output for direct control of an electromagnetic polariser, a low threshold demodulator, 48-channel capability, wide and narrow band audio selection, a scart output socket and a user-friendly, full-function remote control system with LED display and a "TV release" function. The ITT Nokia LNB is optimised for use with the company's 55cm dish and receiver unit. The package sells at around £400. There are also two satellite-ready TV sets, Models SAT6390 and SAT7190, with built-in satellite tuners or the option of retrofit tuners. Other retrofit items that can be used with these sets are a NICAM stereo decoder and a picture-in-picture module. Both sets have a built-in f.m. radio.

Announcements of readiness for satellite TV are coming from various High Street traders. Dixons/Currys say that "they intend to be the dominant retail force in the satellite TV market" with receiving equipment priced from £199-99. An installation service is being provided by the Group's Mastercare service division. The Focus/Multibroadcast rental chain expects to install some 32,000 receivers during the first year of Astra broadcasting out of an anticipated market of 600,000 units.

THE CAMCORDER MARKET
Sales of camcorders worldwide are beginning to rise substantially. When figures become available it's expected that some 6m camcorders will have been sold during 1988, representing a turnover of $7.3bn. The largest markets, the USA and Japan, are expected to have taken 2m and 1.5m units respectively. For the UK deliveries of around 120,000 are anticipated -- BREMA figures show that 82,000 camcorders were delivered during the first nine months of 1988. Sales growth of over fifty per cent was seen in Japan, where one household in ten now owns a camcorder. Matsushita has suggested that camcorder sales will soon outstrip sales of still cameras.

CABLE TV
It's understood that Robert Maxwell has put up for sale his loss-making British Cable Services, which includes the old Rediffusion networks and several more recent multi-channel franchises -- it's the UK's largest cable TV operation. US firms continue to be the only ones prepared to put money into cable TV in the UK: the latest franchise awarding by the Cable Authority has gone to East London Telecommunications which is owned by Jones Intercable and Pacific Telesis. The franchise covers Barking, Bexley and Redbridge.

THE CD-R DISC
A blank, recordable compact disc, which is expected to be known as CD-R, has been demonstrated by the Tokyo electronic components and magnetic tape manufacturer Taiyo Yuden. The characteristics of the disc meet the basic Philips/Sony specification for compact discs. This is the latest in a series of announcements that have come from various firms which are conducting research in this field. Taiyo Yuden say that initially the aim would be to make the discs available for professional use. Copyright presents a serious problem in the domestic context, as it does with DAT. Once the technology has been mastered however its seems inevitable that it will eventually be offered on the consumer market. Recorders are still under development. The principle involved is to use a laser to alter the magnetic state of a disc layer, to give digital indication of either one or zero. With the Taiyo Yuden disc a 7-9mW laser is used for recording and a 2mW laser is used for playback. The disc is not erasable. Kodak however has recently announced the development of an erasable, recordable CD using what is known as thermo-magneto-optical technology.

TUNER PROVIDES MONITOR CONVERSION
Feedback Instruments Ltd., Test and Measurement Division, Park Road, Crowborough, E. Sussex TN6 2QR (telephone 0892 653 322) has introduced a tuner system, designated Model AV7300, to enable a dedicated colour monitor to be used as a TV receiver in addition to its monitor function. The unit can be permanently connected to the computer and a TV aerial, with simple switching between the two uses via the TV/computer switch. A green LED indicates the set's operational state. The tuner itself is a Philips type and the system gives push-button selection of up to twelve channels.

BLACK LINE 45AX TUBES
The new Black Line series of 45AX FS tubes from Philips Components provide bright, high-contrast pictures and, when switched off, an unobtrusive screen. The low expansion invar shadowmask used in the tubes combines improved contrast with excellent colour purity and white balance. Use of an invar shadowmask enables the tube to be driven at fifty per cent higher beam power than with a conventional steel shadowmask without discoloration being introduced. As a result a lower light transmission faceplate glass can be employed, giving a dark screen while retaining improved brightness. The invar shadowmask has an expansion coefficient less than seven per cent of that of a steel shadowmask. This leads to a dramatic reduction in beam displacement due to doming with high-energy mask loading. The new shadowmasks are used with the unique 45AX corner pin suspension system.

NEW FROM CROFTON
Two new video products have been introduced by Crofton Electronics of Kingshill, Nextend, Lyonshall, Herefordshire HR5 3HZ (telephone 054 48 557). The first is a miniature monochrome camera with solid-state image sensor, Model CCD2, which is claimed to be the smallest on the market today at 5.7 × 5.7 × 4.8mm and weighing 140g (less lens). The half-inch CCD image sensor provides a total pixel count of 276,450 with a sensitivity down to 3 lux. Output is 1V peak-peak at 75Ω and the signal-to-noise ratio better than 46dB with the a.g.c. off. There's a standard C lens mount and operation is at 11-16V d.c.

The second product is a time/date and message generator with stop-watch facility, known as Model TDM51. It's available in two basic forms, as an assembled PCB for incorporation in other equipment or boxed as a free-standing unit complete with mains transformer, input and output BNC sockets and setting push-buttons. The design is based around a single microcomputer chip with all the functions under software control, making specialised customisation possible. It can be interfaced with almost all video signals regardless of line standard and mains fre-
quency. Applications are wide and diverse, ranging from a simple time/day insert generator for video signal chains to use as an event timer, a video editing ident signal etc.

**VIDEO EQUIPMENT**

Akai's latest VCR, Model VS66EK, is a digital LP machine with a suggested price of £499.90. The digital features include picture-in-picture and freeze frame. The universal remote control handset that comes with the machine is a computerised unit with the ability to learn up to 45 functions from other infra-red handsets so that it can be used to control a TV set, midl-system etc. in addition to the VCR. Other features include a DX4 head, next function memory, child lock, scart socket, digital auto-tracking and QSS, which enables a picture to appear on the screen in 1-5sec. Step-by-step programming instructions are displayed on the screen through the Akai interactive monitor system.

The Matsui VX850 VCR from Currys is of interest in incorporating a teletext decoder at only £350. There's also programmable remote control with LCD display.

The latest 8mm camcorder from Pentax, Model PV-C880E, has a high-resolution 320,000 pixel CCD image sensor that works in conjunction with an automatic exposure system and automatic white balance. Features include an interval recording facility and an over-record facility. The former enables one-second images to be recorded for up to twelve hours at selected intervals of 0-5sec, 1, 2 or 5 minutes. The latter enables the user to make an insert on the tape for up to 3secs. Amongst the many other features is a high-sensitivity, unidirectional electret microphone with a wind-noise cutout device. The suggested price is £1,099.95.

**Video Head Position Checker**

F.M. Martinez

This simple strobe unit can be used to check the position of video heads. As the circuit (Fig. 1) shows, it's based on an MC1455 timer chip which is used as a monostable triggered by the negative-going edge of the VCR's head switching pulse. The output from the monostable is used to drive a yellow LED for a period of approximately 1ms – see Fig. 2.

If the LED is placed directly over the head drum when the VCR is in the play or record modes the three holes above the head can be clearly seen as head A starts its scan across the tape and head B leaves the tape path. In addition, scanning the drum with the strobe unit enables the wiring and any label to be identified.

Two LEDs in parallel were used in the prototype. The chip is capable of handling the source current without damage. As the on time is slightly less than 1ms (with the component values shown) no limiting resistor is required.

If the drum above one of the heads is marked with a small adhesive label tinted with yellow text marker and a line coincident with the centre of the drum is drawn on the label, head A or head B can be clearly identified by scanning the strobe around the circumference of the drum.

By using a suitable circuit to invert the head switching pulse input to the MC1455 chip the position of head B can be monitored as it starts to scan the tape.

The values of C1 and R1 were chosen so as not to load the head switching pulse generator. The values of C3 and R2 determine the LED on time, in this case 1ms.

The unit can be used for experimental or educational purposes where tracking effects with early models can be seen and the effects of the PG1, PG2 and record phase adjustments on the position of the heads can be demonstrated.
Camcorder Servicing

Part 1

Steve Beeching, T. Eng.

The camcorder is one of the latest items of domestic electronic equipment that the owner/user takes for granted and often abuses. A large proportion of owners seem to assume that the camcorder contains something like a clockwork mechanism and have no idea of the internal complexities. Whenever I open one in front of the owner there's a gasp before the cliches start to come out - "how tiny/complicated/don't know how you can see" etc. As a result of this attitude camcorders get dropped in the sea/sand, on concrete, on the lens, and are generally slung about - until something goes wrong when there's a moan about the cost of repair.

The technology is developing rapidly as chips grow more legs and get smaller. More diverse functions are being designed into individual i.c.s, and as a result of this failures often produce fault symptoms that are not necessarily indicative of the source of the problem.

Camcorder servicing cannot be carried out on the principle of replacing components until the fault clears. With this approach you will introduce more faults as you go along, adding to the final cost. The source of a fault must be tracked down carefully, then only a few components replaced, either on a logical basis or for elimination purposes.

It's not a good idea to plague manufacturers' technical departments. The answer you get will depend on the information you provide: if you are not correct, you will be given incorrect repair suggestions. It's my fate in life that such conversations usually end up with "when you've tracked it down, let us know for our records".

Much of the development that has gone into camcorders has been undertaken to improve the manufacturers' market share and profitability. The aims have been to reduce size, maximise usability and maintain a competitive price in worldwide markets. Unfortunately ease and speed of manufacturing tend to be incompatible with ease of servicing. Generally, manufacturers don't consider servicing, which is of little interest to them. As an indication of the scale of production at present, JVC recently increased the output of its camcorder plant at Yokohama from 120,000 to 150,000 units a month - that's about 6,000 a day.

Workshop Requirements

It's possible to service camcorders profitably, but to be successful a number of basic principles must be understood and observed. First, there's no point in attempting to repair high-technology products using surface-mounted components unless you are fully equipped to handle them - otherwise only damage will result. Surface-mounted components are not well marked, just coded to indicate what they are: with transistors and diodes there are two letters, resistors have three numbers and capacitors noth-

Sacrifice components for the sake of the PCB. If a board is damaged a new one will be required, and this isn't cheap (£150-£250). The soldering iron should have a tip size down to 0-4-0-8mm and, to preserve the workability of the tip, be temperature controlled. I find that I have to replace my 0-4mm Weller tips, at a cost of around £3 each, every couple of weeks. The workbench must be clean, tidy and anti-static, with no components, solder blobs, food etc. lying about.

Servicing Equipment

Each manufacturer's camcorder will require extension leads and odd jigs to support the camera section. Expect to pay about £150 per set for JVC camcorders, somewhat less for Panasonic. Some leads for one manufacturer will work with another's models but it's very frustrating to find the right kind of connector with one pin short or one pin too many.

Colour and grey-scale charts are required for camera work, lit by a quartz-iodine lamp as close to 3,200°K as possible. A chart of red and blue sections side-by-side is useful for R/B matrix systems. Some pornographic calendars are good for flesh tone and a general check on colour reproduction, with a mixture of reds, blues, yellow, browns and greens.

An oscilloscope with dual traces and external triggering is required - a bandwidth of 20MHz will do. For the camera section of the workshop a precision colour monitor and a vectorscope should be permanent fixtures.

In other words, camcorders are not for the unskilled, the faint-hearted or the enthusiastic amateur. Unless you are prepared to spend £3,000-£5,000 on equipment, leave them alone. Camcorders that have been "got at" could well cost several hundred pounds to put right. We hope you'll find the rest of this article of interest, but inevitably the interest for many readers will be academic.

The VHS-C Format

The VHS-C format uses a small version of the standard VHS cassette: its size is about a third of that of the standard cassette, though the recordings are compatible. Initial JVC VHS-C camcorders provided only up to thirty minutes' recording time. Other manufacturers produced

![Image](image_url)

Fig. 1: The VHS-C cassette.
full-size VHS camcorders. The size of the unit is determined largely by the size of the cassette housing. While a full-size camcorder is not heavy, it’s bulky and difficult to balance for long periods of time. With these camcorders the tape runs for three hours but the batteries don’t, so external battery power is necessary.

To overcome the short recording time of its initial camcorders JVC designed the GR-C7 VHS-C camcorder which has a CCD image sensor and half-speed, long-play facility. The ability to record for up to an hour with a very light-weight camcorder proved to be popular. As a result, JVC-manufactured versions of the GR-C7 appeared in the ranges of other Japanese manufacturers and some European companies. Later, in 1986, record-only models were introduced. These weighed less than 1kg with the cassette and battery included.

The supply spool in a VHS-C cassette is a small version of the standard VHS cassette spool. It can sit on an open turntable within a VHS VCR. Despite the small diameter of the spool, the socket is the same as that of a standard cassette. The take-up spool in the VHS-C cassette is mounted internally on a small spindle. It’s driven by a toothed gear on its circumference, as shown in Fig. 1.

When a VHS-C cassette is mounted in a cassette adaptor the recording can be played back via a full-size VHS VCR. The supply spool sits on the VCR’s supply spool turntable while the take-up spool is driven by the VCR’s take-up turntable via a small intermediate gear—G, see Fig. 2—within the adaptor. Early versions of the cassette adaptor were “manual”: loading arms A and B were moved outwards and forwards manually to match the tape path by a side mounted wheel and internal gears. Later versions use a battery-driven motor which is actuated when a VHS-C cassette is inserted in the adaptor. In either case the tape is pulled out of the VHS-C cassette to the front of the adaptor, thus matching a standard cassette. A small point worth noting is that when a VHS-C cassette is put into an adaptor a few seconds of the beginning of the recording are “lost” within the adaptor, because the internal take-up path is increased.

The VHS-C Drum

VHS-C camcorders have a very small, light-weight video-head drum assembly. Various features ensure that VHS compatibility is maintained. Most full-sized VHS camcorders use the same small head assembly. It’s two-thirds the size of a standard VHS drum and has four heads mounted on it, designated A, A’, B and B’. These are used in turn to play or record video tracks on the tape. The four heads enable the standard VHS tracks, ch. 1 or A and ch. 2 or B, to be laid down on the tape and played back: the switching sequence is determined by the amount of tape wrapped around the drum. The standard VHS drum is 62mm in diameter while the small camcorder drum is 41mm in diameter.

A comparison of the two types of video-head drum is shown in Fig. 3. Table 1 lists specifications. In the VHS format successive tracks are recorded with an azimuth of ±6°: the azimuth for head A is +6° while the azimuth for head B is −6°. From Fig. 3(a) you can see that in the standard VHS system head A comes into contact with the lower edge of the tape as head B leaves the upper edge. Thus head A will follow and record or play back an A track. As head A leaves the upper edge of the tape head B comes into contact with the lower edge and so on along the length of the tape. As the video head travels around with the drum the tape moves, very slowly in comparison, in the same direction. Thus each head produces a slanted track as it rotates through 180° which, with an overlap margin of about 3° at the beginning and end, gives a total tape wrap of 186°.

Let’s call the length of the track and of the drum circumference while the tape is in contact with it \( l \). Ignoring the overlap, we can say that the length of path 1 is \( \pi \times D/2 \), where D is the drum diameter, 62mm. Thus \( l \) is about 97.4mm. For compatibility, the track length produced by the small camcorder drum — see Fig. 3(b) — must be the same, i.e. 97.4mm. Since the drum diameter is 41mm, the circumference \( \pi D \) is 128.8mm. So to maintain the same track length the wrap must be 97.4/128.8 or three-quarters of a full rotation.

Table 1: VHS and VHS-C specifications.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>VHS</th>
<th>VHS-C</th>
</tr>
</thead>
<tbody>
<tr>
<td>A head azimuth</td>
<td>+6°</td>
<td>+6°</td>
</tr>
<tr>
<td>B head azimuth</td>
<td>−6°</td>
<td>−6°</td>
</tr>
<tr>
<td>A' head azimuth</td>
<td>−6°</td>
<td>+6°</td>
</tr>
<tr>
<td>B' head azimuth</td>
<td>−6°</td>
<td></td>
</tr>
<tr>
<td>Drum diameter</td>
<td>62mm</td>
<td>41mm</td>
</tr>
<tr>
<td>Tape wrap</td>
<td>180°</td>
<td>270°</td>
</tr>
<tr>
<td>Drum speed</td>
<td>37.5 r.p.s.</td>
<td>37.5 r.p.s.</td>
</tr>
</tbody>
</table>
Fig. 4: Video head sequence.

Fig. 5: How the tape is scanned in the VHS and VHS-C systems, showing how compatibility is achieved. Tape viewed from the head side.

Fig. 6: Video head on/off switching in both the record and playback modes is required with the VHS-C system.

Fault Conditions

While the compatibility is good, when faults occur the symptoms may not be as obvious as one might expect. The main problems that produce picture disturbances are rotational jitter, eccentricity and very small changes in rotational speed. While the tracks are recorded in the order A, B, A', B', recording and playing back in that order. Whichever head is in use, the next one to be used is 90° ahead of it. Fig. 4 illustrates this. Thus the tracks are recorded in the sequence A, B, A', B'. Heads A and A' have a +6° azimuth while heads B and B' have a -6° azimuth. Fig. 5 shows the compatibility achieved in this way.

Fig. 7: The main VHS-C switching waveforms.

Fig. 8: The VHS-C head switching system.

Fig. 9: VHS-C timing diagram.
Causes of this trouble are: irregular drum bearings; drum eccentricity; an offset drum; tolerances in the Hall-effect devices used in the head drum drive system; and tolerances in the drum motor windings.

When a tape recorded on a VHS-C machine is played back on a standard, two-head machine you can find that there's a small line of horizontal displacement about a third and again at two-thirds of the way down the screen. This is caused by the extra heads in the VHS-C drum hitting the tape as they come into contact with it: although they are not switched on, the physical shock produced by initial contact disturbs the tape tension value.

A quick test of whether the four VHS-C heads are out of phase during playback is to momentarily touch the pinch roller, causing a quick pause. This makes the A and A' (and the B and B') heads change over. It happens because there's only one control track pulse per pair of video tracks, so that any one control track pulse can be for the AB pair or the A'B' pair. When you make the capstan servo skip a control track pulse in this way the relationship between the heads and the tracks skips through 180°, giving the changeover. The same effect can be achieved by brief use of the pause button.

This test can also reveal tracking problems resulting from tip height differential between the A and A' or the B and B' heads. On one occasion I had an "intermittent" tracking fault due to a faulty drum which would track or not depending on the chance start-up from play. If the playback sequence ABA'B' matched the recorded tracks there was no problem, but if the sequence was out of phase the playback would not track.

The cure for these troubles: replace the whole drum assembly, upper (video head) and lower (drum motor) section, and in some machines the head preamplifier in order to match it to the heads.

**Drum Speed**

When servicing a VHS-C camcorder there's a trap that even experienced video engineers can easily fall into. With standard VHS machines the servo timings equate to field rate, i.e. 40msec periods. The VHS-C drum speed is different however, resulting in servo waveforms that may be unexpected.

To meet the requirement that a TV field is recorded on a single track during half a drum revolution, the standard VHS drum speed is 25 r.p.s. The TV field has a duration of 20msec: thus the track path is traversed in 20msec and a full revolution takes 40msec, which is 25 r.p.s. or 1,500 r.p.m.

With a VHS-C drum the track is laid down over a 270° revolution of the head. This 270° rotation must still take 20msec to maintain compatibility. If 270° = 20msec, 360° = 26-6666msec, i.e. a single rotation takes 26-6ms which is a rotational speed of 37-5 r.p.s or 2, 250 r.p.m.

**Video Head Switching**

In a standard VHS VCR the video head not in contact with the tape in the playback mode is switched off, to prevent noise pick-up. This switching is not necessary in the record mode.

Three heads are normally in contact with the tape in a VHS-C machine. Only one is doing any work, so it's essential to switch off the others to prevent crosstalk between the heads. The switching system used switches the heads on individually in succession in both the record and playback modes.

This is illustrated in Fig. 6. Head B' is about to scan the tape, on which head A is recording a track – as shown it has moved a third of the way along the tape. At this particular point all four heads are in contact with the tape. As a recording is taking place, the need to switch off heads A', B and B' is clear – to prevent heads A' and B damaging the previous track and head B' altering the A head track being recorded. If the machine was in the playback mode at this time, head B would produce severe crosstalk if not switched off. Heads A' and B' would not produce much interference as they are of the wrong azimuth for the tracks they are covering.

With a standard VHS two-head drum the heads are 180° apart and both are driven by the f.m. recording signal. The wrap is 180°, taking into account the two overlap periods at the beginning and end of each track. This overlap provides a "window" area in which head switching occurs during playback, ensuring signal continuity and interference-free switching points.

We can use the overlap technique in quite the same way with the VHS-C system since the heads are switched on and off in the record as well as the playback mode. To get an overlap we must adjust the record switching so that interference-free playback switching is achieved. Consider Fig. 4(b), where head A is nearly at the end of its scan and head B has just come into contact with the tape. The heads are 270° apart and the wrap is 277°m, so for 7° both these heads are in contact with the tape. To get the result we want head B is switched on for about 1ms before head A is switched off. This corresponds with an overlap of about 16 lines, and as the playback head switching signal is centred within this overlap period there's a margin of ± 8 lines.

Fig. 7 shows the main switching waveforms, at 12.5Hz and 25Hz. As with standard VHS machines, the 25Hz signal is referred to as the r.f. switching signal or flip-flop and the 12.5Hz signal is derived from it by dividing by two. The four switching signals SW1-4 are synchronised to the 25Hz r.f. switching signal but the timing is modified so that each head is switched on (high level) eight lines (518μsec) before the 25Hz signal transition and off eight lines after the next 25Hz signal transition. Thus the recorded overlap period is centred within a 16 line period, leaving a sufficient margin of error for interchange tolerances in the playback mode. Accurate timing signals are developed digitally within a single i.c. and are not dependent on timing capacitors. In consequence they are not susceptible to drift.

Fig. 8 shows in block diagram form the VHS-C video head switching system. In the record mode the f.m. carrier is applied to the heads via switches SW1-4, the switching signals being timed to give the required overlap. Switches SW1-4 remain active in the playback mode to prevent crosstalk. The input to the playback circuits is determined by the combined logic of the 25Hz and 12.5Hz signals. This means that the switching transition is the same as the r.f. switching signal transition and the switching is therefore centred within the 16-line overlap.

The timing network doesn't differentiate between record and playback. It can be seen from Fig. 8 that switches SW1-4 determine the record switching while the combined effect of the 25Hz and 12.5Hz switches provides the required playback switching. Record/playback control is normally carried out within the preamplifier module.

The head switching waveforms are produced by the main servo chip, which operates in conjunction with a single 32.768kHz crystal clock to determine the timing of all the switching and servo signals.
The timing diagram is shown in Fig. 9. There are two inputs to the system, the 32.768kHz clock with a pulse period of 30.53μsec (in round figures) and the drum pick-up PG pulses. The latter are at a frequency of 37.5Hz and are divided by three to give 12.5Hz or 80msec. The pulse derived from the drum PG delay monostable is of about 1.9μsec duration and is adjustable. It provides a delay between the drum PG pulses and the start of the 25Hz flip-flop. This delay can be used to set the timing of the playback switches and set the r.f. switching point to 6.5 lines prior to the start of the field-sync period. The adjustment is done by means of a single potentiometer (PG1) instead of the two (PG1 and PG2) used in standard VHS machines. The rest of the timing is determined digitally. Note that it takes three full revolutions of the drum to complete the sequence, i.e. for all four heads to record or play back.

The 1.9μsec pulses from the drum PG delay monostable have a period of 80msec. On the falling edge the 32kHz oscillator is reset and a single preset pulse is generated. This preset pulse resets all the counters and initiates the start of the 80msec timing period. Two counter networks produce the overlap delay pulses and the 25Hz flip-flop delay pulses. The overlap pulse is a count of 33 clock pulses for the high state and 622 clock pulses for the low state. Four of these overlap pulses occur between each preset pulse. It can be seen that the 33 count is in fact the overlap period. The 25Hz flip-flop delay signal is in the high state for a count of 17 clock pulses and in the low state for 638 clock pulses. There are again four of these pulses between each preset pulse.

In both cases the total count is 655, where 655 x 30.53μsec = 20msec. In order to time the overlap period each video head switching pulse (SW1-4) is set by the rising edge of the overlap pulse and reset by the falling edge of the next overlap pulse. This extends each head switching pulse for 688 counts or 21msec. The 25Hz r.f. switching pulse starts on the falling edge of a delay flip-flop pulse. The effect of this is to place the r.f. switching pulse transitions precisely in the middle of the overlap delay pulses. The 12.5Hz signal is derived from the 25Hz r.f. switching pulses by division.

**General Points**

This completes our outline of the differences between the standard VHS and VHS-C systems. Note however that some full-size camcorders such as the Panasonic NV-M1, 3, 5 and 7, the Hitachi VM200 and the Grundig VS150 use the small head drum. Any problems associated with the VHS-C four-head system also apply to these larger models therefore.

In VHS-C camcorders the preamplifier is plugged into the main PCB and a minor shock can disconnect one or more of the timing signals, leading to a fault symptom not unlike that produced by dirty heads. If the technician is not aware of this he may well change the drum before discovering the cause of the problem.

If one head is clogged, the noise flashes at about 12Hz, whether colour noise or spots. Always be aware of the four-head sequence, and when using a dual-trace scope to check the playback signals display at least two periods of the r.f. switching signal in order to see all four f.m. outputs.

The next article in this series will deal with pick-up devices, signal processing and fault finding in this area.
Still Swimming
Les Lawry-Johns

First I'd like to thank John de Rivaz for his helpful suggestions on medical matters. I think however that for the time being I'll carry on in this daze and see how things turn out. Maybe it's something to do with all those TV sets over the years. It could of course be the effects of whisky, about half a bottle per night, just to keep the blood thin you understand. But it could affect my head as well. Something's wrong, because I can't repair some of the Bush models that keep coming in – the T20s and T22s I've written so much about over the years. Lately they seem to be beating me.

The Decca/Tatung 120

Then there was the Decca (Tatung) set that came in the other day. Fitted with the 120 series chassis. It kept blowing the 1A d.c. fuse in the power supply. I checked the BU426A chopper transistor and found that it was short-circuit, so I looked around for a reason. R810 was open-circuit. It's 150kΩ, so I fitted two 330kΩ resistors in parallel in its place. With these, a new BU426A and fuse fitted. I told him that the panel had nothing to do with the concentration. I helped him take the set out to his car and he drove off in good humour, leaving me with his unwanted bits and pieces, including the complicated panel. I kept looking at it and felt pleased that I wasn't expected to repair it.

The Decca Hybrid CTV

Here's another example of the daft things that keep happening here. A Decca colour set was brought in, fitted with the late hybrid chassis. The complaint was excessive red. To save me having to think I changed the video panel. The resultant display was nicely balanced. I told the pushbuttons and tuned one of them for London reception, at the same time noticing that the others weren't all that good at holding in. The owner had said however that all he wanted done was the red picture, nothing else. When he came to collect it I showed him the panel and mentioned the pushbuttons. He said they were all right and agreed that the picture was good. So he paid up and left.

Just as I was eating my lunch the phone rang. It was him again, moaning his head off about the buttons and saying it must be because of the new video panel I'd fitted. I told him that the panel had nothing to do with the buttons, and that there was nothing more I could do as he didn't want to bring it back to the shop. So that's it. He'll have to keep hitting the buttons until they click in.

Well that's it for now. Be seeing you!

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Most jobs in all spheres of life call for special tools. Electronics is no exception. Imagine trying to repair a VCR without a torque cassette or an alignment tape. The job can be done, but it takes about three or four times longer than it need do. Use of the correct tools makes the job in hand much simpler, and you find that the investment in tools pays for itself over and over again.

The world of mathematics is like a vast tool kit. If we can master the use of as many of these tools as possible, the physical problems and calculations we have to deal with will be greatly simplified. With mathematics it's the effort required to master the techniques that will pay for itself over and over again.

One such technique is the use of complex numbers (otherwise known as j notation) to assist in the analysis of a.c. circuits that use inductors, resistors and capacitors. Vector methods are normally used to illustrate simple cases, but their use requires that you memorise all sorts of different rules. Vector methods cannot, by any stretch of the imagination, cope with complicated problems easily. With j notation however all problems can be handled with the same ease.

This article is not intended to be a complete course on j notation - there are many excellent textbooks for that purpose. Instead the aim will be to try to unify our ideas of numbers by showing that real numbers form a subset of the complex numbers and that in a corresponding fashion the previous concept of numbers is abandoned however: instead it's refined by adding more numbers to only an integer power? A positive number has two square roots, one cube root, two fourth roots and so on. Wouldn't it be nice if any number had two square roots, three cube roots, four fourth roots etc.?

This leads us to the next question, which is why can't we find the square root of a negative number?

The common denominator of all these problems is that $\sqrt{-1}$ is not defined in the real number system. If we can define it however all these problems vanish. Thus $-2^5$ will be defined and any number will then have two square roots, three cube roots, four fourth roots and so on.

As there's no real number corresponding to $\sqrt{-1}$ we have to imagine one. Mathematicians call this number i (for imaginary), but to avoid confusion with current electrical engineers call it j. It's defined as $j^2 = -1$, or $j = \sqrt{-1}$.

We can now find the square root of any negative number, e.g. $\sqrt{-9} = \sqrt{9}\sqrt{-1} = 3j$. The above example of $-2^5$ solves as:

$$-2^5 = (-2)^2 \times (-2)^{0.5} = (-2)^2 \times \sqrt{-2} = 4 \times \sqrt{2} \times \sqrt{-1} = 4\sqrt{2} j.$$

Numbers that are multiples of j only are called imaginary. It's possible to combine a real number and an imaginary number into one quantity that's called a complex number. For example, $4j$ is imaginary while $3 + 4j$ is complex. A complex number like $3 + 4j$ is one number. Provided it is treated as such, complex numbers follow all the usual rules of algebra and can be manipulated just as easily as real numbers.

**Operations with Complex Numbers**

Complex numbers cannot be represented in a straight line as real numbers can. But remember how at each stage in our education our concept of numbers has to expand rather than change. Complex numbers are no different. We can expand our number line “up and down”, utilising the whole plane. The real number line remains as a subset of the set of complex numbers thus represented. This type of diagram is called an Argand diagram. Fig. 2 shows an example.

The complex plane can be thought of as a map or graph with x and y co-ordinates which must be handled separately. For those who were wondering what all this has to do with electronics, the resemblance of complex numbers to vectors should now be clear. Complex numbers are far easier to manipulate however than are some of the methods of vector addition used in a.c. theory problems.

Addition of complex numbers is straightforward: the real parts are added and the imaginary parts are added, giving another complex number, i.e.:

$$(a + jb) + (c + jd) = (a + c) + j(b + d)$$

e.g. $(3 + 2j) + (6 + j) = 9 + 3j$.
Fig. 1: The real number line, with some examples of real numbers included.

Fig. 2: The complex plane, with some examples of complex numbers shown.

Fig. 3: Modulus and angle of a complex number.

Fig. 4: Inductor with series resistor.

Subtraction is simply the reverse of addition, i.e.:

\[(a + jb) - (c + jd) = (a - c) + j(b - d)\]

e.g. \((9 + 3j) - (6 + j) = 3 + 2j\).

Multiplication and division by a real number are also as you’d expect, e.g.

\[(3 + 2j) \times 6 = 18 + 12j\].

To multiply one complex number by another, once again the ordinary rules of algebra apply. We must remember that \(j^2 = -1\) when we collect the terms together. Thus:

\[(a + jb) (c + jd) = ac + jad + jbc + j^2bd\]

\[= ac - bd + j(ad + bc)\].

For example:

\[(3 + 2j) (1 + 3j) = 3j + 9j + 2j + 6j^2\]

\[= -3 + 11j\].

Notice that in this example the number \(-3 + 11j\) is still written with the real part first, even though this is a negative quantity.

Division of one complex number by another requires more thought. We can however use the trick of multiplying the top and bottom of the equation by the same quantity, which must be the complex conjugate of the bottom line. The top and bottom lines are then expanded separately. This will make the bottom line a real number, enabling division to be carried out easily. The following example should make this clear:

\[\frac{a + jb}{c + jd} = \frac{ac - bd + j(ad + bc)}{c^2 + d^2}\]

It looks far more complicated than it is! Take this example:

\[\frac{-3 + 5j}{2 - 3j} = \frac{(-3 + 5j) (2 + 3j)}{2 - 3j} = \frac{-21 + j}{13} = \frac{-21}{13} + \frac{j}{13}\]

Finally we can define the modulus of a complex number \(Z\) as being

\[|Z| = \sqrt{a^2 + b^2}\]

where \(Z = a + jb\).

The modulus represents the magnitude of the number, or in graphical terms its distance from the origin. The angle that this modulus makes with the real line is given as \(\tan^{-1}(b/a)\). Fig. 3 should make this clear.

\(j\) Notation

Now that we’ve met the complex variable \(j\) and seen how to perform simple arithmetic with complex numbers we can apply these techniques to problems involving the impedances of capacitors, inductors and resistors, and see how these quantities can be simply combined.

Taking inductors first, we originally learnt that the impedance of an inductor \(X_L = 2\pi fL\), with a phase lag of 90° for the current. It’s this phase lag that prevents direct addition to other impedances. Suppose however we say that the impedance of the inductor is given by \(X_L = j\omega L\), where \(\omega = 2\pi f\) (\(\omega\) is angular velocity, and removal of the terms 2\(\pi\) simplifies the algebra). The presence of the \(j\) term carries the information about the 90° phase difference. More importantly however this impedance of \(j\omega L\) can be combined directly with other complex impedances. For example, suppose we have a 12.7mH inductor in a circuit operating at 50Hz. Its impedance will be

\[X_L = j\omega L = j\times 2\pi \times 2 \times 50 \times 12.7 \times 10^{-3} = 4j\Omega\],

or 4\(\Omega\) inductive as we may say. If we connect this inductor in series with a 3\(\Omega\) resistor, the composite impedance is simply \((3 + 4j)\Omega\). If there were more calculations to do we would simply carry the composite impedance as \((3 + 4j)\Omega\) through to the next step.

The modulus of the impedance would be \(\sqrt{(3^2 + 4^2)} = \sqrt{25} = 5\Omega\) (which means that it would draw 1A from a 5V, 50Hz a.c. source), and the phase difference between voltage and current is \(\tan^{-1}(4/3)\) which is approximately 53°. A look at Fig. 4 should make this clear.

Let’s now consider capacitors. We can replace our
original concept of \( X_C = \frac{1}{(2\pi fC)} \) by \( X_C = \frac{1}{(j\omega C)} \).

Notice that if \( j \) is transferred to the top line the formula becomes \( X_C = -\frac{j}{(\omega C)} = -\frac{j}{(2\pi fC)} \).

To take an example, consider an 800\( \mu \)F capacitor working at 50Hz. Its impedance is

\[
X_C = \frac{1}{j \times 2 \times \pi \times 50 \times 800} = \frac{4}{j} \Omega.
\]

This may seem very strange: how does something have a negative impedance?!! Remember that the \( j \) carries the information about the phase difference. Here \(-j\) simply tells us that the current leads the voltage by 90°.

Both the impedances we've been considering can be represented on one diagram, as shown in Fig. 5. Any impedance, no matter how complicated, can be represented by a point on this diagram. Point Z, \( 3 + 4j \), might represent a 12.7mH inductor with a 300 d.c. resistance winding, working at 50Hz. Point C, \( 0 - 4j \), would represent an ideal 800\( \mu \)F capacitor, again working at 50Hz.

This diagram will look familiar to anyone who has worked out this type of problem using vectors. But, as subsequent examples will show, the use of \( j \) notation makes things so much simpler. Notice also that any simple concept of resistance and d.c. circuits will fit in without any changes to the concept being required.

**Example: Series LCR Circuit**

The circuit shown in Fig. 6 has an inductor, a capacitor and a resistor in series, all fed from a 1kHz a.c. supply of 130V r.m.s. If the circuit consisted of three resistors in series analysis would pose no problems. By using \( j \) notation we can however combine the three impedances directly, just as we can with resistors. The combined impedance \( Z_T = R + j\omega L + \frac{1}{j\omega C} = R + j\omega L - \frac{j}{\omega C} \). Putting the numbers into this formula gives us:

\[
Z_T = 12 + j\left(\frac{2,000 \times \pi \times 4.27}{1,000} - \frac{1,000,000}{2,000 \times 5 \times \pi}\right) = (12 - 5j)\Omega.
\]

Thus the combined impedance of the three components in series works out to be the complex quantity \( (12 - 5j)\Omega \). We could also work out the current by dividing the supply voltage by \( 12 - 5j \), as follows:

\[
\frac{130}{12 - 5j} = \frac{1,560 + 650j}{144 + 25} = 9.23 + 3.846j \text{ Amps.}
\]

The modulus of this current, which is the value we measure, is given by

\[
|Z_T| = \sqrt{(12^2 + (-5)^2)} = \sqrt{169} = 13\Omega.
\]

The modulus of this current is 130/13 = 10A.

Notice however that the complex expression for current enables the phase angle to be worked out as:

\[
\text{Angle } \theta = \tan^{-1} \left(\frac{3.846}{9.23}\right) = 22.62^\circ.
\]

The current leads by this angle \( \theta \), by virtue of the \( +j \) in the expression for current. We would expect this anyway since there is more capacitive reactance in the circuit than inductive reactance, but the correct manipulation of the numbers involved confirms this without any need to remember rules about phase lead or lag.
It's important to interpret the phase lead or lag correctly. A \(-j\) in the impedance expression will give rise to a \(+j\) in the current expression (since current = voltage/impedance): both these forms represent a phase lead for the current.

What happen if we change the value of the inductor to 5mH? Well, let's put numbers into the formula again:

\[ Z_T = R + j\omega L + 1/j\omega C = R + j(\omega L - 1/j\omega C) = 12 + j(31.8 - 31.8) = 12 + 0j = 12\Omega. \]

The expression has become entirely resistive! In other words the inductance and capacitance have cancelled each other out, so that all the external source sees is a 12\Omega resistive load. This condition is known as resonance of course. In the series circuit the lowest impedance occurs at resonance while in the parallel LC circuit the opposite happens at resonance, the capacitance and inductance "cancelling" to create an infinitely large impedance. The proof of this is similar and is not worth repeating here.

**Case Study**

At this point textbooks generally provide a proof of the properties of most RC and LC circuits. There's little point in doing so here - proofs are seldom required in real life. To illustrate the way in which circuit responses are calculated however we'll look at a practical example.

The circuit shown in Fig. 7 is being used to couple a video signal from one VCR to another nearby machine for copying purposes. The essential elements of the circuit can be redrawn as shown in Fig. 8. The point we are interested in is the frequency response fall off caused by the cable capacitance. If the circuit consisted of a resistive potential divider we could simply say that \( V_{out}/V_{in} = R_{bottom}/R_{total} \). If we change resistance to complex impedance we can use the same potential divider rule, i.e.

\[ V_{out}/V_{in} = (R \parallel j\omega C)/((R \parallel j\omega C) + R) = \]

\[ \frac{R \times 1/j\omega C}{1/j\omega C + R} = \frac{R/(1/j\omega CR)}{(R/(1+j\omega CR) + R} \]

Now multiply every term by \( 1/(1 + j\omega CR) \).

\[ V_{out}/V_{in} = R/(R + R) (1 + j\omega CR) = 1/(1 + 1 + j\omega CR) = 1/(2 + j\omega CR). \]

In this example \( R \) is 75\Omega. Let's consider the response at the chroma carrier frequency of 4.43MHz. If the loss of response at the chroma carrier frequency is too great the burst will be weak and there will be attenuation of the h.f. signal components, causing all sorts of colour problems (not to mention poor luminance etc.).

At 4.43MHz, \( \omega = 2\pi f = 27.8 \times 10^6 \text{ Rad Sec}^{-1}. \) Hence \( V_{out}/V_{in} = 1/(2 + j(27.8 \times 10^6 \times 75 \times C)) = 1/(2 + j(2.085 \times 10^9 \times C)). \)

We can now calculate the ratio \( V_{out}/V_{in} \) for all values of \( C \) from this one equation. Suppose that the connecting cable has a capacitance of 1,000pF (\( 10^{-9} \text{ Farad} \)). The voltage ratio would be:

\[ V_{out}/V_{in} = 1/(2 + j(2.085 \times 10^9 \times 10^{-9})) = 1/(2 \times j(2.085)) \text{ which is approximately } 1/(2 \times 2j). \] To tidy up:

**FREE NEXT MONTH! POCKET MAGNIFIER**

Next month's issue comes with a cover-mounted gift, a handy magnifying glass that will meet many day-to-day needs in TV/VCR servicing, such as checking for poor quality joints and printed track defects and when trying to read small print in a poor quality circuit diagram.

**CD PLAYER SERVICING**

Whenever anything new arrives in the workshop for repair, the TV/video serviceman is expected to be able to deal with it. By now many of you will have been asked to tackle CD players. If not, you probably soon will be - CD players are selling well and are bound to become a significant part of the average service department's work load. Next month we start a detailed series on CD players by Joe Cieszynski. It will cover the theory of the whole system, with practical hints and fault-finding procedures given as various topics are dealt with, starting with the disc itself and the coding system used for the audio and control data.

**FIND ASTRA BY COMPUTER!**

Or any other satellite for that matter. A program for the BBC Micro computer to enable the azimuth and elevation for any location in the UK to be found, given the longitude and latitude which can be obtained from an Ordnance Survey map. The program is user friendly!

**INTRODUCTION TO S-VHS**

The S-VHS system is being heavily promoted: it gives much improved picture definition compared with standard VHS. Nick Beer describes the basic features of the system.

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date
\[
\frac{1}{2 + 2j} \quad - \frac{2 - 2j}{2 + 2j} = \frac{2 - 2j}{4 + 4} = \frac{1}{4} - \frac{j}{4} = \frac{1}{4} (1 - j)
\]

which is approximately \( V_{out}/V_{in} \).

This result immediately tells us two things. First that the chroma carrier frequency at 4.43MHz has been reduced in amplitude to about \( V/2/4 \), i.e. approximately 0.35 of its original strength, and that it is phase shifted by about 45°. All of which points to the need for a much smaller cable capacitance!

In Conclusion

In practice of course it’s not necessary to derive everything from first principles. We could look up in a table that the circuit’s response is \( V_{out}/V_{in} = 1/(2 + ju CR) \) and the phase difference \( \theta = -\tan^{-1}(ju CR/2) \), then put our numbers into the formula to work out what we wish to know. Fig. 9 provides details of common simple networks.

One big advantage of using \( j \) notation in design is that it lends itself readily to repetitive calculation. It’s very attractive to those who use computers to design their circuits for them. The input and output of a circuit can be related by an equation involving \( j \), and hence the output for any input can be readily calculated.

We know that when calculations on a.c. circuits are done we have to make allowances for the phase shifts introduced by the capacitors and inductors. This can be done by using vector methods or the “\( j \) operator” method. For circuits with more than a few components the vector method is very tiresome, especially if it’s necessary to change from voltage reference to current reference and vice versa.

By assuming that an inductor has an impedance of \( ju L \) and a capacitor an impedance of \( 1/ju C \), where \( j = \sqrt{-1} \), it is very simple to analyse all circuits directly, just as if we are dealing with resistors.

Resistance can be considered as a special type of impedance, i.e. an impedance that contains no complex component. So for purposes of calculation resistance corresponds to the real numbers and impedance to the whole complex plane, which of course contains all the real numbers.

We’ve illustrated this by the worked example of the loss of h.f. response due to cable capacitance when one VCR is coupled to another one.

I hope that this basic introduction to the topic of \( j \) notation will stimulate readers to further reading and development.

**Problems with the Philips VR2021**

B. Ross

The machine was used beneath an ageing Rank colour receiver (A823 chassis). This has a thyristor power supply which we thought might have been interfering with the machine, since moving it away from the set lengthened the time between failures. The fault still occurred in the workshop however.

Some time was spent on the power supply, as the mains plug was a sloppy fit and we suspected that transient sparks and arcs travelling through the power supply could be causing problems. We then found that when trying to record manually or via the timer the channel number could be selected but not held, i.e. the channel display reverted to 00. At this point a scrap machine was dragged out of the dungeon so that panels could be swapped. The front panel keypad was o.k., but changing the U20 computer panel provided a cure.

The machine was returned after a long soak test. Three days later it was back again. This time the protection circuit was operating, switching off the relay in the power supply. This is located on the U180 motor control board. Replacing T7025 and C2028 seems to have produced a lasting cure.

**Deck Trouble**

The third machine would also thread up then unthread after a couple of seconds. This time the problem was mechanical. During threading the pressure roller assembly didn’t travel quite far enough to the end of the carriage guide and fully into the locating slots of the scan unit brackets. When the pressure roller mechanism operated the roller was not secured against the capstan. The roller could be held in by hand whilst the mechanism operated, normal playback then being obtained with a good picture.

Attempts were made, without success, to alter the...
pressure roller position on the threading cord and to move the position of the cord slightly. Fitting a pressure roller from a known good machine produced no improvement either. As no way of repositioning the threading cord easily could be seen we concluded that a new cord or complete removal and rethreading would be required. Instead, the scrap machine was again raided, the cassette deck being swapped over. The machine now threaded up and played back correctly mechanically, but there was no picture as the video heads were badly corroded - liquid spillage?

The scanning unit from the original deck, known to be in good condition, was refitted. The advantage of swapping over the scan unit is that it contains the complete tape path as a subassembly, i.e. the heads, capstan, guides and motors, so that no realignment is required. We were upset to be rewarded with a weakly contrasted picture with random colour splashing and bands of static-like interference. All connections were checked and found to be o.k. Further playback then produced the good picture we'd expected. Our thoughts about this are that connector H5 from the rotary transformer to the playback amplifier may have been making poor contact or that there had been poor earth contact on one of the earthing wires.

Repair Viability

When it comes to the viability of maintaining these machines, in view of their age, the general cost of spares, the small number of machines that come in for repair and the points raised by R. Caley in a letter earlier last year (Letters, March 1988), the use of components from scrap machines has to be seriously considered. There appear to be quite a lot of 2020 and 2021 machines on the surplus market. Can anyone advise on the cost and availability of the service program plus adaptor for tracking faults in the computer section of these machines?

Miniature CCTV Camera

The Crofton CCD2 is claimed to be the world’s smallest CCTV camera at only 5.7 x 5.7 x 4.8cm plus lens. For further details see Teletopics, page 260.
Servicing the Sanyo Models CTP7130/1/2

John Coombes

Many Sanyo sets produced over the period 1981-1985 were fitted with the 80P series chassis. There were however several different versions of the chassis, involving a number of component variations. The main changes come with different tube sizes. The present article is based on Models CTP7130, CTP7131 and CTP7132 which are fitted with the A56-540X 22in. c.r.t.

No Sound or Raster

No sound or raster is the most common fault symptom so we’ll deal with this first. The simplest initial check to make is to see whether the c.r.t.’s heaters are alight. If they are the power supply and line timebase are functioning. Check whether C253 (47µF) and/or C241 (0.01µF) is short-circuit. These capacitors decouple the supply to the colour decoder chip and will pull down the l.t. supplies if shorted.

If the c.r.t.’s heaters are not alight, check whether the 145V h.t. supply is present at point 4B1 on the main board. If this supply is present, check out the line timebase as follows.

Check for the presence of a squarewave signal at the base of the line driver transistor Q461 (2SC2482). Absence of this waveform casts suspicion on the LA7800 sync/timebase generator chip IC401 which should be checked by replacement. If this fails to restore the drive waveform, check whether this i.c. is receiving its 12V supply at pin 15. If not, R458 (2.7kΩ) could be open-circuit or C458 (100µF) short-circuit. If the 12V supply is present check whether a sawtooth waveform is present at pin 2. Absence of this waveform should lead to checks on the line hold control VR901 (300Ω) — check the condition of its carbon track; on the line phase control VR451 (5KΩ) which should be checked by replacement; on R452 (12kΩ) which could be open-circuit; and on C451 (5,600pF) which could be open- or short-circuit. If the sawtooth waveform is present at pin 2 of IC401 check whether the driver transistor Q461 is short-circuit or its base feed resistor R450 (330Ω) is open-circuit.

If there’s a squarewave drive at the base of Q461 move on to check for the presence of a drive signal at the base of the line output transistor Q462 (2SD1279). A correct drive here could indicate that Q462 is open-circuit or that the line output transformer T471 is defective. No waveform at the base of Q462 could indicate that this transistor is short-circuit, that the line driver transformer T461 has an open-circuit winding or dry-jointed pin or that its feed resistor R462 (330Ω) is open-circuit. In the latter event the decoupling capacitor C463 (22µF) could be short-circuit.

Note that failure of the line output transistor Q462 can be caused by a dry-joint on the heatsink support tag. Resoldering will cure this.

Power Supply Troubles

If there’s no 145V h.t. supply at point 4B1, move over to the power supply section. The circuit is shown in Fig. 1. It’s basically a Siemens type self-oscillating chopper circuit, with transistors Q302/3 acting as a thyristor which when triggered by the waveform developed across R313 switches the chopper transistor Q304 off. Chopper transformer T301 provides mains isolation.

The first thing to check in the power supply is the mains fuse F302 (2AT). If this has blown, check the bridge rectifier diodes D301-4 (4 × RM111), the associated protection capacitors C304-7 (1,000µF), the filter capacitors C301 and C309 (both 0.1µF) and the reservoir capacitor C308 (200µF).

If F302 is o.k. check the d.c. fuse F301 (1A). The usual cause of this having blown is the chopper transformer Q304 (2SD1279) or C315 (2,700pF) in the snubber network going short-circuit. Other items to check if necessary are the three other transistors in the circuit, Q301 (2SC536), Q302 (2SA1246) and Q303 (2SC2274) – check these by replacement – zener diode D305 (EQA02-08RG), the 145V rectifier D323 (GF8-30G or 3JH61), diodes D307 and D308 (both type ES-1), C314 (220µF) and, if fitted, C326 (2,700pF). If these items are all in order suspect the chopper transformer T301 of having shorted turns.

If F301 is intact, check the voltage across C308. If there is no voltage here check the mains input circuitry, the on/off switch and the filter coils L301/2. If C308 has some 300V across it, check Q303 (2SC2274), D306 (ES-1), C329 (150µF), C469 (47µF), R318 (0-33Ω), R315 (39Ω), R302 (470kΩ), R314 (181Ω), and T301 for being open-circuit. If a reading of 300V is obtained between the collector and emitter of the chopper transistor Q304 it’s open-circuit. R302 can be dry-jointed and can go high in value.

C312 (10µF) smooths the supply for the error detector transistor Q301 which, with zener diode D305, sets the d.c. conditions for the trigger transistors Q302/3. If C312 loose capacitance the set will be erratic in starting up. Check it by replacement.

Field Faults

For field collapse, first check that IC401 has 12V at pin 12. If not, check zener diode D412 (EQA02-11D), R400 (150Ω) and C411 (470µF). The most common cause of field collapse however is failure of the field output transistors Q442 (2SD843) and Q443 (2SB753). One or both may have failed – check them by substitution. The LA7800 chip or the field driver transistor Q441 (2SC2002) could be responsible – again check by substitution. We’ve had R441 (470Ω), R442 (470Ω) or R437 (15Ω) go open-circuit and C443 (0-18µF) or C444 (4,700pF) go short-circuit. The scan coils can go open-circuit.

For lack of height (may be all right with the height control VR431 at maximum) check the field output transistors Q442/3, then if necessary check R4105 (68Ω) and R4106 (33Ω). These resistors are in series with the 15V regulator transistor on the scan correction panel. They can go open-circuit and dry-joints can occur in this area. In later models these resistors are wirewound types.

No Sound

For no sound, first check for an open-circuit loudspeaker. Then check that the LA4250 audio amplifier chip

TELEVISION FEBRUARY 1989
For no colour the first item to check is the M51393P colour decoder chip IC201, by replacement. The voltage at point 2N should vary from 0-13V with the setting of the colour control. If there is no variation or intermittent variation, replace VR905 (10kΩ). IC201 is mounted in a holder. If the pins of the chip or the holder are dirty you can get no colour, intermittent loss of colour, colour flaring on red, blue or green, loss of one colour, low contrast or background colouring on lowlights.

The 4.43MHz crystal X261 can also be responsible for loss of colour. Check it by replacement. The associated trimmer VC261 may be misadjusted. Other possible causes of loss of colour are failure of the pulse shaper transistor Q231 (2SC536); R225 (2.2kΩ) going open-circuit; the chroma delay line L242 being open-circuit or dry-jointed; and VR240 (3kΩ) going open-circuit or having a defective track. If still in trouble check that the line hold control VR901 is set correctly and if necessary check IC401 (LA7800) by replacement.

For no digit display, first check LD1751 (E1581L) by replacement. Check whether IC701 (AN5011) has 6V at pin 11. If this voltage is missing, check D708 (EQB01-06) and R718 (681Ω). If necessary check IC701 by replacement.

The 80P Chassis
The 80P is a compact chassis with much of the circuitry incorporated in a small group of i.c.s. IC101 i.f., IC201 colour decoder, IC171 audio amplifier and IC401 sync/timebase generator. It’s used in 14, 20, 22 and 26in. models. The 20in. models CTP6130, CTP6131 and CTP6132 are similar to the 7130/1/2 covered in this article but there are important differences. For example the chopper transformer has two output windings providing 110V and 18V lines. In the power supply R302 is 330kΩ, R313 is 2.2Ω, C308 if 100μF and F301 0-8A. The scan correction panel is omitted and the line output transistor is incorporated in a small group of i.c.s, IC101 i.f., IC201 colour decoder, IC171 audio amplifier and IC401 sync/timebase generator.
VCR Clinic

Philips VR2340
For intermittent noisy playback pictures – it looks just like the effect of dirty heads – clean the earth screw connection on head preamplifier module A420.

Philips VR6660
This machine was almost dead – the only sign of life was the head drum which was rotating much too fast. All the supply lines were present and disconnecting various plugs and sockets as instructed in the 12C bus fault-finding chart proved to be inconclusive. Whilst carrying out scope checks we discovered that the power-on reset signal was high all the time. Transistor 7151 was open-circuit. We replaced this 2SC1847 transistor and the machine works once the screw has been retrieved.

Mitsubishi HS318
The fault here was a very intermittent one: the drum motor would stop at random intervals during play or record. The deck would then shut down to produce the stop mode. Monitoring the drum speed control voltage was inconclusive because as soon as a probe (or a finger!) was touched on the collector of Q4A1 (drum control line) the motor’s operation would revert to normal. The trouble was being caused by the motor control chip. This is part of the quite inexpensive stator assembly whose part no. 409-B-051-03, is not given in the manual. Replacing it is a rather fiddly job however.

JVC HRD225/Ferguson 3V36
“Sound deteriorates when hot” was the complaint with this machine. We found that when the machine had been running for an hour or two the E-E sound became distorted and threatened to disappear altogether. The playback sound remained o.k. A scope check showed that the audio signal coming from the receiver section was “strangled” at TP4 on the tuner/timer panel because the interstation mute circuit was coming into operation. This is based on the action of the 15.625kHz tuned circuit T5. Careful adjustment of T5 to peak up the line-rate waveform at the collector of Q11 overcame the problem.

Panasonic NV788
The fault with this machine was complete loss of both the playback and E-E sound. There was no switched, regulated 12V supply to the audio panel. Tracing it to source via the video panel finally brought us to the syscon board, where regulator transistor Q6062 had 12V at its base but nothing at its emitter — the base-emitter junction was open-circuit. We replaced this 2SC1847 transistor with a BD137. Restoration of power to the audio section also brought up the back-light in the LCD counter display. Had we known about this we’d maybe have found the culprit sooner.

Finlux 2030/Tatung VR8495/B & O VHS82 etc
The Philips deck used in these machines is also used in many others. We’ve had several cases of failure to enter the rewind search (review) mode. What happens is that when review is keyed the machine shuts down and often ejects the tape. The culprit is the reel drive clutch (called the coupler, part no. 4822 528 20428) which binds — in one direction only! — and effectively jams the mechanism.

Reports from Philip Blundell, Eng. Tech., Eugene Trundle, Nick Beer, Alfred Damp, J. Olijnyk and Ian Bowden

Philips VR6660
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JVC GRC7
A fairly common fault with this and similar camcorders is the cassette lid’s securing screw working loose and falling into the mechanism. In most cases no harm is done and the machine works once the screw has been retrieved. Sometimes damage can occur however. In a recent case the screw jammed under the right-hand side (exit) guide and bent the spring, slide washer and slide plate that keep it on the curved and narrow. The sliding base of the guide then jammed at the entrance to its V notch, bringing up the emergency display of simultaneously flashing stop, play and fast forward indicator LEDs. These emergency mode indications are invaluable and are becoming more common, even on domestic machines.

Toshiba V83
We’ve recently had three of these machines that would intermittently shut down in the record or playback mode. Observation of the deck at the moment of failure showed that the take-up reel had stopped, allowing slack tape to spill on to the deck. The problem was in each case cured by replacing the reel motor, part no. 70326539.

Sony CCD-V200
The shop mentioned that the auto focus on this top of the range “professional” camcorder didn’t seem to be too hot. When we checked with the Siemens star we found that the manual focus was sharp but the auto-focus system produced defocusing. The focus calibration was also off; when focused at 2 metres the reading on the focus ring was about 3 metres. The machine worked well when the plane back and auto focus had been adjusted.

Grundig VS200
This VCR wouldn’t accept a cassette, though the customer’s complaint was that it wouldn’t record! In this machine there’s a safety system in the syscon circuit to prevent activation of the mechanism if the brake release solenoid hasn’t been energised. After removing a diode to override this safety arrangement a cassette could be inserted. Then, intermittently but gradually becoming permanent, the brakes wouldn’t release, causing a terrible
We inspected the servo board under a powerful magnifier and found that a Darlington type transistor, which is a conventional component, had been resoldered. The fault was present when the machine tried to lace, and it was not a true 1:1 squarewave. At this point the machine decided to work correctly and no chatter was heard. On playback this VCR produced either a rolling picture or a blanking of the top part of the picture. When the video heads in these machines start to wear out, the clarity of the picture is reduced. The cause of the problem was a poor installation of the video heads. We convinced him that there was nothing to worry about.

**Panasonic NV-M5**

This camcorder's auto-focus system didn't work. It was a fairly simple problem to deal with as we soon found that the system was not oscillating. The symptoms were as follows: the drum and take-up reel were spinning at high speed in the forward direction while the supply reel rotated in the reverse direction. The syscon in these machines is fairly complex, but when you get to know it and apply a logical fault-finding procedure, you find that it rarely causes difficulty. Not long after delving into the syscon I found myself heading towards the reel servo where the switching transistor Q204 was short-circuit.

**Salora SV9300/Mitsubishi HS330**

In playback the tape laced up but the sound and vision wouldn't switch from the E-E mode. We soon found that the switched 9V line was missing as the 2.5A fuse F901 in the mains transformer's 14V a.c. winding had gone open-circuit. It had died rather than blown, and a replacement put that right. A long soak test produced no further problems.

**Panasonic NV-MS1**

The garbled message I received about this camcorder, which had been bought the day before, mentioned frame jitter in the electronic viewfinder and on the monitor. It transpired that the customer had been filming in the early morning when it was misty with hazy sunshine: on bright white scenes there was a barely perceptible 50Hz flicker. We convinced him that there was nothing to worry about and suggested the use of a filter. He then mentioned noise in fast forward and rewind. These machines - the latest S-VHS ones - are a bit noisy but this one was excessively so because of a scraping reel drive pulley. A replacement put that right.

**Sony SLF1**

This one was brought in by a merchant seaman who used it on board ship. This explained the rusty aerial socket! The symptoms were as follows: the drum and take-up reel were spinning at high speed in the forward direction while the supply reel rotated in the reverse direction. The syscon in these machines is fairly complex, but when you get to know it and apply a logical fault-finding procedure, you find that it rarely causes difficulty. Not long after delving into the syscon I found myself heading towards the reel servo where the switching transistor Q204 was short-circuit.

**Mitsubishi HS349**

On playback this VCR produced either a rolling picture or a picture with the top part blanked out. When the machine was dismantled the picture returned to normal. Tapping the servo board made the fault come and go and a check on the drum flip-flop waveform showed that when the fault was present it was not a true 1:1 squarewave. At this point the machine decided to work correctly and no amount of tapping and banging would provoke the fault. We inspected the servo board under a powerful magnifier but couldn't find any dry-joints. So to do the utmost to prevent a comeback we resoldered all the components and wire links connected with generation of the drum flip-flop signal, from the drum pick-up pulse on CA1 through Q4B0 and Q4B1 to pin 24 of 14A0 and then from pin 11 of 14A0 to plug CE.

**Panasonic NV688**

Sometimes this machine wouldn't switch from LP operation in the record mode, while in playback it would select LP by itself with an SP recording and what can only be described as LLP with an LP recording. After a lot of tapping, prodding and flexing of boards we found that the supply to the SL/LP discriminator IC2005 was varying and at times non-existent. There was a dry-joint on a wire jumper that's part of the supply.

**Ferguson 3V54**

The job card said intermittent play and record and chewing tapes. When the fault was seen tape movement ceased, the tape being left in the fully laced position. The capstan motor had stopped due to a dry-joint at the emitter of Q603. I've often resoldered the connections to this transistor and Q604 when servicing these machines as the joints have always looked suspect.

**Telefunken VR2931**

This VCR is similar to the Ferguson 3V65. The cause of a hum bar on the monitor screen was really quite obvious — C3 (2,200μF, 16V) in the supply to the 5V regulator was bulging and leaking electrolyte down the rectifier panel.

**Some Quickies**

**Ferguson 3V29:** We've had several cases of no clock display due to the i.c. being faulty.

**Sharp VC651:** This machine would run for hours, days or weeks before the fault showed — there were then very wild speed variations. My first thought was a duff capstan motor, which in the circuit diagram is shown as a black box. Ordering and fitting a complete unit seems to have proved successful, touch wood!

**Panasonic NV-G25**

We've recently had two of these machines with the same problems. Both were about a year old, the complaint being of a poor picture and intermittently low sound. When the video heads in these machines start to wear out you get a slight increase in overall picture noise and bands of noise in only the top third of the picture in the review mode, particularly near the beginning of a tape. The only cure as far as I know is to replace the heads. I did find that by adjusting the inlet guide by approximately a quarter of an inch, the image was improved. The audio/control head assembly is now supplied as part no. VBR0125 instead of the original VBR0116 — perhaps the new type will last longer.
November was a relatively quiet month for DX-TV reception. There was some activity on several days and there were two periods of enhanced tropospheric conditions, on the 4th/5th and 14th. The 4th produced signals from Ireland, Luxembourg, France and the Benelux countries. There was an improvement on the 5th with numerous French signals, West German Band III/u.h.f. signals and Swiss ch. E12/u.h.f. reception. The 14th again produced reception from Ireland, West Germany, France and the Benelux countries in central/southern England.

F2 layer reception was noted on several days early in the month. The 6th produced two ch. E2 signals, one with the familiar EBU test pattern (thought to be from the Gulf area) and the other unidentified. There was further weak F2 reception on the 7th, again during the morning. Two further days with F2 reception during the morning occurred on the 12th/13th, when an EBU pattern and a blank raster were seen together on ch. E2.

Excellent signals were produced by the Leonids meteor shower during the 14th -19th, with a particularly active period during the morning of the 18th. There were no reports of Band III MS. Further MS activity occurred on the 30th.

There were only a few SpE signals of any consequence, as follows:

- 7/11/88 TVP (Poland) ch. R2.
- 11/11/88 TVE (Spain) E3.
- 12/11/88 TVE E2; ARD (W. Germany) E2.
- 14/11/88 TVE E2, 3.
- 17/11/88 Intense signals from TVE chs. E2, 3, 4 and RTP (Portugal) chs. E2, 3 were received mid-morning.
- 18/11/88 TVE E2, 3, 4.
- 19/11/88 DR (Denmark) E3.
- 23/11/88 TVE E3.
- 25/11/88 TVE E3.
- 28/11/88 TVE E3.
- 29/11/88 CST (Czechoslovakia) R1; TVE E2, 3.

My thanks to Cyril Willis (Kings Lynn), Iain Menzies (Aberdeen), David Oliver (Birmingham), Simon Hamer (Powys), Roger Fussell (Torpoint) and Tim Anderson (St. Leonards) for sending in reports.

**Suitable Tuner for DX-TV**

Bill Cotterill (Tipton) who builds a lot of equipment for DX-TV reception tells us that he is now using the recently released NSF 240-039-ET001 tuner. Its performance is similar to the classic ET021 in terms of gain, noise, overload capability and frequency coverage. Fig. 1 shows the pin connections.

**SpE Research**

A report from the RSGB on work being carried out at Southampton University suggests that the cause of SpE propagation is shear winds in the upper atmosphere.
anyone assist with identification?

switch to narrow selectivity by depressing the left-hand selectivity

then switch back to medium and repeak the right-hand

a local W. German transmitter. Can (Derby) on ch. E36. Thought to be from

and photographed by Garry Smith

Somebody's tablecloth! Seen recently

and to be distributed via Telecom 1C.

Switzerland: It will soon be legal to receive the French La 5 and M6 channels, RTL and any satellite downlinked material intended for domestic entertainment.

Finland: The MTV commercial channel hopes to establish its own transmission network. Currently it leases facilities from the Finnish Broadcasting Company YLE for morning TV with news/information/general entertainment.

Hungary: From January MTV is to operate on a seven days a week basis. The MTV-2 broadcasting hours are also to be extended.

Modifications to the D100 Converter

The HS D100 De Luxe DX-TV converter was reviewed in the December issue. Excellent though the unit is, a few simple modifications will improve the operation of the system at little cost.

First I suggest fitting a mains on/off switch on the front panel. A miniature double-pole toggle switch will serve the purpose, matching the general size of the other switches. Drill a hole of appropriate diameter, carefully and slowly, on the right-hand side of the front panel in line with the selectivity switches and the on LED, between the latter and the D100 lettering. Properly, the drill should move and scratch the panel lightly, the mark can be removed by carefully rubbing with a cotton bud and Vim/Ajax powder! Once the switch has been fitted, cut the mains input wiring at the heatshrink sleeved joint. There's sufficient cable within the unit to connect the mains input to the switch and the latter to the mains transformer. When clipping the box together take care not to trap wires between the two halves. Carry out this operation with the unit isolated from the mains supply! A matching Letraset "on" can be applied and clear varnished.

I found that when progressively switching to reduced bandwidth it was necessary to adjust the tuning. This problem can be overcome by repeaking the two selectivity stages slightly. Switch to wideband operation and, with a weak signal, adjust for optimum picture. Then switch to medium selectivity (right-hand switch down). If you find that the tuning needs adjustment, make a slight adjustment to the right-hand selectivity stage (farthest from the modulator). Retune for optimum wideband reception then switch back to medium and repeak the right-hand selectivity coil. With the fine tune position retained, switch to narrow selectivity by depressing the left-hand

switch. If retuning is needed, return to the medium position and set for optimum then return to the narrow setting and peak the selectivity coil nearest the modulator. Once this operation has been completed, switching progressively from wide to narrow will require no retuning.

Fit an additional earthing solder tag between one of the 4BA aerial input retaining bolts and the aerial input (phone) socket on the tuner case.

The u.h.f. calibration was good but v.h.f. left something to be desired. Switch to Band I and locate a ch. E4 signal. If retuning is needed, return to the medium position and set for optimum then return to the narrow setting and peak the selectivity coil nearest the modulator. Once this operation has been completed, switching progressively from wide to narrow will require no retuning.

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Satellite TV News

A 24-hour Spanish-language news service called Televisa, not unlike the CNN operation, came into operation at the beginning of December. This free channel is being carried via an ECS-4 downlink initially but may go to Astra at a later date. It originates in Mexico and is supported by advertising.

A news service from Visnews, called Good Morning Europe, is operational on a three-month trial basis. It consists of ten-minute news packages which are uplinked from London starting at 0230 GMT each day. Late US material is included, but the use of sound in syncs will make domestic reception difficult — the service is intended for European broadcasters, five of whom have already taken on the service.

Delegations from Yugoslavia, Algeria and China recently visited SES in Luxembourg (Astra) to discuss the possibility of starting a Third World Channel.

A new experimental service called Qamarsat (Moonsat) is using three C Band (4GHz) channels for several hours daily with downlinking from the Arabsat bird. The service consists of general entertainment etc. plus educational programming and covers over eighty per cent of the Arab world from the Gulf to Morocco and down to Equatorial Africa. If successful, the London-based Arab Spacescene Corporation hopes to start a daily 12-hour service. A further plan is to provide a scrambled S Band (2-6GHz) TV service via Arabsat covering much of Europe and Africa. This would be one of the largest satellite coverages when in operation.

As mentioned last month, TDF-1, the first DBS craft, is now in operation providing massive MAC signals on two channels. Ian Waller (Lincoln) noted signals on chs. 1, 5 and 9 (11-72, 11-8 and 11-88GHz), with D2-MAC. The very high level signals seem to spread everywhere. With a 1-5m dish evidence of the signals can be seen at ±8° off the 19°W orbital position. It’s reported that one engineer resolved signals simply by pointing an LNB at the satellite. The quoted power is 64dBW.

Gorizont at 14°W has been seen carrying the Moscow first programme (without sound) on 11-541GHz. The transponder provides the UK with about 39dBW. With a 1-5m dish the signals have varied from noisy to sparkly-free — Gorizont is unstable in its slot, hence a cyclic variation in signal strength. The polarisation is circular, but a linear feed worked — a Teflon strip for insertion in the feed tube is being prepared to give correct reception of circularly polarised signals.

During early November several enthusiasts received PanAmSat (PAS-1) carrying system M signals with coverage of the US elections. Two transponders were being used, at 11-5 and 11-58GHz. The path here at Romsey is over two-thirds obscured by nearby housing but the signals were locked with only half-bandwidth filtering in circuit. Mexican programming was noted on the 30th, on test, at 11-5GHz.

John Standon (North East Aerial Systems) has been in touch recently. His company now deals solely with business satellite activities. He mentioned that C Band signals from BrazilSat craft at 65°W and 70°W have been received in Yorkshire via their spot beams despite the fact that the estimated e.i.r.p. is only 4dBW. A new patented system called Starcatcher is in use, extending a receiver’s threshold down to virtually zero. It seems that the new system employs a selective video processing operation — we hope to be able to provide further details in due course. Examples of the possibilities with this remarkable unit include Ku Band reception from Intelsat at 27-5°W with a six-inch dish and C Band reception of AFRTS with entertainment quality using a patio-mounted 90cm dish. This system could lead to a rethink about aerial requirements in the TVRO field.

A new downlink via ECS-4 at 13°E and approximately 11-56GHz was seen at the end of November, with the identification Galavision. The polarisation is horizontal.
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Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £2 cheque or postal order (made out to IPC Magazines Ltd.), the query coupon and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

SONY SLC9
This machine has a fault on playback. With prerecorded tapes and tapes recorded up to about three months ago playback seems to be o.k. With more recent recordings however a picture is obtained for about three-five seconds after which the picture breaks up two or three times then disappears, leaving a blank, unmodulated raster. On selecting cue and review or pause then playback the picture reappears until these keys are released, then the blank raster returns. The fault seems to start up at the same point of the tape — checked by rewinding and playing back again — suggesting a possible record fault.
This symptom is produced by the mute circuit which comes into operation when the control track head is not producing strong enough pulses. Cleaning this head (part of the audio head assembly) is usually all that’s required. If this doesn’t work the head could be worn and in need of replacement.

GRUNDIG CUC220 CHASSIS WITH REMOTE CONTROL
When the set is switched on it works for only about two-four minutes then switches off. If one of the buttons, say number 8, on the remote control unit is pressed the set comes on and remains on all evening.
Check that pin 14 of IC2365 remains high when the set should be on. If it does, suspect the BC337 transistor T2378 if, when the fault occurs, its collector voltage goes high. If the voltage at pin 14 goes low when the set switches off IC2315 and IC2365 are suspect.

FERGUSON 3V31
The problem with this machine is that the full erase head is on in the play mode though not in double speed, fast forward/rewind search and pause, when the oscillator is turned off — same in audio dub, though full dubbing doesn’t take place. The relays have been checked. The original fault was no capstan drive as Q10 was open and a scrap chassis is to hand.

SHARP VC381H
This VCR won’t work in the video search mode. In the playback mode everything is all right until the fast forward or rewind button is pressed to put the machine into video search. The tape then unloads and the machine goes into fast forward or rewind as though video search doesn’t exist. IC801 and D7758 have been replaced. The three inverter chips, IC805 and IC806 have all been checked with a logic probe. The mode switch also appears to be working correctly. Pin 59 of IC801 is low and doesn’t change at all. The print is also fine.
Check that pins 1, 4 and 5 of 17754 go high in the search mode and that pins 12, 13 and 16 go correspondingly low. If D7753’s cathode doesn’t go high at this time, suspect Q7751. If pin 59 of IC801 doesn’t go high for video search, isolate it and check again. If it now goes high something is loading it down. If it doesn’t go high the trouble remains around IC801. Check the smoothness and level of the supply voltage at pin 32 (9-9V) and the oscillator components R882 and C802.

PHILIPS CTX-E CHASSIS WITH VST
Every time this set is switched on the channels have to be retuned. The set is then all right until switched off. When it’s switched on again, even after only a few minutes, retuning is necessary.
The most likely culprit would seem to be the CCAM memory chip IC7800, type SAB3013. Before condemning it, check that the 5-5V supply at pin 9 is correct and that its clock oscillator produces a 4V peak-peak waveform at pin 2. This is governed by the timing components R3800 and C3800.

SAISHO VR805
When record is selected the machine holds on pause, the pause indicator lights and won’t disengage. After two-three minutes the machine returns to the stop mode. Recording is normal when the timer is used. All other functions work correctly.
First check thoroughly that there’s no corrosion or leakage in the operation PCB or input control (syscon, prefix 10) PCB due to liquid spillage. Next confirm that pin 48 of the syscon chip IC1001 always remains high at about 10V. If so suspect IC1001. If not check Q1014 and R1036.

PANASONIC U2 CHASSIS
This set has an intermittent power supply fault. Occasionally R832 (150Ω) will glow like a firework, then the set will shut down with 340V at the collector of the chopper transistor Q801 and nothing at its other electrodes. To make fault diagnosis difficult, the set will work normally for hours on end day after day. The 160V h.t. is correct and a scrap chassis is to hand.
There’s a reasonably sure way of curing this one, but it involves replacing several components as follows: D812, D809, Q802, Q803, D808, D814, R832 and R803. We would advise new components rather than salvaged ones — the latter may also be suspect.

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TELEVISION FEBRUARY 1989

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HITACHI VT8000

There's an intermittent fault in the record mode. The playback picture is fine but the sound level drops approximately every four seconds then comes straight back up again.

Relay RL401 on the audio panel could be to blame but it's more likely that the cause of the trouble is on the deck. Check the tape's back-tension and the condition of the pinch roller. If these are o.k., clean the audio head and check its tilt - follow the instructions given on page 2-17 of the manual, then give the top of the head a very slight tilt outwards towards the tape. If these steps produce no improvement the audio head is suspect.

TEST CASE 314

Each month we provide an interesting case of TV/video servicing to exercise your ingenuity. These are not trick questions but are based on actual practical faults.

The workshop was its normal chaotic self on this winter afternoon. Techno-Supersleuth was in his corner puffing on his fag and, for some obscure reason, drawing arcs from a Sanyo line output transformer; in his corner Hubo was doing wonderful things with a CD player while dreaming of a 60MHz scope and a function generator; in another corner Television Ted was triumphing over dry-joints in a Philips G11 between eating bacon crisps. And in the fourth corner of the workshop a strange drama was developing.

The patient was a Panasonic NV7200 VCR. Its owner had complained of "no playback signals", which was so. Apart from an occasional short burst of picture and sound when the play button was first pressed, all that the machine would produce was a snowstorm on the screen and a hiss on sound - just as if a blank tape had been fed in. The E-E signals were o.k. once a local station had been tuned in, which exonerated the tuner and much of the electronics.

A good tape was inserted and the play mode was selected. A finger on the audio head lead-out then produced a healthy buzz from the monitor set's loudspeaker - strange! A finger on the leads and connections from the video heads to the signals PCB brought up noise from the video tape was back-to-front. You can't get away with this here, and the customer said that he'd had the problem with all the tapes he'd tried, including library ones. Another known good tape was loaded, and we carefully watched the tape as it emerged from the cassette. No, it wasn't being twisted over.

The next test, really somewhat irrelevant in the absence of playback sound, was an ohmmeter check on the windings of the rotary transformers and the video heads themselves. All proved to be in order, but since we had another video head drum for this model in stock we fitted it. This made no difference of course. Another thought was that the head switching was incorrect, so that each head was being switched out as it started to scan the tape. The head wiring and the SW25 flip-flop waveform were correct however, and since the sound is recorded longitudinally in this machine no drum or head problem could account for the loss of sound.

Next came a check that should have been done earlier - try to make a recording. A minute or so of off-air programme was recorded, rewound then played back on another machine. There was perfect recording of both vision and sound! This cleared the heads, tape path and many other things of suspicion.

Testing in the playback mode commenced again, with a half-wound prerecorded tape. While playing with the operating keys we discovered that the machine would produce playback pictures in the review (search backwards) mode. Resisting the temptation to scream, we pondered on this additional absurdity. Of course! As we watched the tape whizzing backwards light dawned. Which item was the culprit? See next month's issue.

ANSWER TO TEST CASE 313 – page 210 last month –

Last month's puzzle was not really a difficult one, though it did show how a bit of thought on the theoretical aspect can provide a quick solution. The low scan amplitude problem described was due to low input and output signals to and from the field output chip, but the primary cause of the lack of height was in fact too much signal!

As with all field timebases, this one has a feedback loop to ensure height stability with time and temperature and to help with linearity correction. In this design the field scan coils are themselves within the feedback loop. The coils are returned to chassis via a small-value resistor, R3420 (1-3Ω), which is used to sample the sawtooth current flowing. This resistor develops a feedback signal which is potted down to a suitable level by the parallel-connected height control and then fed back to the sawtooth generator section of the timebase.

What had happened was that the value of the sampling resistor had increased slightly, so that the amplitude of the sawtooth voltage developed across it had also increased. The excessive feedback suggested to IC7375 that the height was too great. Doing its job correctly, this chip reduced its output in order to restore approximately correct conditions at its negative feedback input pin 2. The width was affected (bowed out sides) because the feedback signal is also used by the EW raster correction circuit. Fitting a new 1-3Ω resistor put matters right.

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<th>Price</th>
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<tbody>
<tr>
<td>Basic Thorn/Granada</td>
<td>£15</td>
</tr>
<tr>
<td>From: FERG, GEC, ITT, DECCA, PHILIPS, DORIC, FINLANDIA etc.</td>
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<td>Thorn 9.6k</td>
<td>£15</td>
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<td>Basic Electronic Thorn/Japs</td>
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<tr>
<td>Mechanical</td>
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<tr>
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<td>£95</td>
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<tr>
<td>20&quot; ITT Remote</td>
<td>P.O.A.</td>
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<td>20&quot; Remote/monitor Style</td>
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</tr>
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<td>from £45</td>
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<td>Ferguson 22BS Professional Series</td>
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<td>Finlux 28&quot; F.S.T.</td>
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<td>Luxor F.S/T.Solaro</td>
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<td>£16.00</td>
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<tr>
<td>3HSS-N</td>
<td>£16.00</td>
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<td>3HSS-A</td>
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<td>3HSS-B</td>
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<td>3HSS-M</td>
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<td>3HSS-NA</td>
<td>£20.00</td>
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<tr>
<td>3HSS-C</td>
<td>£25.50</td>
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<tr>
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