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TELEVISION

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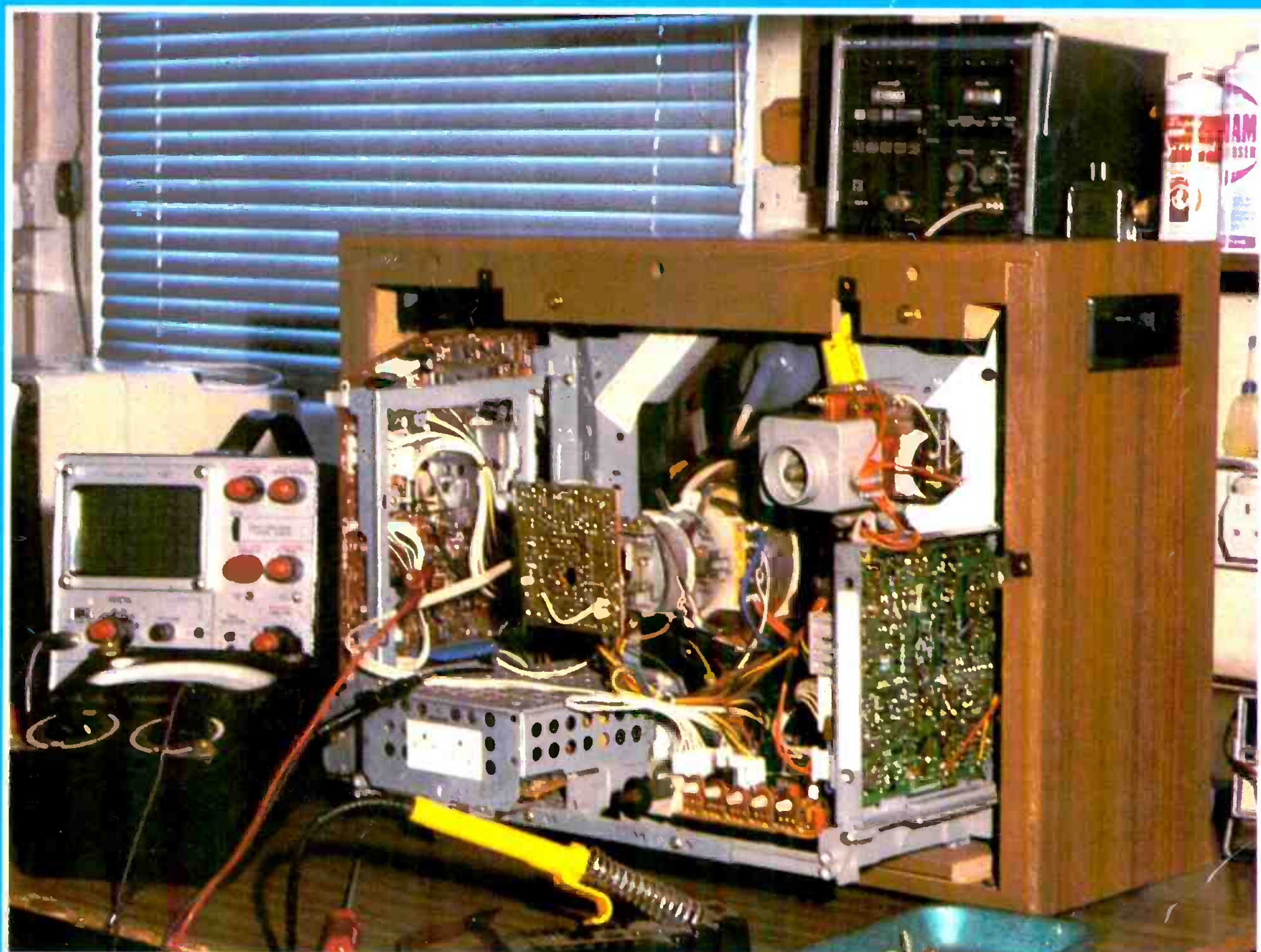

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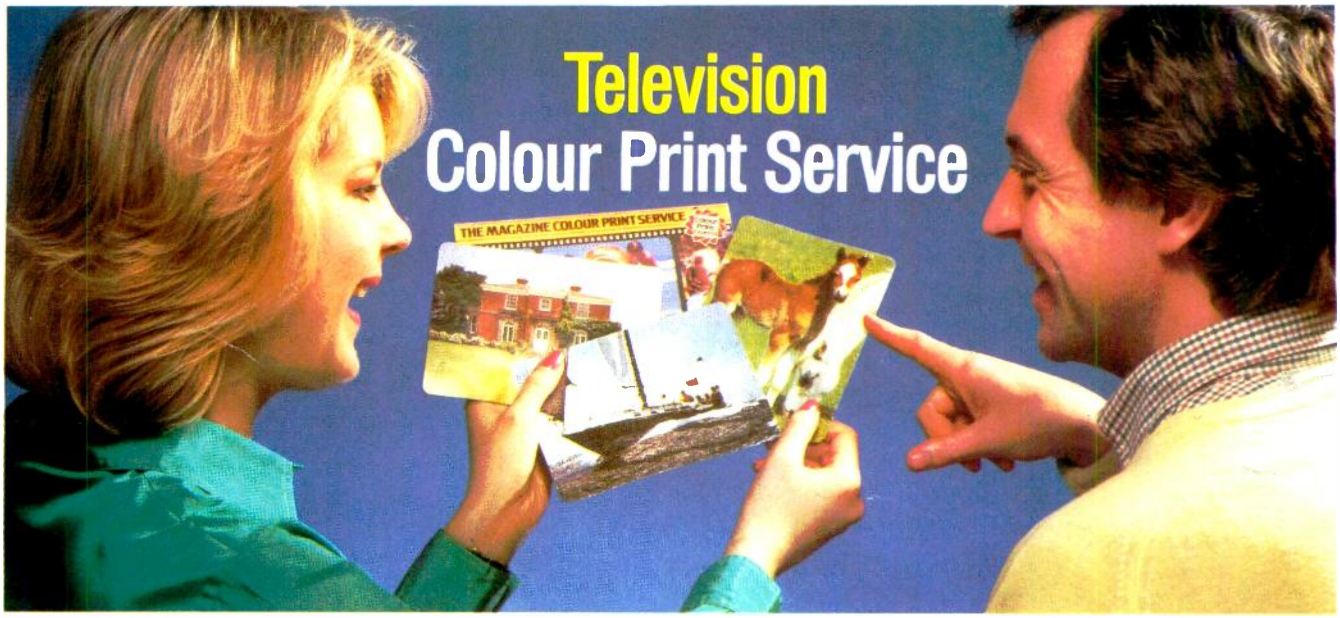

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Requests for advice on dealing with servicing problems should be directed to our Queries Service. For details see our regular feature "Service Bureau". Send to the address given above (see "correspondence").

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DBS PROSPECTS IMPROVE

The conventional view not long since was that there was no conflict of interest between cable and satellite TV. We were to have them both. Satellite links would serve the cable networks, providing programme feeds. The public would also get its DBS channels. A cable socket at every front door plus a dish on the roof or in the garden. We've come a long way in a short time however. As the sums have been worked out, so the vista of endless lines of communication of every possible sort has receded. At present, satellite reception looks to be the more likely way in which most of us will eventually be given a wider choice of programme material. True this will mean fewer channels than a cable service, with less scope for extra facilities and a higher initial outlay for the viewer, but the economics of satellite broadcasting are beginning to look rather less daunting than those associated with cable TV.

The cable lobby has been calling "foul". The government, having first encouraged potential cable operators, then changed the rules of the game – at a delicate time, before anyone had got around to raising the funds required to buy the cables and associated equipment and get them installed. The changes came with the last budget, when the regulations on capital allowances for tax purposes were altered. The effect of this for prospective cable operators was to defer the likely break even point from seven to nine years. Well, having to wait for seven years to show a profit was bad enough. If the prospect is one of having to wait for a decade or so before profitability is achieved one might as well call it a day. The funds would earn a lot more in the building society or some other more prosaic investment.

In what looked like a rather desperate move the Cable Television Association proposed to the Information Technology Minister Kenneth Baker that the government should provide grants under a section of the Industry Act. The section concerned has been used to encourage investment in areas that promise growth, and would help compensate for budget induced difficulties. Industries of all sorts have always had to live with the problems caused by budget changes however. In the event, the Cable Television Association seems to have received a dusty answer.

Even before the budget changes, which could increase cable TV costs by up to 45 per cent, those companies awarded the initial eleven cable franchises were expressing serious doubts about the prospects. Several have already postponed the start of their services by a year, and reservations over the terms of the draft contracts have been expressed. A director of one of the companies has commented that with the increased costs on top of everything else "... quite frankly I do not think cable is going to get off the ground in the United Kingdom".

That could all be part of an attempt to bring pressure on the government. But it doesn't create the sort of image that will encourage prospective cable customers. The impression at present being given is one of companies so strapped for funds that a decidedly lack-lustre service will be on offer when it does come along. The government has been less than helpful, but if the end result is simply that a lot of expensive cable doesn't get installed then at least we'll be spared another of those white elephants born of misplaced enthusiasm.

Both Thorn-EMI and British Telecom have been reviewing the extent of their commitment to cable TV in the light of the present gloomy outlook. Those of us who are dedicated Thorn watchers will see this as a sign of the way in which things are going – Thorn generally get it right. The other side of this coin is the fact that Thorn's interest in satellite broadcasting appears to be on the increase. In addition to being one of those planning to participate in the official UK satellite service, along with other companies, the BBC and the IBA, Thorn are understood to have had talks with the Luxembourg Coronet venture (see Teletopics, July). This venture is primarily intended to provide satellite links for cable TV operators, but the medium-power satellites involved would provide signals receivable by individual households using a dish of a metre or less. Whether Coronet comes to anything remains to be seen. Finances have yet to be raised, and although agreement has been reached with the Luxembourg government there's been strong opposition from European post/telecommunications organisations, Eutelsat and various governments, especially the French, mainly due to Coronet being backed by US interests. Remember that Luxembourg helped pioneer commercial radio however. The Irish government appears to be anxious to establish a satellite service that's likely to be commercial, and various smaller countries have been given satellite channel allocations – San Marino, Lichtenstein, Monaco and Andorra for example. There appears to be a lot of scope for commercial DBS services in Europe, though one can't help but wonder what sort of programmes would be pumped out.

Fifteen organisations have applied to the IBA to participate in the proposed UK satellite TV service. At the time of writing the IBA is reviewing the applications prior to making recommendations to the Home Secretary. For its part the government is introducing measures to assist in getting DBS going. The IBA is to be given the discretionary power to extend the franchises of ITV companies participating in the DBS service at the next renewal date without advertising, i.e. going through the usual franchise renewal procedure. The life of the IBA is to be extended, and a satellite broadcasting board is to be set up to regulate UK DBS services. It seems that DBS TV is at last on the move.

At this point it appears that those interested in investing in TV service extensions in the UK are more inclined to put their money into satellite rather than cable ventures. Apart from the wider coverage, it's likely to be easier to sell the idea of satellite TV to the public than cable.

COVER PHOTO

Our cover photo this month shows a Sony KV2000UB awaiting attention at the service headquarters of R.N. French Ltd. (Audio Visual Rentals), Sedlescombe, East Sussex. Our thanks for their help.

HELD OVER

Due to shortage of space in this issue the concluding instalment of the TV Test Pattern Generator series has had to be held over until next month.

Stereo TV Sound

David Looser

The American Electronic Industries Association (EIA) recently announced that it was recommending the Zenith proposal for stereo sound on American TV. Following shortly after the BBC's successful tests of a digital sound system, this raised the prospect that there will be at least four totally different and incompatible stereo TV sound systems in use world wide in a few years' time.

The Pilot-tone System

To see how this state of affairs has come about, it's instructive to consider the stereo system widely used for stereo on f.m. radio and why this is unsuitable as it stands for TV use. Fig. 1 shows a simplified block diagram of a coder for this system, which was originally designed by Zenith in the 60s and is known as the "pilot-tone" system. Left and right audio signals are each fed via 50μsec pre-emphasis networks and 15kHz low-pass filters to a matrix which produces a compatible mono signal (L + R) and a stereo difference signal (L − R). The L − R signal is double-sideband, suppressed-carrier, amplitude modulated on to a 38kHz subcarrier which is then combined with the L + R signal and a 19kHz pilot tone to form the composite signal. This composite signal is fed to the f.m. transmitter. Fig. 2 shows the spectrum generated by this process. The low-frequency portion up to 15kHz is occupied by the mono compatible signal (L + R) while the region from 23-53kHz carries the stereo difference signal (L − R).

With this system the bandwidth of the modulation handled by the transmitter and the receiver is increased by a factor of 53/15, or about 3·5 times that of a mono transmission. It's an unfortunate fact that the noise output of an f.m. discriminator increases as the square of the bandwidth. So the noise performance of this stereo system is about twelve times or 22dB worse than that of a mono transmission. This sensitivity to noise applies not only to random noise (hiss) but also to interfering signals, where it can give rise to whistles and other annoying background sounds.

The TV sound carrier (which of course is also f.m.) has to contend with large amounts of interference from the vision carrier. This interference can be coupled into the sound signal in various ways, but the most important factor is the conversion of the vision carrier's amplitude modulation to phase modulation (p.m.). Although this conversion can occur in almost any part of the transmission path, it occurs mainly in the vision transmitter's final power amplifier and the receiver i.f. amplifier's band-shaping filter. At the vision detector, the 6MHz intercarrier sound signal acquires this phase modulation which cannot be removed by the limiting that removes a.m. Since the unwanted p.m. is generated by the vision carrier's a.m., it's a distorted version of the video signal and thus has a similar frequency spectrum to the video signal.

Although the frequency spectrum of a video signal varies with picture content, there's a pattern that's dictated by the scanning process and is thus common to all pictures. The most significant frequencies present are the field frequency (50Hz) and its harmonics (100Hz, 150Hz etc.) which produce the characteristic buzz sound, and the line frequency (15·625kHz) and its harmonics (31·25kHz etc.). Each of these line scan harmonics also has its own "family" of field harmonics at either side – see Fig. 3.

In a mono transmission the field rate components cause most annoyance. The line frequency will in theory cause a problem but in practice this doesn't arise because its amplitude is much reduced by the de-emphasis components in the receiver and because, for those who can actually hear 15·6kHz, it tends to be masked by accoustic radiation from the set's line scan components. The line scan harmonics, being well beyond the limits of human hearing, are no problem at all. If a stereo transmission using the pilot-tone system is involved however the results will be very different. It will be seen by comparing Figs. 2 and 3 that two line scan harmonics, 2fh at 31·25kHz and 3fh at 46·875kHz, occur within the sidebands of the modulated L − R signal. The subcarrier demodulator would convert them to new frequencies of 38 − 31·25 = 6·75kHz and 46·875 − 38 = 8·875kHz, both of which are audible and very annoying. The "family" of field harmonics around each line harmonic would give the whistle a rough quality and, since the amplitudes of these harmonics vary with picture content, the "quality" of the sound would vary with picture content, further increasing the annoyance.

There are three ways of overcoming this problem. (1) To improve the transmission system to reduce the video crosstalk in the audio signal. (2) To alter the stereo system's parameters to reduce its susceptibility to such crosstalk. (3) To abandon the pilot-tone system in favour of something more robust. The Americans have chosen to combine methods (1) and (2) while other countries have opted for a combination of methods (1) and (3).

Split-sound Reception

There are several ways in which the signal-to-interference ratio can be improved, the most obvious being to abandon the use of the intercarrier sound technique. Intercarrier sound is almost always used in TV sets nowadays, but it's quite in order to use a u.h.f. f.m. receiver of conventional superhet design to receive the TV sound. Because such a receiver doesn't use the vision carrier as a "local oscillator" (as in the intercarrier system), it's immune to the effects of p.m. on the vision

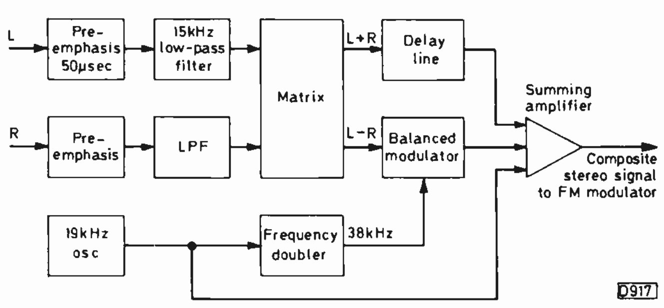

Fig. 1: Pilot-tone coder block diagram.

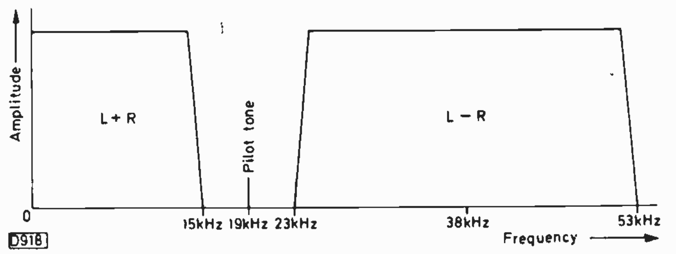

Fig. 2: Pilot-tone system frequency spectrum.

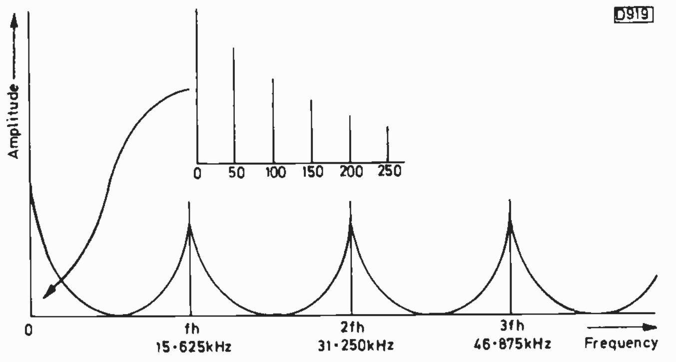

Fig. 3: Video signal spectrum.

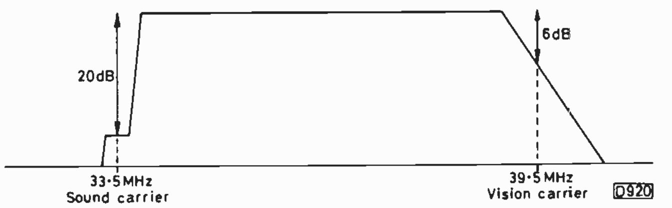

Fig. 4: The i.f. response required for correct reception of a vestigial-sideband transmission.

Fig. 5: Response for improved sound reception.

carrier and should thus be free from video interference.

Unfortunately this technique has its drawbacks. In particular, the tuner's local oscillator stability requirements are severe. To illustrate this point, if it's desired to receive the ch. 37 sound (sound carrier frequency 605·25MHz) using a superhet receiver with an i.f. of 33·5MHz (the standard UK sound i.f.), the local oscillator will be operating at 638·75MHz. Since the peak deviation of the sound carrier is 50kHz, the local oscillator's spurious f.m. must be held at less than 50Hz peak, or 0·1 parts per million, to keep the signal-to-noise ratio better than 60dB. Using a standard varicap tuner, the hum and noise at the tuning pin would have to be kept below 3μV, a very difficult matter.

The Quasi-split Technique

As an alternative to this "split-sound" technique, it's possible to improve the intercarrier receiver's performance. The problem with the intercarrier receiver centres on the i.f. bandpass shaping required. Nowadays this is done by a filter (often a SAWF) between the tuner and the i.f. amplifier chip. Fig. 4 shows the required shape. The most noticeable feature of this is the asymmetry around the vision carrier frequency. It's this asymmetry, necessary for the correct reception of vestigial-sideband transmissions, that causes the a.m./p.m. conversion.

It's not possible to have a full bandwidth symmetrical response because most of one sideband is removed at the transmitter, but if a response shape like that shown in Fig. 5 could be adopted then a substantial reduction in vision carrier p.m. could be expected. This is clearly impossible for the vision signal, since it would attenuate all but the lowest frequencies. One way around this is to adopt the so-called "quasi-split" or "split-intercarrier" receiver technique shown in block diagram form in Fig. 6. This arrangement is becoming popular on the continent, largely because of the W. German stereo system (of which more later), and is a valid technique for mono receivers. The split-intercarrier receiver is still an intercarrier receiver and is sensitive to vision carrier p.m. generated in the transmitter and other parts of the receiver, but with care in the design of all parts of the system it can offer a reduction in vision buzz levels of around 10dB.

Improvements to the Pilot-tone System

This improvement is not sufficient to allow noise-free operation with a pilot-tone stereo system, and some alterations to the parameters of the system are called for. The major change suggested by Zenith is to alter the subcarrier frequency to 2fh (31·468kHz in the US system). This means that the major interference within the bandwidth of the modulated L − R signal is reduced to zero when the subcarrier is demodulated. But the field-rate sidebands of this interfering signal are reproduced at their original frequency and produce a similar buzz sound to the field frequency harmonics themselves.

Zenith considered that their proposed changes would be sufficient to produce a system with adequate performance, but the EIA seem to disagree since they've recommended the use of the DBX noise reduction system. This – a rising competitor to the better-known Dolby system for tape noise reduction – offers a noise improvement of about 20dB over the audio band.

The FM-FM System

A different approach was taken by the Japanese when they introduced their own stereo system, which has been in regular broadcast service since 1978. This system, known as the f.m.-f.m. system, uses a frequency modulated subcarrier to overcome the noise problem. This subcarrier, again centred on 2fh, carries the L − R signal, the L + R signal being carried at baseband as with the pilot-tone system. Because of the use of an f.m. subcarrier, the L − R signal suffers from a significantly lower noise

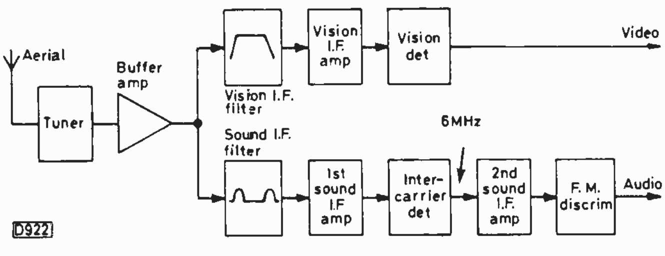

Fig. 6: Block diagram showing the quasi-split technique for improved sound reception.

level than that associated with the Zenith system's a.m. subcarrier. It also allows the subcarrier channel to be used to carry a separate programme from the main channel. This gives bilingual capability or alternatively allows viewers to decide whether they wish to hear the answers in quiz shows in advance of the participants.

These improvements are not obtained without a price however. The price is the relatively high distortion associated with the use of an f.m. subcarrier – due to the fact that the modulated subcarrier must be closely band limited before being combined with the main channel at the transmitter, in order to prevent it causing interference with the main channel. This band limiting removes the f.m. signal's higher order sidebands, i.e. those that enable low-distortion demodulation to take place. In practice the f.m.-f.m. system produces about two per cent distortion on its subcarrier channel, compared to the less than 0.1 per cent that can be achieved with an a.m. subcarrier. In addition the video derived interfering signals, though silent in themselves, can interfere with the subcarrier in a complex way, producing a form of distortion known as "buzz beat". It results in a "rough" sound to high frequencies such as the harmonics of piano or violin music.

In this context it's interesting that the Zenith proposals allow for a second programme to be carried by an f.m. subcarrier at 4fh (62·936kHz). It's admitted that this would be a fairly "lo-fi" service.

The Two-carrier System

Instead of using subcarriers in the manner described above, the "wide open spaces" of the broadcast TV bands suggest an alternative solution – the use of two carriers. This is the method chosen by W. Germany in the system used there since 1980. This uses a second sound carrier, spaced at 0·24MHz from the main one and transmitted at a level of −7dB with respect to it. As with the Japanese f.m.-f.m. system, this allows either a stereo signal or a second programme to be transmitted.

When used in the stereo mode the main carrier carries L + R while the second carrier carries a 2R signal. The reason for transmitting 2R instead of L − R is as follows. Since both carriers are interfered with by the same video signal they acquire the same background noise. If L + R and L − R signals are matrixed to L and R in the decoder, this noise will add in the case of the L signal and cancel in the case of the R signal, producing a one-sided buzz. By using L + R and 2R the noise becomes equal in the two speakers and is at a lower level.

This system seemed to be sufficiently attractive for UK use for the BBC to investigate a UK version. Tests have been carried out using a second carrier spaced at 0·304MHz from the existing sound carrier, i.e. 6·304MHz (actually 6·3046375MHz) from the vision carrier. These tests were considered to be disappointing. To avoid intermodulation effects causing patterning on the picture it was found to be necessary to lower the level of the main sound carrier by 6dB, to −13dB with respect to the vision carrier, and to use a maximum level of −22dB for the second sound carrier. In W. Germany the main sound carrier has always been transmitted at −13dB, and a level of −20dB is used for the second carrier.

The BBC Digital System

The BBC engineers felt that these levels were too low to guarantee high-quality sound reception, particularly in fringe areas, and as a result the BBC have proposed a further system. This would retain the use of a second carrier, but digitally modulated. A second carrier spaced at 6·55MHz from the vision carrier allows the system to carry about 700kbit/sec, enough for two high-quality sound channels. Digital modulation is inherently more tolerant of poor signal-to-noise ratio in the transmission system than f.m. or any other analogue modulation technique. In addition, since the spectrum occupied by the digital signal is wider than with f.m., the visibility of any intermodulation patterning is reduced.

The BBC system was tested last year in the Wenvoe area. This was chosen because the hilly terrain would result in any multipath propagation problems showing up. In addition, the long chains of rebroadcast transmitters that derive their signals from Wenvoe enabled the ability of existing, unmodified transposers to handle the system to be evaluated.

The tests were very successful. Using carrier levels of −10dB for the normal f.m. sound and −20dB for the extra digital sound, the system was found to be very robust. Even when the signal had passed through as many as five transposers, the system gave good sound quality at virtually all sites where a colour picture could be received, and even a few where no picture at all could be resolved! Further tests have been carried out to ensure that the additional signal doesn't cause any significant impairment to the picture and performance of existing domestic receivers.

Cost Factors

Assuming that further tests don't bring to light any as yet unexpected problems, the success of the system will depend on one major factor – cost. This has two aspects.

First there's the cost to the broadcaster. Going stereo can be very expensive to a broadcaster, particularly one like the BBC whose operation is spread over many studio and transmitter sites. Re-equipping studios for stereo sound and the addition of two-channel audio capacity to microwave links would be expensive, though possibly most expensive of all would be the extra production costs associated with making programmes in stereo. Compared with this the extra cost of digital encoders at the main transmitters is negligible.

Secondly there's the cost to the viewer. Whilst many would like to receive stereo sound if it was available, it seems that few would be prepared to pay a significantly higher price for sets that enable them to do this. Receivers for the BBC system would, at least in the short term, be noticeably more expensive than those for any of the alternative systems. This is likely to lead to pressure from the trade to adopt one of the other systems. I feel that this would be a pity. The BBC system has several attractive features. Apart from the promise of higher sound quality than the alternative systems could provide, it's the only one in which the stereo signal is entirely separate from the normal mono sound. This means that the mono and stereo signals can each be separately optimised in terms of dynamic range, equalisation etc. for their respective audiences. In particular, the user of a stereo receiver could expect a true "hi-fi" sound that's not been compromised to take account of existing sets with their usually tinny speakers and inadequate audio amplifiers.

Handled properly, stereo could bring to TV sound the quality that's been absent for too long. It would be a pity to accept a compromise for short-term ends.

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20mm		1¼"	
50MA	10 for 70p	250MA	10 for 65p
315MA A/S	10 for 50p	750MA	10 for 65p
500MA	10 for 50p	7A	10 for 50p
1A	10 for 50p	10A	10 for 50p
2.5A	10 for 1.00	20A	10 for 50p
3.15A	10 for 1.00	50A	10 for 50p

Thorn Mains TX 3000/3500	7.50
Thorn Mains TX 8000/8500	10.00
Thorn S.O.P.T 8000/8500	3.50
Thorn Scan TX 3000/3500	6.00
Thorn EHT TX 3000/3500	6.00
Thorn LOPT 9600	12.00
Thorn LOPT 1615	7.25
Thorn LOPT 1590/91	7.25
Thorn LOPT 1690/91	7.25
Thorn LOPT 8000	9.80
Thorn LOPT 8500	9.80
Thorn LOPT TX9	9.85
Pye LOPT 713	10.00
Pye LOPT 725	9.85
Pye LOPT 731	10.18
Philips LOPT G9	8.80
Philips LOPT G11	13.75
GEC LOPT 3113	7.40
Diode Split LOPT AT2076/35	14.75
Sanyo LOPT AM–WM–21	6.75
Sanyo LOPT AM–WM–4	7.30
Philips LOPT G8	7.80
Sanyo LOPT (CW21) 4-2751-44700	5.00
ITT LOPT CVC5-9	9.60
ITT LOPT CVC30	8.75
ITT LOPT CVC45	9.75
Baird 8750	10.25
Baird 8752	10.25
Korting AZ9100	10.25
Korting B92-170	10.25
Korting AZ2101	10.25
Korting AZ2103	10.25
Korting ZTR1001	10.25
Siemens V1155	11.75
Siemens V1823	11.75
Zanussi BS2222	10.25
Zanussi BS2223	10.25
Salora FR0057	10.25
Salora FR0029	10.25

300 Mixed Resistors	1.50	10 Spark Gaps	1.00
300 Mixed Capacitors	1.50	10–16 pin Quil IC Socket	90p
150 Mixed Electrolytics	2.00	20 Assorted TV Knobs	1.00
100 W/W Resistors	1.00	10–16 pin Quil to Dil IC Socket	90p
20 Mixed Conv Pots	1.00	100 Mixed Diodes	1.00
40 Mixed Pots	1.50	50 Mixed Mica Washers	65p
20 Mixed Sliders	1.00	300 Mixed Resistors & Capacitors	1.50
40 Mixed Presets	60p	10–16 pin Dil to Dil IC Socket	1.00
20 Mixed VDR & Thermistors	1.00	50 Electrolytics & 50 Capacitors	1.00
20 Mixed Ferrite Cores	50p	50 Mixed Poly Capacitors	1.00
100 Mixed Ceramic Discs	1.00	30 Mixed Neons & Bulbs	1.00
20 Mixed Valve Bases	1.00		

AC128	39	BC172	9	BC559	8
AC131	40	BC174B	23	BC595	8
AC138	40	BC177	24	BCX33	22
AC141K	39	BC182LB	12	BCX34	11
AC142K	38	BC183L	12	BD115	49
AC153	39	BC184L	13	BD131	30
AC176	33	BC187	24	BD132	46
AC176K/		BC204	15	BD133	59
AC128K	93	BC208	9	BD139	36
AC188	38	BC212L	9	BD140	38
AD142	1.18	BC213L	12	BD144	1.70
AD143	1.08	BC237	12	BD150	50
AD149	98	BC238B	8	BD163	98
AD161	32	BC238L	8	BD201	74
AD162	32	BC250A	15	BD203	78
AD263	1.05	BC251	8	BD204	99
AF127	45	BC252A	20	BD222	48
AF139	38	BC294	37	BD225	52
AF239	41	BC301	32	BD232	50
BC107	15	BC303	31	BD233	60
BC108	15	BC307	10	BD234	60
BC109	15	BC308	8	BD237	55
BC115	16	BC309	14	BD238	65
BC117	21	BC327	18	BD241	59
BC125	26	BC328	18	BD244	85
BC126	23	BC337	17	BD278A	81
BC139	27	BC338	17	BD386	68
BC141	34	BC347	8	BD433	71
BC142	30	BC394	8	BD437	83
BC143	31	BC454	8	BD592	1.20
BC147	12	BC455	8	BD589	1.20
BC148	12	BC456	10	BD677G	1.35
BC149	12	BC460	40	BD707	95
BC153	16	BC463	22	BD708	95
BC154OR	16	BC546	8	BDX10	93
BC154YL	16	BC547	12	BDY20	1.09
BC157	12	BC548	12	BDY82	99
BC158	12	BC549	8	BF137	20
BC159	15	BC557	10	BF153	20
BC171	9	BC558	10	BF154	25

BF167	24	BFR62	28	NKT276	20
BF173	29	BFR81	29	NKT453	1.65
BF179	32	BFR87	25	DT112	1.92
BF180	33	BFR90	1.74	DT121	2.08
BF181	30	BFR91	2.08	R1038	80
BF184	30	BFT42	30	R1039	80
BF185	30	BFT43	30	R2008B	1.40
BF194	16	BFX38	40	R2010B	1.10
BF195	16	BFY50	30	R2030	70
BF196	16	BFY51	34	R2265	1.30
BF197	15	BFY52	34	R2305	80
BF198	19	BRC116	1.50	R2322	50
BF199	15	BRC1693	1.43	R2443	25
BF223	18	BU105	1.00	RCA16446	30
BF224	19	BU126	1.10	RCA16599	1.25
BF238	20	BU207	1.05	RCA16600	1.40
BF240	9	BU208	1.15	RCA16799	1.13
BF241	21	BU208A	1.15	RCA16800	1.42
BF255	10	BU326A	1.30	RCA16802	1.38
BF256S	20	BU407	1.70	S1299	2.25
BF257	28	BU408	2.76	S28000	1.25
BF259	28	BU500	2.30	S6080A/B	3.50
BF271	25	BU526	2.46	T6050V	1.30
BF274	11	BU807	2.94	T6052V	1.30
BF337	29	C1129	9	T9003V	1.25
BF338	34	C1172B	9	T9010V	1.45
BF355	40	E5386	54	T9053V	1.30
BF362	50	E9003	28	T9054V	1.00
BF391	21	E9005	25	T9039V	1.10
BF394	16	ME0404	10	TIC45X	50
BF422	47	ME0412	10	TIC46	48
BF423	53	ME6002	10	TIC106C	40
BF450	43	MJ2501	2.36	TIP29	42
BF453	53	MJ3001	2.21	TIP30	42
BF458	37	MJE182	47	TIP31	35
BF459	40	MJE340	50	TIP32	43
BF461	59	MJE520	50	TIP33	61
BF556B	35	MJE2955	1.40	TIP41	42
BF596	15	MJE3055	1.50	TIP42	45
BF694	16	NKT241W	8	TIP110	61
BF757	62	NKT241G	8	TIS91	25
BFR52	31	NKT241Y	8	ZTX550	30

INTEGRATED CIRCUITS

				TBA530	1.26	TDA2002	2.80
BRC1330	1.40	SN76013ND	1.80	TBA540	1.00	TDA2030	2.10
BRC3064	1.00	SN76023N	1.80	TBA550Q	1.82	TDA2522	2.10
BRC/M/200	1.00	SN76033N	2.00	TBA560C	1.50	TDA2530	2.61
BRC/M/300	1.00	SN76115	2.00	TBA641	2.05	TDA2540	3.50
CA3060	1.58	SN76131N	1.58	TBA651	2.50	TDA2560	3.50
LM1303P	1.48	SN76226N	1.25	TBA720A	2.49	TDA2581	3.00
ML231B	2.20	SN76227N	1.00	TBA750	2.20	TDA2591	1.96
ML237B	2.00	SN76530P	1.30	TBA800	1.62	TDA2611A	1.95
ML239B	2.86	SN76622N	1.00	TBA810S	1.00	TDA2640	2.90
MC1327AP	1.25	SN76660N	80p	TBA810AS	1.00	TDA2690A	1.50
MC1358P	1.30	SN76666N	75p	TBA920	2.08	TDA3560	6.00
MC1455P	18p	SN76744	1.92	TBA950	1.95	TDA3503	2.90
MC14516BCP	60p	TA7117P	1.00	TBA1440	1.92	TCEP100	3.48
SAA1025	7.20	TA7109AP	2.80	TCA270SA	1.05	TEA1009	1.95
SAA1124	4.50	TAA611	1.40	TCA270C	1.05	MC14426P	4.80
SAA5010	6.00	TBA120B	1.20	TCA270CQ	1.05	MC14429P	4.50
SL432A	1.80	TBA120C	1.20	TDA1004A	4.00	MC14514	5.00
SL1430	2.50	TBA120CQ	70p	TDA1035T	3.50	UA758PC	2.50
SN15846N	60p	TBA120S	70p	TDA1037	2.72	UA1008A	2.66
SN74123N	65p	TBA120U	1.00	TDA11705	1.50	ULN2165	1.30
SN74154N	1.40	TBA395	1.00	TDA1200	2.42	ULN2216A	1.25
SN76001N	1.40	TBA480Q	1.40	TDA1270	2.76	UPC1365C	5.75
SN76110N	1.14	TBA510	1.90	TDA1327	2.53	SC9488P	1.40
						SC9511P	1.40
						SW153	2.50

Thorn 8/8K5 ex equip panels untested

PSU	2.88
FTB	3.75
Decoder	4.00

Thorn 9K ex equip panels untested

PSU	12.00
Decoder	5.00

Thorn 9K6 ex equip panel untested

Decoder	5.75

Thorn 3/3K5 ex equip panels untested

PSU	3.75
LTB	3.75
Video	2.50
Chroma	2.00
FTB	2.75
IF	1.75
Conv. 3K	3.00
Conv. 3K5	3.75
Autovox Decoder FG/01 new boxed	5.00
Thorn 4000 Convergence panel ex-factory	3.75

Thorn 4000 PSU panel ex-factory	2.50
Thorn 3K5 beam limiter board new	1.75
Thorn 3K5 PSU bottom board PC206 new	2.75
Thorn 3K5 IF panel new	3.00
Thorn 3/3K5. EHT & scan TX + R2008B on alum chassis ex-equip	1.80
Thorn 8/8K5 damaged FTB for spares	1.25
Thorn 8/8K5 damaged decoder for spares	2.25

UHF TV Aerial for portable	50p
Indoor Aerial Parabolic Type Reflector to Help Combat Ghosting Problems	2.50
Line Connectors	38p
Coax Plugs	10 for 1.65
Band Change Switch Assy, Pye 725	40p
Flush Mounting TV/FM Diplexer	1.00
Switched Flush Fitting Aerial Outlet	1.00

Pye 78+161	50p
Pye 147+260	50p
Thorn 56+1K+47+12	1.24
Thorn 50+40+1K5	60p
Thorn 128+16+1K7+116+462+126	50p
Thorn 120+72+300	50p
RBM 250+14+58 (TV161)	63p
Pye 3R5+15+45 (713)	90p
Philips 2R2+682	90p
Philips 47R	52p
Thorn 350+20+148+1K5+317	1.40
Thorn 6+1+100	92p
Thorn 3000 Metal	1.45
Thorn 8/8500 Plastic	1.45

EHT TRAYS

Thorn 3000	5.50
Thorn 8000	3.50
Thorn 8500	6.00
Thorn 9000	7.90
Thorn 9600	6.00
Thorn 900/950	1.50
Pye 713 4 lead	5.83
Pye 713 5 lead	5.97
Pye 725	6.35
Decca Bradford	5.00
Baird 8750	7.10
Korting AZ9100	7.10
Philips G8 (520)	6.50
Philips G8 (550)	6.50
Universal	5.00

MULTISECTION CAPACITORS

100+150+150	350V	50p
220+47	350V	65p
200+150+50	350V	60p
200+200+100	325V	54p
32+32+16	275V	52p
200+200+100+32	350V	70p
100+50+150	350V	58p
400+400	200V	72p
32+32+16	350V	52p
200+32+300+100	350V	70p
225+25	350V	50p
200+200+100	350V	70p
200+100	325V	65p
200+100+100+50	350V	60p
200+200+100	350V	55p
200+200+75+25	350V	60p
50+50+8	300V	55p
100+50+100	350V	55p
100+150+50	350V	55p
2500+2500 (Thorn 8K)	63V	1.20
150+150+100	300V	1.80
200+47	250V	65p
500+500	175V	
Thorn TX9		1.00
175+100+100	350V	
Thorn 3K5		2.25
400 Thorn 9K	400V	2.50
470	250V	
Philips G11		1.50

CAN TYPES

0.2MF 250V	50p
2MF 250V	50p
22MF 275V	50p
50MF 275V	50p
100MF 150V	65p
100MF 250V	70p
100MF 450V	75p
220MF 400V Thorn 9K	1.30
220MF 450V Thorn 4K	1.30
400MF 350V Thorn 8K	1.00
800MF 250V Print type	80p
800MF 250V	70p
1250MF 40V	50p
1250MF 50V	50p
1500MF 70V Thorn 3K	1.00
1500MF 100V	1.05
2000MF 30V	50p
2200MF 40V Thorn 4K	95p
2200MF 63V Philips G9	1.25
2500MF 35V	65p
2500MF 40V	65p
3000MF 30V	65p
3300MF 16V	50p
3300MF 25V	60p
4700MF 16V	72p
4700MF 40V	75p

Thorn/Decca/GEC On/Off Switch. Push to make	75p
Philips G11 On/Off Switch. Push to make	75p
ITT CVC8 On/Off Switch	65p
ITT CVC9 On/Off Switch + Relay	90p
Philips G8 On/Off Switch	75p
Thorn 3/3500 A1 Switch	50p
Thorn 4000 A1 Switch	50p
Korting Shift Pot 50Ω	65p
2-5A Push to make on/off switch	15p

DIODES

AA112	8p	IN4003	4p
AA119	8p	IN4004	5p
AA143	8p	IN4005	5p
BA115	8p	IN4006	5p
BA154	8p	IN4007	6p
BB103	8p	IN4148	2p
BB105B	30	IN4149	6p
BR103	52p	IN4742A	8p
BR303	46p	IN5254B	8p
BT106	1.50	IN5349	14p
BT116	1.00	IN5400	12p
BT119	2.56	IN5401	12p
BT120	2.82	IN5402	14p
BT151 650	1.00	IN5404	12p
BY127	12p	IN5406	16p
BY188	16p	IN5408	16p
BY204	26p	IS025	8p
BY206	16p	IS131	8p
BY207	16p	IS1658	8p
BY208/800	38p	MR854	35p
BY223	95p	SKE1/02	20p
BY225	1.20	MCR106/1	1.00
BY227	28p	MCR406	35p
BY298	22p	2N4444	1.50
BYX22/400	30p	Y827	80p
BYX55/600	30p	Y969	75p
BYX71/350	80p	ZX150	12p
BZV15 C12R	1.16	DA91	5p
BZV15 C24R	1.16	MCR106/7	1.00
IN60	8p	MCR106/8	1.50
IN2070	8p	TD3F800H	2.80
IN4001	4p	TD3F800R	3.00
IN4002	4p	BY255	30p

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(1) You have not received the goods or had your money returned; and
(2) You write to the Publisher of Television summarising the situation not earlier than 28 days from the day you sent your order and not later than two months from that day.

Please do not wait until the last moment to inform us. When you write, we will tell you how to make your claim and what evidence of payment is required.

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This guarantee covers only advance payment sent in direct response to an advertisement in this magazine not, for example, payment made in response to catalogues etc., received as a result of answering such advertisements. Classified advertisements are excluded."

Some Confessions

Les Lawry-Johns

It's either that I'm getting old and senile (true says HB) or it's that I'm drinking too much in a frantic effort to thin down my blood (my story). The result of a recent blood test showed it to be 70 per cent proof. Maybe this explains my antics, which are becoming more and more worrying. Listen to this.

The 3500

You'd think these elderly Thorn sets couldn't possibly cause a problem. They never used to. When I was capable of rational thought, that is. Anyway, June phoned to say that her's had gone wrong and that she couldn't bring it in. It's the large 26in. version in a heavy cabinet, so this was understandable. I said I'd call. At the same time another lady popped in to say that her large G8 required attention and would I call. I thought I'd do June first, then pop over and do her. June said her colour had gone (I thought).

So, armed with the usual boxes plus a 3500 decoder panel, a G8 line output transformer and tripler, I set off. On arrival at June's I was savaged by her dog. My fault. I'd gone in the back way and opened the kitchen door. I was flat on my back with him about to rip my throat out when a puzzled look came over his dear old face as he recognised whom he was about to kill. "Get off Piddler you fool, its only me" I gasped. Then he trotted off to find his ball and threw it at me, thinking it was fun time. June came down from wherever she'd been and dragged him away, enabling me to collect my things and go through to where the set lived.

I switched it on and it hummed away to itself, but no colourless picture appeared. I queried this with June who insisted she'd reported that the colour went first, then the set went off. Ah. Remove rear cover and check voltage at h.t. fuse. 30V instead of 60V. So I raised the right side line timebase panel and unhooked the tripler. Still 30V. I then checked the R2008 line output transistor which was o.k. and went on to check other things that tend to load the h.t. line. Nothing came to light. I was inclined to suspect the e.h.t. transformer, and thought it would be prudent to nip back to the shop, pick up a spare panel and fit this to clear the job up quickly. It took some ten minutes, during which time Piddler forgot who I was which led to a repeat performance.

"Stop it you daft bugger. Go and find your ball and leave me alone for Gawd's sake." He trotted off into the lounge and settled on the armchair next to the set. Once more June dragged him off and I was left to fit a replacement panel. Hummm the set went, and again there was 30V at the 60V fuse. Check tube base voltages for clues. Cathodes normal at over 100V – but so were the grids. These should have been at zero or slightly negative. I could hear a slight bubbling noise and the penny then dropped. No negative supply to the grid bias control meant that the tripler wasn't working. Oh dear. Off went the set and off went I to get a tripler.

Something was worrying me. If the tripler had caused the trouble in the first place it could well have damaged the transformer on my replacement panel. So I thought it would be wise to pick up another working panel as well as a tripler – if I had one. I managed to find one and test it in the rig. It said it was o.k. Back to June's. This time Piddler wagged his tail and dropped his ball under my feet. Over I went and bang went the panel.

"I hate you, soppy great sod" I bawled.

"Come along darling" said June as she dragged him off again.

I fitted the tripler first and my fears were confirmed by 30V at the h.t. fuse. Fit spare panel. The e.h.t. now rustled up nicely, but the Channel 4 test pattern lacked height and linearity. Whilst I was adjusting the controls the 60V fuse failed. It hadn't done this before so something new was afoot. The R2008 had shorted – and I was at the end of my tether. Blinking back the tears, I fitted a new transistor and wondered what would happen next.

With a new 2·5A fuse in place the picture was back and I carried on setting up the test pattern, finding it difficult to obtain full height without a fold-up at the bottom or teletext at the top. At last it was done and I reported to June. She surveyed the picture and expressed satisfaction. Suddenly there was a donk as something dropped down and the picture became severely rippled. I knew what had happened. Tripping over Piddler's ball had jolted the panel with the result that the core of the coil in the 60V line had been loosened. It had now dropped on to the decoder board.

Once more the rear cover was removed, after which the core was retrieved, fitted and secured. I was paid off and departed, cursing myself at making a right muck up of a straightforward job. At least a G8 wouldn't cause any troubles. Not a dear old G8.

The G8

Still feeling confused, I arrived at my next destination. The door was opened and a pretty little bitch hurled herself at me. After various doggie pleasantries she ran through to show me where the set was. Taking the back off, I checked the left side fuses to ensure that h.t. was present. It was, and as expected the 800mA fuse on the right side scan panel was open-circuit. I checked the current briefly. Over 1A and the line output transformer was discoloured. A new transformer was fitted with no trouble at all. The snag was that I'd forgotten to pack 800mA fuses. Since the normal current is under 500mA, I fitted a 630mA anti-surge type. The set then worked nicely and after being paid and saying goodbye I prepared to depart.

As I was about to drive off there was an irate call.

One way of seeking business, or "Oh Lord would it spoil some vast eternal plan If I were a wealthy man?"

"Didn't last long did it?" So back with the gear and I could hear the power supply tripping away. The 630mA fuse had failed, but why was the power supply tripping? Absence of the load after failure of the fuse should have produced sullen silence.

I then did what I should have done initially. I'd merely checked that the h.t. was present, not measuring it carefully. It was 220V, not 200-205V. I set it at 200V and the tripping stopped. The load on the right side fuse was under 500mA so I went through my pockets. Joy – an 800mA fuse!

"There'll be no callbacks this time madam" said I, wishing that I could be a bit more sure. All was well however and it was back to base, feeling shattered at this lack of expertise, care and ability to think straight.

The Fidelity

A Fidelity CTV14R colour portable was awaiting our (lack of?) attention. We'd sold it a year or so ago. The owner's complaint about it was repeated but intermittent shut down, reverting to channel one each time. He said it was random channel change, but it was really shutting down then coming on again in the start-up condition.

Slight pressure on the front panel produced the shut down and restart. A tap on the top did the same. So we removed the back and applied pressure here and there. It seemed that the front panel was the focal point, so we removed it, expecting to find a cracked track or a dry-joint. No amount of disturbance would produce the shut down with the panel out however, so we tried the main panel. This did it and out came the panel. Again no disturbance would produce the shut down. Tapping the now nearly empty cabinet did. I was puzzled and idly tapped the tube base – very lightly. That did it. Oh please, not the tube! Lightly disturbing the base panel then led us to the focus control, where the earthy end was not securely bonded to the print. Resoldering this restored continuous operation. Well, well!

Greetings

Best wishes to Alan Daines of Canterbury, a hard working member of the clan. Keep it going Alan. Message via Stan Westover of SEME. Thanks to A.S. Foster of Brixham, Devon. The doctor had only one hand on my shoulder, rest assured. They don't really do that . . . do they?

Servicing the Sony KV2000UB

Part 1

David Botto

This was one of the most popular Sony TV sets. There are two versions, the Mk. I and Mk. II. They differ in many respects, but it's simple to find out which version you have on the bench. As is usual with Sony receivers, the KV2000UB is made up of a number of printed circuit boards that are identified by letters. In the Mk. I version there are two main signals panels, A and B: the Mk. II version has a single, larger A panel containing the circuit functions of the two previous boards. Looking into the rear of the Mk. II version with the back removed, you'll see the larger A board mounted vertically on the left-hand side. Much of the discrete component i.f. and decoder circuitry used in the Mk. I version is replaced by three i.c.s on this later panel.

Power supply panel F is at the bottom left. The mains bridge rectifier is followed by a transistor chopper circuit which incorporates three protection arrangements, ECL (excess current limiting), ECC (excess current cut-out) and OVP (over-voltage protection). These protective circuits are well designed and if a fault condition causes any one of them to sense that all is not in order the receiver trips or shuts down completely. The power supply circuit (Mk. I version) is shown in Fig. 1. The panel is accessible and dealing with faults is straightforward – provided you understand the principles of operation.

The a.c. mains supply passes via switch S901, connector F1, the mains fuse and filter then R602 (2·7Ω, 7W w.w. non-flammable)/thermistor TH601 (part no. 1-800-356-00) to bridge rectifier diodes D601-4 (four U05Gs). The 320V produced across reservoir capacitors C606/C621 is fed to the chopper circuit via fuse F602. T601 is the chopper transformer and Q607 the chopper transistor. The 18·5V supply at the collector of the driver transistor Q606 is derived from the 320V rail via R617 (33kΩ, 7W metal oxide non-flammable).

Transistors Q604/5 are connected in an astable multivibrator circuit that acts as a pulse-width modulator. The start-up supply for the multivibrator and the error amplifier transistor Q601 is obtained via R604 and R605 (both 47kΩ, 1W metal oxide non-flammable). Once the circuit is working normally these stages are supplied by D609/D614 which produce 21V across the reservoir capacitor C612. The emitter of the error-amplifier transistor is held constant at 12V by R612/D605 – R612 should always be replaced with a 1W type.

The multivibrator free runs at about 10·8kHz – measured using our workshop frequency counter. In normal operation it's triggered by pulses from the line output transformer T801. In the Mk. I version these are derived from tag 4, which also supplies the 33V rectifier D803: in the Mk. II version they are taken from tag 6 which supplies the 18V rectifier.

Preset VR601 sets the voltage at the base of Q601. This voltage is derived from the 135V h.t. line via R607 etc. and varies with any h.t. voltage fluctuations. Q601's collector voltage is thus varied to provide the control action – at the junction of R615/6 in the pulse-width modulator circuit. If the voltage at the base of Q601 falls, the on time of Q604 will be increased, and vice versa.

In addition to the 135V supply, panel F produces a 16V start-up supply for the line oscillator i.c. This is developed across C626 and appears at pin 2 of connector F3.

The ECC circuit operates if the power supply's output is short-circuited or more than twice the correct load current flows. Under these circumstances the voltage across C610, which is charged via D606/R614, rises sufficiently for Q603 and Q602 to latch on, shorting the base of Q604 in the multivibrator circuit and thus killing the 135V h.t. supply.

The ECL circuit operates if the peak current flowing into the load exceeds 1·3A. Under these circumstances the voltage across R628 will be sufficient to turn Q608 hard on. The effect of this on the multivibrator circuit is to switch Q604 off and leave Q605 on, again killing the h.t. supply. Even a brief overload will trigger the ECL protection circuit.

The OVP circuit operates when the 135V line rises above its correct level. In this event zener diode D615 conducts, switching on Q602/3.

There are some differences in the Mk. II version of the F board. The mains filter circuit T603/C601/C629 can be missing; C606/621 are replaced by a single 250μF unit (C606); L602 becomes L601 and fuse F602 is deleted. Several component reference numbers differ, e.g. D609 and D614 are interchanged.

Power Supply Fault Finding

A common fault with these receivers is tripping – the set seems to be trying to work but can't quite make it! To deal with this you need a variac or a tapped mains input transformer – something that's essential for tests on the KV2000UB – to enable you to reduce the mains input voltage. Start off with about 150V a.c. If the set then starts to work, you've almost certainly got a fault on the power supply panel.

Connect a digital voltmeter – best for all tests on this receiver – across the h.t. line. A handy place is pin 1 of socket F3. Slowly turn up the mains input voltage. If the h.t. voltage rises above 135V and the set cuts out at about 140-150V, the OVP circuit is operating and there's a fault in the power supply regulation.

The first component to suspect, always assuming that some person unknown hasn't twiddled VR601, is the h.t. reservoir capacitor C620 (it's C622 in later versions of the Mk. II chassis). The h.t. voltage goes high when this capacitor's capacitance falls – if it starts to leak, line ripple appears on the h.t. line, giving the rather puzzling effect of blanking out the luminance signal. Then test resistors R607 (33kΩ, 2W metal oxide non-flammable), R633/R609 (1kΩ), R610 (2·7kΩ) and R608 (3·9kΩ). Replace these last three with small 1W types for greater reliability. Carefully check the preset VR601 and make sure that thermistor Th602 (TH4700) is intact.

Should you ever have low h.t., probably with picture ballooning, and VR601 has no effect when turned, Q601 almost certainly has an internal short-circuit.

When the set trips and reducing the mains input to 110V a.c. doesn't restore operation – or perhaps the set is completely dead – the power pack can easily be checked for correct operation before moving on elsewhere. To do this, remove connectors F3 and F4 and connect a dummy load – a 100W, 240V bulb works well – between pin 1 of F3 and chassis. With 240V mains input the lamp should light and the h.t. rail should measure 135V d.c. plus. Also check for 16V d.c. plus at pin 2 of F3. If it's not present, check R638 (1·2Ω, 1/8W), D611 and D612 (R640/D612/D613 in later versions). Make sure that there are no dry-joints at the appropriate winding of T601. The 16V supply reservoir capacitor C626 (100μF 25V) likes to dry up, causing all manner of problems – such as intermittent start up.

If the lamp doesn't light, further tests on the power pack will be required. Fortunately it's easy to work on if tackled in the right way. If the mains fuse F601 has blown, check C601 (0·22μF, 300V Mylar) – replace it using one with a higher working voltage rating. Also check C629, though this one seldom seems to fail, and the diodes in the bridge. The mains switch S901 has been known to go open-circuit.

Connect the receiver to the a.c. supply via the variac and gradually increase the input from about 110V a.c. while measuring the voltage across C606. This should rise to 320V d.c. A word of warning. If F602 has blown and the set is connected to the mains supply and then disconnected, C606 and C621 will take a little time to discharge (via R603). So don't touch the fuseholder until these capacitors have been discharged or you could get a very nasty shock. Discharge them to chassis via a 5kΩ resistor – whatever you do don't short out these capacitors or horrible things may happen with damage to the circuitry.

The power panel can be removed by disconnecting F1-4, unscrewing two self-tapping screws at the rear, then sliding it out. The metal cover is easy to remove by taking out the four screws that hold it to the printed board. You will now need a d.c. supply so that the panel can be operated whilst disconnected from the mains and the rest of the receiver. Use either a really well-smoothed supply or two PP9 batteries to produce 18V, negative to chassis. Connect the positive side of this supply to the cathode of D614 (Mk. I version). The current flow from the 18V supply should be about 17-18mA.

Use an oscilloscope with 10:1 probe to check the waveforms at the collector and base of Q604. These should be as shown in Fig. 2. Remember that the multivibrator is running free, so there may be some slight variations is these waveforms. If all is well, reduce the d.c. supply to 9V (or one 9V battery) and link the anode of D614 to the junction of VR601/R608 – leave the 9V supply connected to the cathode of D614. It's helpful to solder short lengths of bare wire, only half an inch, to the various test points to make connections easier. Mark or note the position of VR601's slider before disturbing it. Connect the scope to Q605's collector. With the d.c. supply now at 9V, the consumption should be about 9·8mA. If all's in order, the waveform shown in Fig. 3 should be seen. Turn VR601 anticlockwise and the pulse width will narrow: turn it clockwise and it will widen. Return the slider of VR601 to its initial position and check the waveforms at the base and collector of the driver transistor Q606 (see Fig. 4).

To check the action of the protection transistors Q602/3, connect one end of a 10kΩ resistor to the 9V positive supply and touch the anode of the zener diode D615 with the other end. The waveform at the collector of Q605 will disappear and you'll have to disconnect the 9V supply and reconnect it to start things up again.

Leaving all connections as they are, connect a linking wire from the positive side of the 9V supply to the junction of L602/R617. Increase the supply to 18V d.c. The complete power pack is now operating from the 18V d.c. supply and the waveforms at the base and collector of the chopper transistor Q607 should be as shown in Fig. 5. A digital voltmeter connected between pin 1 of F3 and chassis should give a reading of about 11·5V d.c. The start-up voltage at pin 2 of F3 should be 1·2V d.c. plus.

The procedure outlined above should enable faults on board F to be speedily located. If the chopper transistor has failed, don't replace it before making further tests. It's best to replace the insulating washer as well. Dried out electrolytics and leaky diodes can cause problems. Check the print for dry-joints, especially around the chopper transformer T601. Rapid checks on semiconductor devices and capacitors can be made with a component tester connected to the scope, saving lots of time.

If the power supply works all right when loaded with a 100W bulb but not when connected to the rest of the set, a few simple tests will quickly reveal in which section of the receiver the fault lies.

Fault Isolation

Connect a digital voltmeter between the h.t. line and chassis on panel F. Unplug connector F4 from the board and switch the mains supply on. F4 feeds the audio circuit and the tuning system. If the 135V supply is present there's almost certainly a fault in the audio circuit. Check the driver and output transistors and the 33μF smoothing electrolytic – this is C249, C247 or C253 in different versions. The audio section is reliable, but has been known to fail.

If the fault is still present, switch off, replace F4 and remove connector E5 on the E (line output) panel. Switch on. If the 135V line is absent you've eliminated boards B and D (timebase board). Switch off and replace E5. Remove E2, power up and if the 135V line is present there's a fault on the tube/RGB output board C. Check transistors Q701-3 (type 2SC1127 or 2SC2278) and, in the Mk. I version, D701 (HF-1C) and C709 (4·7μF, 250V electrolytic).

If you've still no 135V line, switch off, replace E2 and disconnect E6 in the centre of the E board. This takes the line scan coils, the pincushion transformer and the horizontal shift system out of circuit. Switch on and see whether the 135V line is present along with a vertical line at the centre of the screen.

If there are still no results, switch off, replace E6 and disconnect E1. This disconnects the e.h.t. department, containing the tripler etc.

If there are still no signs of the 135V line when the set is switched on again the fault must be on board E. All this plugging and unplugging sounds like hard work but can be done in a few minutes. It's a good idea to clean the connectors as you remove them, with just a spot of switch cleaner.

Line Timebase Faults

The first thing to check on board E is the efficiency diode, D806 (SID30-15) in earlier versions, D807 (ERC26-15) in later sets. Secondly check the gate controlled switch line output device Q901 (SG613). This is the same device as used in the KV1810UB (see previous article, March 1983). Fortunately, it's much less vulnerable in the KV2000UB. Remember that these devices are very expensive however: never replace one without at the same time replacing its insulating washer, the efficiency diode, and the protection capacitor C812/C814 (depending on version). Also examine choke L807/806 (SRC – sine resonance choke) for any signs of burning or overheating. Change C901 as well – it's connected across Q901.

Then check the whole of board E for dry-joints. Connect the scope, via the 10:1 probe, to the base of Q901 and supply 110V a.c. to the receiver. A picture and the drive waveform shown in Fig. 6 should be obtained. Slowly and cautiously increase the mains input to 240V.

If the set keeps tripping and the connector unplugging procedure previously outlined has been carried out, check the line driver transistor's collector feed resistor. This is R808 or R809 depending on version – 39Ω, 1/8W non-flammable. It likes to go open-circuit with the result that the set trips. If necessary check the start-up diode D507 (SIB01-02) and the following feed resistors: R551 (1kΩ,

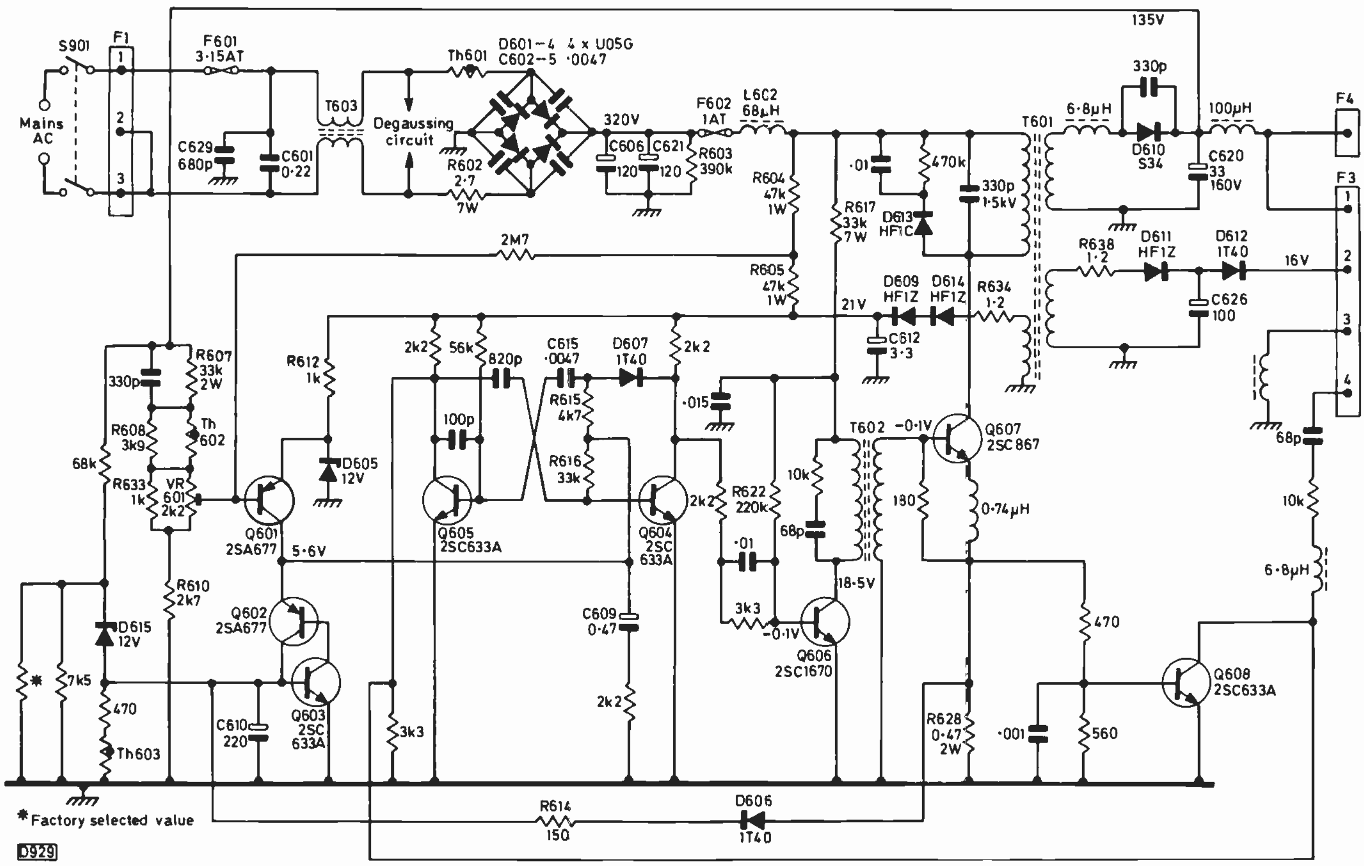


Fig. 1: Power supply circuit, Mk. I version.

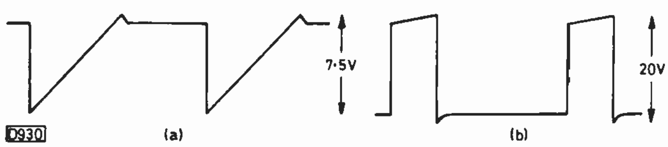


Fig. 2: Waveform at the base of Q604 (a) and at its collector (b) with an 18V supply, free-running at 10·793kHz.

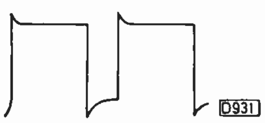


Fig. 3: Waveform at the collector of Q605, with 9V supply.

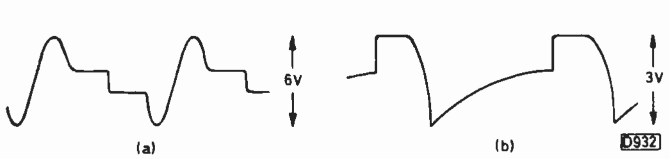


Fig. 4: Waveforms at the collector (a) and base (b) of Q606 with a 9V supply.

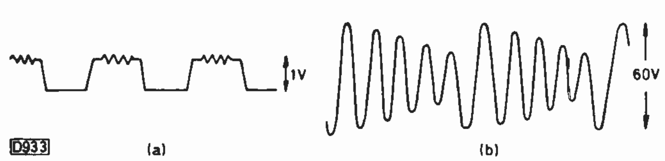
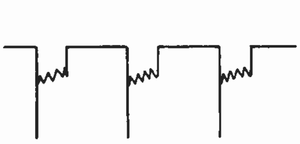


Fig. 5: Waveforms at the base (a) and collector (b) of Q607 with an 18V supply.



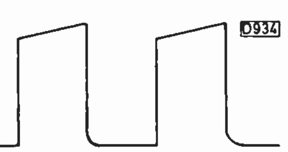


Fig. 6 (left): Drive waveform at the base of Q901.
Fig. 7 (right): Waveform at pin 14 of IC502 (CX158).

½W), R555 and R563 (both 120Ω) in the earlier chassis, R552, R555 and R556 respectively in later versions of the Mk. II.

On rare occasions the CX158 line generator i.c. (IC502) has been known to fail or behave intermittently. Before condemning it, examine the various capacitors around this i.c. carefully – the small electrolytics tend to dry up and corrode. C532 (4·7μF) and C530 (3·3μF) are the ones to check first – they are C538 and C535 in later versions of the Mk. II.

To check IC502 – with the receiver disconnected from the mains supply – connect 9V d.c. positive to the cathode of D507 and the scope, via the 10:1 probe, to pin 14. The waveform shown in Fig. 7 should be seen – it may vary as the line oscillator is running free. It's a good idea to heat and cool the i.c. whilst running it at 9V. This helps to show up any tendency to intermittent operation of either the i.c. or associated components. If necessary check the line driver transistor (Q510 or Q507 depending on version).

If the 18·5V supply rectifier D804 (S34) fails or the 33V supply rectifier D803 (HF1) goes short-circuit the set can trip. This is in the Mk. I version. In the Mk. II the supplies are 18V and 33V, the diode references varying with the two variants of this version (before and after serial number 600,001). The 1·2Ω resistor in series with the 18V rectifier sometimes goes open-circuit, the result being tripping.

There are several low-value, low-wattage resistors on all versions of the E board. It's a good policy to test them all – it takes only minutes and can save hours of time in fault location. C807 (330μF, 50V) on the Mk. I panel can go partially open-circuit, giving rise to weird effects in the field timebase circuitry.

In Part 2 we'll deal with the rest of the timebase circuitry, the signals panels and mention a few odd faults.

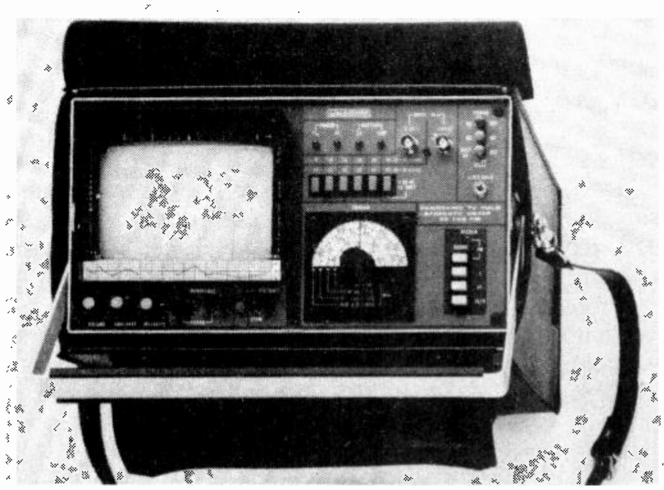
The Unaohm EP730AFM Panoramic Monitor

Eugene Trundle

When the u.h.f. network in the UK is complete – and it's almost there – there'll be about 650 TV transmitting sites, each radiating four services. This represents around 2,600 vision transmitters operating on the 44 channels available. The corresponding sound transmissions bring the total number of carriers in the u.h.f. broadcast band to over 5,000. There have been developments in Band II as well. Where there were once but three national programmes, a multiplicity of local services has sprung up in the last few years. Down here on the south coast the v.h.f./f.m. band is crowded with Continental broadcasts, despite their being "behind" the directional Band II receiving aerial. Although activity in Bands I/III is currently declining in the UK, there are various European CCIR standard B transmissions that are receivable in southern England and these have to be sorted from such 405-line transmissions that remain.

Where does all this leave the aerial rigger? Straddling the chimney with his dipole in his hand! No problem in a Welsh valley where he's cut off from the rest of the world, alone with his 80W relay down the road and multiple reflections off the hillsides around. But thoroughly confused perhaps in the home counties, midlands and coastal areas, with transmissions from several sites, wanted and unwanted, adjacent and dispersed, all perking up on his field strength meter so that its little needle works like a fiddler's elbow as the bands are tuned . . . Is this the BBC-2 vision signal from the Bretch Hill relay or the sound carrier from Sutton Coldfield BBC-1? Has the pointer gone off the Band II clock as a result of Wrotham's Radio 4, or are we picking up the CB rig down the road? These and similar problems assail the hapless aerial contractor all the time. With the blossoming of Ch. 4 and S4C transmissions and the spread of teletext receivers, our rigger's lot is not getting any happier – and the customer still expects it to be done for a fiver . . .

There's also a race of people called systems engineers. The ones I mean are concerned with installing and maintaining cable TV systems of the multi-outlet type – in blocks of flats, hotels, schools and similar places. They often need to check the level, balance, reflections and other parameters of their v.h.f. and u.h.f signal carriers. Again, a simple field strength meter is becoming inadequate – and the average tenant's TV set may be in poorer shape than his distribution system! TV service and installation men who know not a smoke cowl from a hip tile also have an increasing need to be able to analyse the r.f. signals coming into their equipment – and generated by it where r.f. modulators are concerned, as is increasingly the case with domestic equipment.



The Unaohm EP730AFM panoramic field strength meter.

Panoramic Principle

The idea of a spectrum type of broadcast band display really came along with the advent of the varicap tuner – an early example was the excellent panoramic monitor featured in the November 1971 issue of this magazine. The mechanics are surprisingly simple. A field frequency sawtooth waveform is applied to the tuner's tuning voltage input so that it scans the band under observation every 20msec. As the sweep is field synchronous, it's only necessary to apply the output from the vision detector to the horizontal deflection system to build up a spatial "blip" display of all the carriers picked up. The result is a spectrum-analyser type display. The instrument under review goes a step further, producing a more practical and readable display based on a 625-line raster, with the blips reproduced in white against a black background.

Features of the Unaohm EP730AFM

The accompanying photo shows the EP730AFM panoramic TV field strength meter whose main features consist of a 15cm monochrome tube and a calibrated tuning scale.

In the picture mode the instrument is in effect a portable TV set which provides a very good quality picture. The geometry is reasonable rather than good, and there is a little more that three per cent raster expansion over the range of the brightness and contrast controls – this e.h.t. regulation was the same with mains and battery operation. The definition is very good, with all the Ch. 4 test pattern gratings easy to see. The finest grating (5·25MHz) seems to be about 3dB down on the others. To help in identifying short-term reflections and similar shortcomings (very important with text reception), a "zoom" button stretches the picture horizontally so that the test pattern frequency gratings or needle pulse can be closely examined. There's also an audio channel with built-in speaker.

The second mode of operation is "field strength". Here the upper section of the screen displays a horizontal white bar whose length varies according to the strength of the input signal. A scale at the top is calibrated in dB relative to 1μV/m to read field strength within the range 20dBμV (10μV) to 130dBμV (3V). This is done in conjunction with a pair of BNC input sockets and a series of push-button attenuators. To cater for tuner tolerances, each instrument comes with an individual calibration graph at the bottom of the screen. This gives the required correction factor to the readings obtained. Unless one's looking for a very high degree of accuracy it can be ignored!

It's becoming conventional nowadays to quote field strengths in dBμV. The conversion to microvolts or millivolts is easy – particularly with this instrument, since a small slide-rule type abac is supplied as an accessory. There's a carrier frequency chart on the back of this: beware of the sound carrier frequencies given – they're for the Continental system, 5·5MHz above the vision carrier!

The third and most interesting mode however is the "panoramic" one, in which the whole of the selected Band's spectrum is displayed. A typical example is shown in Fig. 1, where the four channels of the local group A relay can be seen – the long traces represent the vision carriers and their shorter companions the accompanying sound carriers. Further up the display a group of carriers from a more distant transmitter, operating towards the top of Band V, can be seen. Similar displays are provided in the other bands covered, though the modulation differs – the display shows this.

Identification of individual carriers is facilitated by the electronic cursor at the left. This takes the form of a black line that moves up and down the displayed band with the action of the tuning dial: overlay this with the carrier in question then, on switching to the TV mode, the picture and sound will come up. In Band II the programme is reproduced through the loudspeaker (push the dB button), a beacon lighting up where appropriate to indicate the presence of a stereo subcarrier.

By selecting "expansion" while in the panoramic display mode any section of the band being displayed can be closely examined. Manipulation of the tuning and expansion controls enables the user to zoom in on individual carriers. A typical example is shown in Fig. 2, where the sound and vision signals from a single u.h.f. transmitter occupy almost the entire screen area.

Basically, the machine is mains powered. A sealed lead-acid accumulator is available as an optional extra however. This fits inside the case and can be recharged by the mains-powered charger incorporated. A fully charged

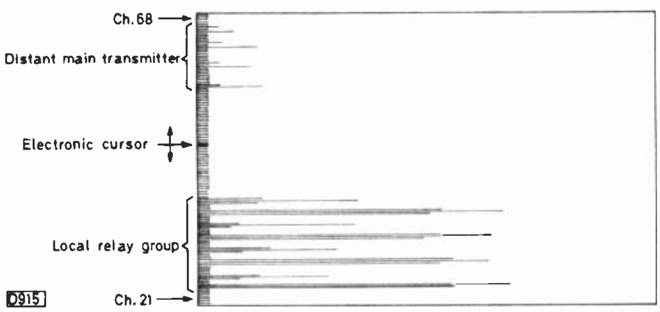


Fig. 1: U.H.F. band display, with the four transmissions of a local group A relay dominant at the bottom.

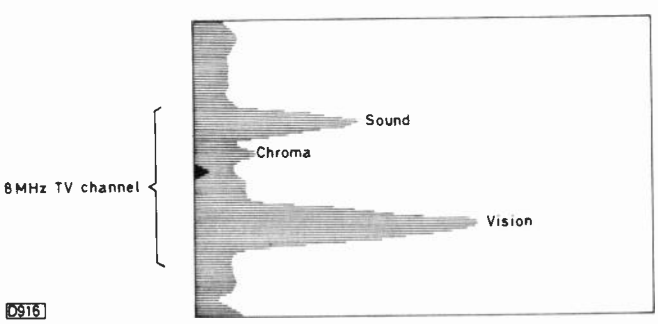


Fig. 2: The expanded mode – a single channel from Fig. 1 enlarged for detailed examination.

Table 1: Specification

Sensitivity: 20-130dBμV in ten ranges (0dB = 1μV at 75Ω).
Input Impedance: 75Ω with a.c. coupling. BNC type input socket.
Field strength accuracy: ±3dB on Bands I-III, ±4dB on Bands IV/V.
Coverage: Band I 45-100MHz; Band II 88-110MHz; Band III 110-290MHz; Bands IV/V 470-860MHz.
Frequency readout accuracy: ±2%.
Monitor: CCIR standard I. Others on request.
Field strength indicator: Peak white to sync tip amplitude. Analogue readout.
Spectrum analysis: Panoramic display of selected band, with selective expansion of any section.
Picture zoom: Double size expansion in the horizontal direction.
Display: 15cm rectangular monochrome tube with magnetic deflection and electrostatic focusing.
Audio output: 300mW via built-in speaker.
Stereo indication: Red LED beacon.
D.C. output: 11V at 50mA.
Power: 220V±10%, 50Hz, or 12V d.c. from optional accumulator. Battery charge facility.
Dimensions: 30×16×39cm.
Weight: 8kg without accumulator.

accumulator will give two-three hours' use. Whilst on the subject of power supplies, a facility is provided for powering a mast-head amplifier at 11V. For the odd non-standard supply systems that may be encountered, recourse can be made to the set-back power supply itself, though I found that most 16V systems operate well enough at 11V. Other features are listed in the specification table above.

A good range of accessories is supplied with the instrument, including a BNC/coaxial adaptor, protection cover, carrying strap, viewing hood and an instruction manual. The latter contains a basic circuit diagram which is just adequate for first-line servicing.

On Test

I lived with this instrument for a couple of weeks, during which I spent a lot of time playing with it. I found that my signals at home were all around an enviable 15mV and wondered why there were no overloading problems with the TV set or VCR. The machine didn't tell me why my teletext reception is a bit garbled, so I assume that this isn't due to aerial or reception problems. I discovered that the broadcast signals are attenuated by exactly 6dB in the VCR (a Sanyo VTC9300PN which does not incorporate an aerial amplifier) and that the VCR's r.f. output is just 2mV. Studying the VCR's output signal characteristics further, I was surprised to find that the vision/sound carrier ratio (two sound carriers, one each side of the double-sideband vision carrier) is 8:1 instead of the conventional 2:1! The 260μV's worth of sound is adequate for all the TV sets I've used it with however. Intriguingly, the ITV and Ch. 4 ratios were found to be very close to 2:1 while the BBC-1 and BBC-2 ratios were around 2·6:1.

Having exhausted the possibilities of the local relay, I went into the wider world and found the instrument very useful when installing and adjusting aerials of all types. Imbalance amongst the received channels can be seen at a glance, though the displayed carrier amplitudes tend to jump up and down rather disconcertingly in the panoramic mode. Not all of this is due to amplitude modulation of the vision signal: it seems to arise from a beat effect between the "blip" and the line structure of the raster – the effect is much less marked in the expand mode.

The instrument really comes into its own when swinging a directional aerial to null out interference from a co- or adjacent channel source. For v.h.f. radio aerial alignment, a compromise between the field strengths of the various transmitters required can easily be obtained. The instrument is not really suited to chimney-pot life, even with the accumulator fitted: it's fairly weighty and burdensome when climbing a ladder or balancing on a roof ridge, and the carrying strap has a similar effect to a cheese-cutting wire!

The detection of ghosts due to TV signal reflections, with or without use of the picture zoom feature, was easy on test-pattern transmissions, difficult with other programme material. For complete analysis of received picture quality, the ideal is to examine the pulse-and-bar and text waveforms. More on this below.

I'd no standard against which to check the absolute accuracy of the field strength readings, but had no reason to disbelieve the quoted accuracy. This was reinforced by investigation of the accuracy of the attenuators fitted – I found a maximum error of just over 1dB, with virtually no variation over the bands. Frequency calibration, measured at three widely different points, is well within two per cent – the dial and pointer system don't allow much greater sighting accuracy than this anyway.

Interference tracing and suppression is greatly facilitated by this instrument. It's much easier to tune a notch filter on an expanded panoramic display than when observing a live picture. Other sorts of interference, including harmonics of amateur radio transmissions and CB rigs, are quite easily seen and recognised, even when they're sporadic in nature. It was fascinating to watch odd transmissions such as v.h.f. communcations, beacons and so on coming and going, and with continuous coverage from 45-290MHz and 470-860MHz there's a lot to see! Radio amateurs, experimenters, BT interference investigators and r.f. test engineers should all find uses for this instrument. I imagine that the DX-TV enthusiast would also find it a boon. There would seem to be much potential for the instrument in the educational field, bringing to life as it does the theory of modulation, sidebands and r.f. spectra.

As mentioned above, it's useful to be able to analyse the vertical interval test signals and teletext data lines. In the absence of a facility for this on a test set like the EP730A the best course is to add a video output socket for driving other equipment. Modification and fitting details are available from the importers. Equipment for eyeheight checking and VITS analysis will hopefully become cheap enough one day for general use: the aerial installer and the systems man may then be able to assess quantitively the more subtle characteristics of the signal he's providing – it would be very nice to quote figures rather than guesses as to the goodness of received signals.

Conclusion

The value and desirability of this instrument depend entirely on how involved you are in this type of work and the standards you set. Though it does have shortcomings, it's a vast improvement on the traditional field strength meter and is, as far as I'm aware, unique in its price bracket and able to fulfil many of the functions of very expensive professional spectrum analysers. £639 plus

VAT is not an unreasonable price if the instrument will be well used, and I get the impression that it will last the course. A spares, recalibration and repair service is provided by the importer's service agents. The instrument is available from Advid Electronics, 17a Mill Lane, Welwyn, Herts AL6 9EU (telephone 0438 832641 and 714159).

Finally I must thank my colleague J. Guppy for his advice and assistance in the preparation of this review.

Teletopics

TV CHIPS

Details of several interesting new i.c.s for TV receiver use have been released recently. The Mullard TDA4503 is a 28-pin device that handles most post-tuner signal processing, i.e. vision and sound i.f. amplification and demodulation, a.g.c., a.f.c., sync separation and the generation of line and field drive pulses. It can be used as the basis of a monochrome set in conjunction with a tuner and audio, video, field and line output stages. A similar device, the TDA 4500, is already in use in the Thorn TX90 chassis. For a low-cost colour set the TDA4503 can be used with the Mullard TDA3565 decoder i.c. This addition to the TDA3500 series of single-chip decoders has only 18 pins, resulting in an economical design. An i.c. incorporating all small-signal colour receiver functions (the TDA4501) is under development.

The TDA4503 operates at typically 10·5V 75mA and is encapsulated in a SOT117 DIL pack with internal heatspreader.

Mullard are also working on a two-chip signal handling system for use in more sophisticated colour receivers that employ microcomputer control. These i.c.s, designated TDA8430 and TDA8460, are expected to be in volume production by the end of 1985. They're analogue devices but will be digitally controlled to reduce the number of adjustments necessary during manufacture. A Philips/ Mullard spokesman commented that the analogue approach will offer a more economical solution to TV signal processing for "at least five years – maybe even ten". CCD field stores are also being developed.

The SGS TDA8170 field output chip is encapsulated in a seven-lead "Heptawatt" flat-pack with tab for heatsink attachment. It's suitable for use in monochrome and colour receivers and is said to be capable of driving all types of yokes in common use. The TDA8172 version is modified for use in receivers with digital signal processing.

BBC'S DIGITAL SOUND SUCCESS

On May 24th BBC engineers carried out what is believed to have been the first "all-digital" transmission (from the initial recording through to the receivers) of stereo TV sound, using the Crystal Palace transmitter after normal closedown. The programme consisted of a pop concert with the sound recorded in digital form. Equipment used for the transmission included a Studer sampling-rate changer to convert from 44·4 to 32kHz and a BBC-designed software-controlled processor to alter the pre-emphasis characteristic from that used by the recorder to that required for transmission. These tests are the latest in a series that began at Wenvoe last October – that test confirmed the ruggedness of digital stereo TV sound in difficult reception areas, the Crystal Palace trial establishing the compatibility of the system, i.e. that no significant interference is caused to sound or vision reception on existing receivers. The BBC is now convinced that a digital system is the best way of providing stereo TV sound from a terrestrial transmitter and is holding discussions with the Home Office, the IBA and the industry to establish an agreed UK specification. Now that compatibility has been established it's hoped to arrange for tests to be carried out from time to time during normal broadcasting hours.

NARROW-BAND TV DEMONSTRATION

Demonstrations with several amateur-built TV cameras working on a low line standard were given at the tenth annual convention of the Narrow Bandwidth Television Association at Clifton, Nottingham on April 29th. Tony Bridgewater, until 1968 Chief Engineer, BBC Television and a pioneer of broadcast television, was a guest at the convention. He spoke of his experience in both planning and operating the Baird 30-line system during the period 1928-35.

The N.B.T.V.A. was formed in the early 70s to link amateurs working on the application of modern techniques to low-definition and mechanical TV. Membership has grown steadily in the UK and in several other countries and members are at present exploring the possibilities of continuous, moving-image TV using a bandwidth of under 15kHz. Systems that have been tried frequently involve mechanical image analysis. A common standard, which was used at the recent demonstration, is 32 lines at 12·5 frames per second. This can be tape recorded and is a viable amateur radio technique. Remarkable detail can be reproduced within its 6-9kHz bandwidth. Work in progress includes trial transmissions on the amateur bands. For further details contact the chairman Doug Pitt, 1 Burnwood Drive, Wollaton, Notts.

BIB DISC CLEANER

Bib have introduced a cleaning kit for use with laser scanned video and audio discs. It consists of a bottle of special formula cleaning liquid, applicator cloths and a chamois polisher. The kit is packed in a storage wallet for dust free protection and has a recommended retail price of £2·99 including VAT.

CALL FOR A SCOTTISH ATV BEACON

Amateur television enthusiasts in Central Scotland who would be willing to participate in financial support or the construction of a 24cm ATV repeater for the area are asked to contact Norrie Macdonald, GM4BVU, 3 Townhill Road, Earnock, Hamilton, Lanarkshire ML3 9UX.

IBC 84

Some ninety papers are to be delivered during the fourteen technical sessions that will form part of the tenth International Broadcasting Convention at Brighton from September 21-25th. They'll cover technical developments in sound and TV broadcasting and allied fields, including satellite broadcasting and reception, higher definition television and video scrambling techniques. A record number of firms (134) will be present at the IBC exhibition. IBC 84 is sponsored by the Electronic Engineering Association, the Institution of Electrical Engineers, the Institute of Electrical and Electronics Engineers, the Institution of Electronic and Radio Engineers, the Royal Television Society and the Society of Motion Picture and Television Engineers. For further information apply to the IBC Secretariat, IEE, Savoy Place, London WC2R 0BL.

VIDEO SHOP DECLINE

The number of outlets devoted to selling and renting prerecorded video tapes is declining and, according to Steve Bernard of distributors RCA, could fall sharply from some 6,000 to 3,500-4,000 by the end of the year. Research carried out by RCA suggests that about half the population regard the local video shop as a sort of sex emporium catering mainly for "extreme tastes". As a result, tape rental is being taken over by supermarkets, tobacconists and other outlets that concentrate on a small selection of best sellers. Derek Mann, chairman of the Video Trade Association, feels that video shopkeepers' interests would be best served by a single trade association – at present there are at least twelve.

BANDWIDTH COMPRESSION FOR HDTV

The Japanese broadcasting authority NHK has announced the development of a system called MUSE (Multiple Sub-Nyquist Sampling/Encoding) that enables a 20MHz high-definition TV channel to be compressed for transmission via an 8MHz channel. It relies on the eye's insensitivity to fine detail in a moving picture. The key to MUSE is a multiple sub-sampling system that reduces the number of picture elements per field to a quarter of the initial number. The receiver requires a 10Mbit memory to carry out conversion to the basic standard: four fields per frame are used, reducing the frame rate from 30 to 15 per second. Experiments with MUSE and other HDTV techniques are being conducted via the Japanese BS2a satellite.

US SCRAMBLED TV SERVICE ABANDONED

The US TV network ABC has abandoned after only five months a novel service it was operating as a pilot project in the Chicago area. The idea was to broadcast scrambled programmes during the periods when the transmitters are normally off air. Subscribers could hire a decoder that enabled the transmissions to be recorded on a standard VCR for viewing later. Despite the growing number of VCRs in use in the USA, it seems that the system was not sufficiently attractive to viewers at an economic price.

DBS LATEST

Fifteen firms, rather more than expected, have applied to the IBA to participate in the proposed UK DBS service. They will form a "third force" in partnership with the BBC and ITV companies as outlined last month.

Luxor has announced that it expects to be able to supply equipment for DBS reception in the UK at £320 per installation, to include the electronics, a 60cm dish aerial, setting up and VAT. This assumes a production run of some 200,000 units – a further reduction in price of around ten per cent is anticipated at higher production volumes. Luxor claims to have around twenty per cent of the domestic satellite receiver market in the USA.

A new DBS transmission standard for European use has been proposed by the French government. The system, called D2-MAC, appears to have certain features in common with the MAC-C system proposed by the IBA last year and backed by both the UK government and the EBU. Philips and Thomson are both backing the new French system.

ALL-DAY ITV POSTPONED

The ITV companies, represented by the Independent Television Companies Association, have informed the IBA that they intend to postpone plans for all-day programming until 1986. The IBA had offered to transmit ITV services after TV-am closedown, but there are doubts whether the likely advertising revenue would make this worth while.

Meanwhile Channel 4 is to extend transmission times from mid-October. Programmes will begin at 2·30 p.m. during weekdays and at 1 p.m. over the weekend.

VIDEO EQUIPMENT

Panasonic have introduced a lightweight portable video recording system consisting of a VCR, Model NV180, that uses standard sized cassettes instead of the VHS C type, the WVPA1E camera and VWET180 tuner/timer. The VCR and tuner/timer together weigh about 6lb, the camera being just over 2lb.

Sony's Betamax VCR with hi-fi sound, Model SLHF100UB, was demonstrated at the recent trade shows. It lays the sound signal on the tape helically along with the video signal, as with the VHS hi-fi sound system.

CED video disc players are now being produced by Korean manufacturer Samsung.

Markplan have introduced a combined VCR/TV set called the Videoport. It's primarily intended for professional/business use and is priced at £1,600 plus VAT. A 12in. colour tube is used for the display.

TV EQUIPMENT

A couple of a.c./d.c. colour portable TV/video monitors have been introduced by Panasonic. Model TC1100G has an 11in. tube and Model TC801G an 8in. tube. Features include video/audio input/output terminals, a dark-tinted glass cover to improve viewing under all lighting conditions, dual-standard PAL operation, and DEF-MOS memory up/down tuning with three controls, plus, minus and store. The suggested retail prices are £388·50 and £355·50 respectively.

An "audiovision" system called TriCon has been introduced by ITT. Instead of connecting cables, the units are linked via 11-pin connectors at the top, bottom and sides. There are seven units, as follows, also a matching trolley stand: 7010 record deck; 7020 cassette deck; 7040 preamplifier/audio control unit; 7060 LW/MW/FM stereo tuner; 7070 TV tuner; 7080 22in. receiver/monitor with teletext decoder; 7090 speaker unit. The latter has bass, mid and treble speakers with built-in amplifiers and level controls for the mid and treble units.

Ferguson have introduced a 22in. component TV set, Model 22B5, based on the TX10 chassis. Called the "Professional Series", the comprehensive specification includes microcomputer control, teletext, a SCART socket, jack connector and bargraph plus numerical displays.

TV Fault Finding

Reports from Mick Dutton, Tony Thompson and Malcolm Burrell

Amstrad Colour Portables

Two of these sets came in for repair recently. The first was a 10in. model (CTV1000) whose problem was intermittent line hold drift. This was easily solved once the back had been removed: the line hold control, a vertical preset, was dry-jointed on one leg. The second was a 14in. model (CTV1400) with the complaint of intermittent no results. The h.t. and e.h.t. supplies were present in the fault condition, and the audio output stage was lively. We decided to check the low-voltage supplies and found that the 12V rail was missing. This was due to a crack in the print between pin 6 of the line output transformer and the 2·2Ω surge limiter resistor R749. **M.D.**

Decca 120 Chassis

A common cause of the no results symptom in this chassis is failure of the BU426A chopper transistor (Q801). Before replacing this it's worth checking the two series-connected resistors R808 (47kΩ) and R810 (150kΩ) to make sure that they are not open-circuit. This applies to other chassis using a TDA4600 i.c. in a self-oscillating chopper circuit, for example R165 (300kΩ) in later versions of the Thorn TX9 and R646 (270kΩ) in the Grundig CUC series chassis. **M.D.**

ITT80-110° Chassis

The problem was top foldover with the TDA2652 field timebase i.c. getting very hot. Changing the i.c. and the two diodes D421/2 (they looked as though they'd been running warm) in the output stage supply circuit made no difference. The output stage supply reservoir capacitor C421 (220μF) was eventually found to be open-circuit. I've since been told that this is quite a common problem. **M.D.**

Thorn 1696/7 Chassis

The problem with this monochrome portable was a hum bar. The l.t. rail was found to be 0·5V low but could be corrected by means of the preset control. A check on the mains rectifier diodes and reservoir capacitor proved negative so we decided to look into the regulator circuit where we found a crack in the print between the collector of the series regulator transistor and its control circuit. Repairs here cured the problem. **M.D.**

Luxor 90° Hybrid CTVs

In my article on the Luxor/Rediffusion 90° colour chassis (July and September 1982 issues of *Television*) I mentioned that I'd not had trouble with the l.t. supply bridge rectifier. Well, guess what? You're right of course! Don't confuse this bridge, which is near the inner edge of the transistor regulator/sound output panel, with the h.t. one that consists of separate diodes mounted on a small plug-in unit on the main horizontal power panel – bottom left as viewed from the rear of the set. This latter bridge gives its share of trouble but the diodes can be easily replaced with BY127s. The l.t. one is an encapsulated type and should be replaced whenever its 710mA time-delay feed fuse, which is on the power board, has been killed. The fuses are not component identified but this one is easy to recognise as the input to it should be 26V a.c., slightly more if the fuse has ruptured. The bridge can be replaced with four BY126s, two mounted on one side of the sound panel and two on the other side. If you plan to do this, note carefully the sense of the plus and minus signs on the block: it's all too easy to get confused.

We had an odd fault with one of these sets recently. The complaint was "lines". When I saw the fault, it had some of the hallmarks of interference – three or four narrow horizontal sections of the picture appeared broken and twitching, though the sound was all right. The latter didn't preclude external interference as a possible cause, as the f.m. sound system gives efficient a.m. limiting (though not every set shines in this respect!). As I altered the brightness however I noticed that the fault varied in intensity, being worse at lower brightness levels. This suggested e.h.t. problems – perhaps a winding on the line output transformer about to break down or arcing in one of the line output stage valves.

As a first line of attack I changed the PCF802 line oscillator valve – I've had weird problems with this on various occasions. For once it was blameless. The line output stage cover was then removed so that the valves could be scrutinised for signs of arcing between the electrodes or the bluish glow that denotes impaired vacuum. Nothing. It then occurred to me to check the c.r.t. base panel where there are several spark gaps that give trouble, though the usual effect is bands of colour imbalance in time with the gap "ticking". You often find that these gaps have been open circuited because of their nuisance value, which is unfortunate for the tube's comfort to say the least. Anyway, there was a dry-joint where the lead carrying the focus potential is anchored, and when this had been attended to the fault had cleared. **T.T.**

Grundig 2222

This set initially had a stabiliser fault, but I noticed that one of the neons flickered. So the touch tune unit was replaced. Now to get this out you first have to remove the "electronic module" which lives on the side of the set and contains the tuning potentiometers and several chips. The neon was changed, and the set was then checked before refitting everything.

When I switched on however the tuning voltage had disappeared. A lot of checking ensued before I discovered that there was no voltage at any of the potentiometer sliders. A further check showed that 30V was being fed to the potentiometer bank, which is rather difficult to remove from the panel. Closer examination revealed that though not shown on the circuit each track is fed via a common strip of carbon track. A check on the voltage at each end showed that it was open circuit, possibly due to my clumsy handling.

Ideally the bank should have been replaced, but we didn't have one and the customer was screaming. It looked as if a temporary repair would be impossible, but I remembered once seeing an engineer clean a volume control and then run a pencil round the track. This was worth a try, so I borrowed a pencil and ran it over the area of the open-circuit track. On switching on again the tuning voltage was present and the set worked normally. I haven't seen it since, but we must remember to order a new bank of potentiometers . . . **M.B.**

Glue and Matchsticks!

I've always had reservations about these new adhesives that enable heavyweight boxers to swing from the ceiling. In most household repairs I find they only fasten my fingers together. One day however I had a Grundig set – one of those with a thyristor line timebase – the fault being a rather narrow picture. Occasionally the set would trip. Investigation revealed that the commutating transformer was falling apart: a drop of glue on the former held it together firmly and restored normal working.

Next day I repaired the line panel in a Philips G8. Clumsy as usual, I snapped the linearity coil. The adhesive was rather more reluctant to work on this until a matchstick was inserted inside the former to link the two halves together. It then worked quite happily, reminding me of an uncle who told me some twenty years ago "never to be without a matchstick in the toolbox!" **M.B.**

VCR Clinic

Reports from Steve Beeching, T.Eng. (C.E.I.), Ian Hutton and Les Harris

Sharp VC9500

A local engineer, Dave, dropped in with a Sharp VC9500 that suffered from sound warble. "No problem" said I. "I'll stick a new capstan motor in it." A valid point to note here is never to open your mouth unless you're prepared to stick your foot in it!

The fault persisted after the new motor was fitted, so various tension measurements were made with my extremely expensive Tentelometer tension meter. The take-up tension varied between 20gms and "wrap the needle round the stop" kgm. This was entirely due to the reel motor practising some kind of stop/start method of take-up drive. Replacing this motor put matters right. **S.B.**

Mitsubishis

Those of you in the servicing trade will know how difficult it is to work your way around an unfamiliar machine. This was the case with a couple of Mitsubishis that came to me from another dealer. The first was an HS304 with an intermittent timer. If it was left for a longish period, say a weekend, then set on Monday morning for timed operation, the first go always failed. After that it worked fine. I spent a lot of time checking through the system. When it failed, the tape started to thread then unthreaded again. As power supply line switching was involved various checks and tests were made on this side of things, all to no avail. I decided to call Mitsubishi.

"Can I speak to VCR technical please?"

"No. They answer calls only between 2 and 4 p.m."

"What happens if you have a fault outside these hours?" Silence.

"You'll have to call back." Click. Sh . . .

Once you do get through however they're very helpful. I related the symptoms and my findings to the man at the other end of the phone.

"Have you checked the PG pulse level?"

"No. Should I? What's that got to do with the timer?"

"Well the power supplies load up and if the PG level is low the systems control thinks the drum's stopped!"

No way, it can't be, I thought whilst checking the PG level. Guess what? It was low and what's more after setting the correct level the timer fault went away.

The other machine was an HS320 that acted funny, like threading up whilst the tape was being ejected and then unthreading again. We initially thought the trouble was due to a damaged front panel, but after fitting a replacement the fault remained along with a reluctance sometimes to thread up when play was selected, resulting in a semi-fast forward. Not knowing the machine's history we decided to fit a new microcomputer control i.c. This was done with difficulty because the low-cost print lifts when heat is applied. That didn't do any good either, so between 2 and 4 p.m. I phoned the man again.

"Have you checked the after loading and unloading switches?"

"No. Where are they?"

"Hidden in the top left-hand corner."

Well, he'd been right last time. So I checked the adjustment of the AL/UL bracket – and another peculiar fault went away. **S.B.**

Hitachi VT19

We've had some fun recently with Hitachi VT19s – after they've been in service for a couple of months. The main fault is intermittent clock setting. My friend Dave had three in various states – one reset intermittently and then couldn't be reset, another couldn't be reset after failing, whilst a third had no clock display at all. Hitachi were very nice about it and gave us some modifications which included replacing transistor Q1795 on the power supply back-up board with a 2SD468. As neither of us had one, we put in BC338s. **S.B.**

JVC HRD110

"My JVC HRD110 works only with JVC tapes" said the customer.

I was in a rough mood. "Got taste then, hasn't it?"

Andy pointed out that if I didn't mend it, we'd lose tape library revenue.

The left-hand cassette detector slide switch lever wasn't in its guide slot. **S.B.**

JVC HR7655

A friend of ours rents a JVC HR7655 from us. He rang one day to say that he couldn't set the channel select on the programmable timer. I didn't think much about it as a fellow JVC engineer agreed that it must be the microcomputer i.c., so I ordered a replacement. Tim brought the HR7655 in a couple of weeks later and sure enough when it was put into the programme set mode the channel indicator didn't pulsate nor could it be set. So the replacement i.c. was fitted. The problem remained. Then smarty-pants Andy pointed out that the tuning selector switch shouldn't be left in the "skip" position but in the "off" position. In this position the channel select could be set and the channel numbers flickered correctly.

I think Tim was mumbling something about no one touching it and he'd murder the kids as he left with the machine. **S.B.**

Clock Faults

Having had enough of making mistakes and misjudgements due to off-hand diagnosis, I decided to take more care with a couple of Panasonic (note – not National any more!) VCRs that had strange timer faults.

The report with the first one, an NV2000, was of clock resetting to zero and not keeping time. Now we're aware of such things as multisocket adaptors and faulty 13A sockets. This one had a loose neutral connection in the plug. So I set the clock and we put the machine on soak test in the showroom. Next day it was pointed out that the machine showed 5·56 a.m. at 8·56. I decided that someone had set the clock wrongly. Next day the minutes were again correct but the hours were wrong. The timer i.c. was the cause of the trouble.

The complaint with the second machine, a new NV370, was that the timer would reset to zero, and after being correctly set would reset to zero later. It was put on soak test for a couple of days and nothing happened till just after 5 p.m. on the second day – after Andy had told the customer that nothing was wrong and he was on his way to collect it. The clock reset to zero. I reset it once more and a few minutes later it again reset to zero. After checking the timer supply line and a "reset level" potentiometer I put the machine back on soak test.

It was fine the following day, but on the second day it reset to zero once more just after 5 p.m. I decided to leave it but there were cries of "look at this". The clock display was randomly flashing different digits at different brightness levels. I put it back on the bench and froze the timer i.c. The display went back to zero. Just for fun I set the clock and heated the timer chip with a hairdryer. First it reset to zero, then it proceeded to give a display that any disco would be proud of.

Pity about the idler pulleys in this model. Maybe the modified ones will be more reliable. **S.B.**

Tape Chewing

Here are some mechanical causes of tape chewing we've experienced.

Hitachi VT11E: Take-up spool stopping due to the fast forward/rewind/play idler stopping in the play mode. The cure is to replace the idler.

Hitachi VT9300/9500/9700: Take-up spool stopping due to a worn play idler. Replace the idler.

Panasonic NV370 and NV850: The cause is again a worn play/fast forward/rewind idler. If the idler has a blue dot on the right-hand side it should be replaced with a modified one that has a black spot on the left-hand side (part no. VXP0521). **I.H.**

Sanyo VTC5400

I've had the same fault on several of these machines – the tape jammed in the machine and no functions working. On inspection I found that the motors would rotate but the machine wouldn't load due to the loading ring being jammed. What happens is that the loading end roller catches on a sharp edge on the ring. Filing a small piece off the sharp edge allows the ring to run smoothly on the roller, curing the problem. You'll find that there are two of these sharp edges on the ring (see Fig. 1) – file both down and fit a new loading belt (Sanyo now supply a smaller one). **I.H.**

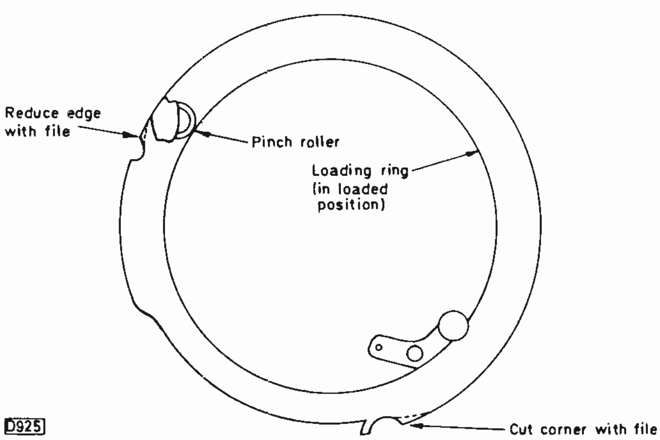


Fig. 1: Loading ring problem, Sanyo Model VTC5400.

Sony SLC6 Mk. II

There's an official Sony modification for tape damage upon insertion of the cassette. I've had this problem and the modification does indeed provide the cure. Details are as follows.

(1) Cut the track between pin 23 of IC501 and R530 on panel SS-9. Add a 1S1555 diode between these points, anode to pin 23.

(2) Add a 1S1555 diode between pin 30 of the i.c. and R530, anode to pin 30.

(3) Add a 1S1555 diode between pin 37 and pin 2 of the i.c., anode to pin 37.

(4) Add a 3·9kΩ resistor in parallel with R579.

The modification also cures another fault. The complaint is that the machine erases only half of the previous recording. Usually the new recording appears on the bottom half of the picture while the previous recording is left on the top half. The cause is that the tension arm is not brought back far enough when the tape is ejected: thus when the next tape is put in the machine the arm doesn't pull the tape far enough across the erase head. **I.H.**

Ferguson 3V29/30

The fault was no colour on playback. On tracing the signal through the machine I found that there was an input at pin 18 of the colour processing i.c. (IC401) but no output at pin 7. Voltage checks then showed that the colour killer was operating. Pin 8 of the i.c. goes via diode D401 to the ch. set/monochrome/colour switch at the back of the machine, and on disconnecting the plug to this switch the colour returned. A measurement from the switch to chassis gave a reading of 200Ω! So the switch was removed from the panel and checked. As it seemed to be o.k. the board was checked for a short. Again no luck. Refitting the switch gave us colour for a short while then off it went again. Another resistance check at the switch produced a reading of 500Ω. So where was this resistance? I found it just before having a nervous breakdown. There was this clear, tacky substance on the rear panel – it could have been flux. Anyway, cleaning if off cleared the fault. **L.H.**

ECONOMIC DEVICES, PO BOX 228, TELFORD TF2 8QP

16029	1.58	2SC1061	0.54	2SD898B	2.67	AN320	4.97	BC171	0.10	BD166	0.38	BF137	0.11	BLY49	2.00	BY203/20	0.18
16181	1.13	2SC1096	1.05	40408	0.45	AN322	4.38	BC172	0.09	BD168	0.66	BF152	0.28	BR100	0.20	BY206	0.17
16182	1.13	2SC1104	2.80	40594	1.39	AN331	2.99	BC172B	0.24	BD175	0.39	BF153	0.52	BR101	0.37	BY207	0.22
16334	0.88	2SC1106	4.12	40595	1.39	AN337	3.99	BC173	0.15	BD177	0.39	BF154	0.23	BR103	0.45	BY210-400	0.24
16335	0.72	2SC1114	5.81	40636	0.86	AN340P	1.06	BC174B	0.24	BD179	0.44	BF157	0.23	BR88B	0.58	BY210-600	0.27
16446	0.89	2SC1124	1.10	40871	1.39	AN355	3.36	BC177	0.18	BD181	0.90	BF158	0.16	BRC-M-300	1.58	BY210-800	0.30
16800	1.25	2SC1151A	4.29	40872	1.39	AN362	1.47	BC178	0.23	BD182	0.98	BF159	0.16	BRC116	0.80	BY223	0.85
16799	2.16	2SC1152	4.25	60857	1.10	AN5111	2.34	BC179	0.23	BD183	0.90	BF160	0.28	BRC1330	1.80	BY224-400	0.90
16801	0.86	2SC1157	4.12	74LS132	0.72	AN5132	3.99	BC182	0.08	BD184	1.10	BF167	0.34	BRC300	1.82	BY225-100	0.79
16802	1.83	2SC1162	0.95	74LS138	0.85	AN5250	3.33	BC182B	0.23	BD187	0.48	BF173	0.30	BRC4443	1.12	BY226	0.28
16803	4.81	2SC1172	1.92	74LS157	0.79	AN5435	2.80	BC182L	0.09	BD189	0.35	BF177	0.50	BRC4444	1.12	BY227	0.44
16805	1.35	2SC1195	2.83	74LS161AN	1.18	AN5610	6.75	BC182LB	0.12	BD190	0.59	BF178	0.36	BRC5296	0.70	BY228	0.54
17074	6.00	2SC1213	0.75	74LS196	1.25	AN5613	3.72	BC183	0.09	BD201	0.54	BF179	0.32	BRC6109	0.75	BY255	0.97
17127	3.91	2SC1226	1.32	74LS20	0.25	AN5620X	4.63	BC183L	0.09	BD202	0.54	BF180	0.32	BRC82	0.98	BY298	0.25
17376	1.43	2SC1306	0.85	74LS244	1.85	AN6320N	3.89	BC183LB	0.23	BD203	0.54	BF181	0.29	BRC83	0.98	BY299	0.25
1N4001	0.05	2SC1307	1.35	74LS30	0.29	AN6342	1.36	BC184	0.09	BD204	0.54	BF182	0.30	BRC84	0.98	BY476A	0.76
1N4002	0.05	2SC1316	3.40	74LS367	1.05	AN6344	4.80	BC184L	0.09	BD207	1.00	BF183	0.35	BRX44	0.54	BYW56	0.30
1N4003	0.05	2SC1364	0.49	74LS373	1.55	AN6363	10.20	BC184LB	0.23	BD208	1.00	BF184	0.39	BRX49	0.45	BYX10	0.28
1N4004	0.06	2SC1383	1.39	74LS47	1.05	AN6551	0.56	BC186	0.24	BD222	0.44	BF185	0.35	BRY39	0.50	BYX55-350	0.48
1N4005	0.07	2SC1398	0.51	74LS73	0.39	AN6552	0.52	BC187	0.18	BD225	0.44	BF194	0.15	BRY55	0.80	BYX55-600	0.25
1N4006	0.07	2SC1410	2.17	74LS74	0.39	AN7145	2.04	BC204	0.14	BD228	0.57	BF195	0.12	BRY56	0.38	BYX71-350	0.67
1N4007	0.07	2SC1413	3.80	74LS75	0.52	AN7150	2.22	BC207	0.12	BD229	0.63	BF196	0.15	BSR59	1.17	BYX71-600	0.85
1N4148	0.03	2SC1505	0.56	74LS86	0.49	AN7151	2.05	BC212	0.10	BD231	0.45	BF197	0.14	BSS38	0.30	BYX94	0.18
1N4448	0.12	2SC1578	6.67	74LS90	0.75	AN7156	2.05	BC212B	0.23	BD232	0.44	BF198	0.15	BSTBD1409	2.48	BYY56	1.09
1N5401	0.12	2SC1617	3.35	74LS92	0.75	AN7158	2.34	BC212L	0.09	BD234	0.38	BF199	0.15	BSTBD1405	4.37	BZV15-C12	0.72
1N5402	0.13	2SC1670	2.84	74LS93	0.75	AN7218	1.49	BC212LB	0.23	BD235	0.43	BF200	0.33	BSTCD146	2.25	BZV15-C12R	0.72
1N5403	0.14	2SC1678	1.25	74LS95B	0.85	AP58076	4.25	BC213	0.09	BD236	0.45	BF216	0.32	BSTC0233	2.25	BZV15-C24	0.72
1N5404	0.15	2SC1810	1.40	7805 TO-220	0.63	AS560S	1.43	BC213L	0.09	BD237	0.38	BF218	0.32	BSTC0246	4.51	BZV15-C24R	0.72
1N5408	0.18	2SC1815	0.41	7805 TO-3	1.05	AU106	1.96	BC213LB	0.23	BD238	0.29	BF222	0.50	BSTC1233	3.91	BZV15-C30R	0.72
1N914	0.05	2SC1829	2.01	7806	0.86	AU110	1.96	BC214	0.09	BD239	0.44	BF224	0.15	BSTC3146	0.71	BZX61 Range	0.16
1S44	0.06	2SC1875	4.77	7808	0.54	AU113	2.15	BC214L	0.12	BD240	0.36	BF237	0.59	BSTCC0143	2.79	BZX70-C11	0.54
1S5012A	0.73	2SC1891	3.35	7812 TO-3	0.54	AY102	2.62	BC214LB	0.23	BD240D	0.47	BF240	0.15	BSTC0643	3.06	BZX70-C12	0.54
1S921	0.09	2SC1929	2.25	7812 TO-220	1.05	AY105K	1.89	BC225	0.24	BD241	0.45	BF241	0.15	BSV57B	2.86	BZX70-C15	0.54
2582	1.94	2SC1942	5.70	7815	0.55	AY106	1.98	BC237	0.09	BD242	0.45	BF244	0.23	BSW68	0.38	BZX70-C30	0.54
2N1302	0.24	2SC1945	4.11	7818	0.55	BA102	0.30	BC238	0.09	BD243	0.44	BF245A	0.33	BSX19	0.30	BZX70-C47	0.54
2N1303	0.34	2SC1953	1.75	7824	0.55	BA1310 (IC)	1.72	BC238A	0.11	BD243A	0.50	BF255	0.18	BSX20	0.30	BZX79 Range	0.09
2N2218	0.38	2SC1957	0.86	AC107	0.66	BA1320 (IC)	1.22	BC239B	0.08	BD244	0.44	BF256	0.25	BSX21	0.45	BZY88 Range	0.09
2N2219A	0.29	2SC1959	0.36	AC117	0.39	BA1330 (IC)	1.82	BC251A	0.15	BD244A	0.77	BF256LC	0.38	BSY52	0.45	BZY93-C12	0.99
2N2222	0.34	2SC1962	1.75	AC123K	0.39	BA145	0.17	BC252	0.12	BD245C	0.88	BF257	0.30	BSY79	0.46	BZY93-C18	0.99
2N2646	0.75	2SC1969	2.92	AC128	0.28	BA154	0.08	BC258	0.22	BD246C	0.74	BF258	0.29	BT100A	1.46	BZY93-C24	0.99
2N2904	0.32	2SC2027	2.67	AC138	0.08	BA155-01	0.12	BC261A	0.20	BD253	0.95	BF259	0.30	BT106	1.20	BZY93-C24R	0.99
2N2905	0.39	2SC2028	1.91	AC141	0.26	BA156	0.12	BC262	0.20	BD278A	0.60	BF262	0.51	BT108	1.31	BZY93-C30	0.99
2N2906	0.34	2SC2029	1.49	AC142K	0.39	BA157	0.17	BC287	0.45	BD317	1.96	BF263	0.51	BT109	1.31	BZY93-C47	0.99
2N3053	0.24	2SC2057	1.07	AC151	0.25	BA159	0.12	BC294	0.45	BD318	2.08	BF264	0.33	BT112	2.25	BZY93-C68	0.99
2N3054	0.90	2SC2073	1.40	AC153	0.30	BA182	0.17	BC301	0.36	BD375	0.38	BF271	0.30	BT113	2.25	BZY93-C7V5	0.99
2N3055	0.55	2SC2078	1.25	AC153K	0.36	BA222 (IC)	1.26	BC302	0.30	BD377	0.23	BF273	0.18	BT116	1.52	ZTK33	0.39
2N3055H	0.77	2SC2091	0.59	AC176	0.17	BA284/2	0.15	BC303	0.34	BD379	0.69	BF274	0.18	BT119	1.80	ZX18	2.47
2N3442	1.05	2SC2122A	4.65	AC176K	0.40	BA301 (IC)	0.92	BC307	0.09	BD380	0.69	BF324	0.16	BT120	1.60	C106D	0.46
2N3702	0.12	2SC2141	1.69	AC179	0.25	BA302	0.90	BC307A	0.14	BD410	0.44	BF336	0.27	BT121	2.25	C1129	0.52
2N3703	0.12	2SC2166	1.35	AC183	0.65	BA311 (IC)	1.06	BC308	0.12	BD412	5.70	BF337	0.36	BT122	2.25	CA1310E	2.45
2N3704	0.12	2SC2216	0.62	AC186	0.30	BA312 (IC)	0.98	BC308A	0.09	BD418	0.76	BF338	0.36	BT123	1.80	CA3044	3.18
2N3705	0.12	2SC2233	2.20	AC186K	0.50	BA313 (IC)	1.28	BC309	0.15	BD433	0.33	BF355	0.36	BT125	2.25	CA3046	2.23
2N3706	0.12	2SC2271	3.64	AC187	0.35	BA316	0.07	BC317A	0.11	BD434	0.39	BF362	0.54	BT126	2.25	CA3060	1.50
2N3707	0.14	2SC2278	1.03	AC187-01	0.40	BA317	0.07	BC323	0.92	BD435	0.42	BF363	0.54	BT128	2.25	CA3065	1.17
2N3711	0.14	2SC2335-KIT	7.61	AC187K	0.39	BA318	0.08	BC327	0.15	BD436	0.42	BF371	0.45	BT128P	2.79	CA3089	3.35
2N3771	1.85	2SC2526	1.70	AC188	0.33	BA328 (IC)	0.80	BC328	0.10	BD437	0.41	BF391	0.36	BT129	2.25	CA3089E	1.30
2N3772	1.55	2SC2551	0.95	AC188-01	0.40	BA333 (IC)	1.24	BC337	0.08	BD438	0.44	BF393	0.90	BT151-800R	1.47	CA3090	1.25
2N3773	1.65	2SC2570	1.80	AC188K	0.39	BA401 (IC)	0.58	BC338	0.10	BD441	1.29	BF417	1.20	BT151 500R	1.25	CA3094	2.00
2N3819	0.28	2SC2570A	0.95	AC193K	0.59	BA511 (IC)	1.98	BC360	0.30	BD442	0.56	BF418	1.70	BTT6018	2.20	CA3131EN	2.83
2N3823	1.06	2SC264A	4.38	AC194K	0.59	BA521 (IC)	1.81	BC368	0.23	BD507	0.54	BF422	0.26	BTT6218	2.20	CA3132EN	2.83
2N3904	0.56	2SC2671	1.99	AD140	0.96	BA532 (IC)	1.88	BC440	0.99	BD508	0.54	BF423	0.26	BTT8024	4.02	CAH76023N	6.00
2N3906	0.56	2SC2728	0.95	AD142	0.96	BA536 (IC)	2.72	BC441	0.40	BD509	1.29	BF435	0.49	BTT8124	4.44	CBF16848N-07	1.41
2N4101	1.10	2SC372	1.27	AD143	0.96	BA6304A (IC)	2.85	BC454	0.32	BD510	0.45	BF450	0.30	BTT8214	5.44	CD4001	0.24
2N4240	3.00	2SC373	1.05	AD145	1.45	BA843 (IC)	3.60	BC455	0.32	BD518	1.36	BF451	0.26	BTT8224	2.70	CD4002	0.24
2N4443	1.35	2SC383	1.20	AD149	0.81	BAV10	0.10	BC460	0.38	BD519	1.36	BF457	0.37	BU105	1.66	CD4008	0.96
2N4444	1.12	2SC388	0.45	AD161	0.30	BAV18	0.10	BC461	0.42	BD529	0.38	BF458	0.35	BU106	2.25	CD4011	0.23
2N4914	0.65	2SC41	1.99	AD162	0.30	BAV19	0.10	BC462	0.27	BD530	0.80	BF459	0.35	BU108	1.90	CD4012	0.24
2N5064	0.64	2SC458	0.55	AD262	0.95	BAV20	0.10	BC463	0.58	BD533	0.60	BF460	0.54	BU109S	1.90	CD4013	0.37
2N5293	0.45	2SC495	0.83	AF114	2.24	BAV21	0.17	BC464	0.58	BD534	0.36	BF469	0.27	BU110	2.52	CD4016	0.37
2N5294	0.45	2SC508	3.36	AF115	0.79	BAX12	0.10	BC465	0.58	BD535	0.44	BF470	0.28	BU111Y	3.78	CD4017	0.74
2N5296	0.40	2SC515A	1.28	AF116	0.79	BAX13	0.10	BC477	0.25	BD536	0.55	BF471	0.28	BU124	1.25	CD4020	0.92
2N5297	0.45	2SC537	0.49	AF117	0.75	BAX16	0.10	BC478	0.29	BD537	0.80	BF472	0.28	BU126	1.11	CD4021	0.24
2N5298	0.55	2SC558	3.35	AF118	0.75	BB105B	0.22	BC479	0.29	BD538	0.60	BF479	0.55	BU134S	4.15	CD4023	0.25
2N5490	1.35	2SC805L	1.05	AF121	0.50	BB119	0.15	BC532	0.25	BD544B	0.75	BF480	0.54	BU204	1.29	CD4025	0.54
2N5496	0.45	2SC820	1.32	AF124	0.36	BC107	0.13	BC546	0.15	BD580	1.06	BF495	0.58	BU205	0.98	CD4028	0.76
2N6107	0.53	2SC643A	1.40	AF125	0.36	BC107B	0.14	BC547	0.09	BD590	1.06	BF506	0.39	BU206	1.20	CD4047	0.96
2N6109	1.43	2SC673	1.11	AF126	0.36	BC108	0.12	BC548	0.09	BD598	1.13	BF509	0.37	BU207	1.50	CD4049	0.52
2N6122	1.80	2SC681	4.00	AF127	0.36	BC108A	0.12	BC549	0.09	BD645	3.62	BF523	0.18	BU208	0.98	CD4050	0.50
2N6130	0.65	2SC684	1.50	AF139	0.48	BC108B	0.15	BC550	0.36	BD677	0.55	BF594	0.24	BU208/02	0.98	CD4052	0.88
2N6133	0.57	2SC685A	2.62	AF178	0.75	BC109	0.11	BC556	0.12	BD680	0.69	BF595	0.24	BU208A	0.98	CD4053	0.72
2N6178	0.66	2SC693	0.69	AF179	0.50	BC109B	0.13	BC557	0.09	BD681	1.34	BF596	0.16	BU208D	1.43	CD4069	0.23
2N6180	0.66	2SC710	0.62	AF180	0.50	BC113	0.12	BC558	0.09	BD695	2.09	BF597	0.24	BU209	1.80	CD4081	0.26
2N696	0.39	2SC717	1.92	AF181	0.48	BC114	0.17	BC559	0.09	BD696	2.24	BF617	0.95	BU226	2.08	CD4093	0.72
2N698	0.39	2SC734	1.30	AF182	0.50	BC115	0.14	BC560C	0.10	BD697	3.27	BF618	0.95	BU312	2.16	CD4511	1.00
2N707	0.39	2SC735	1.05	AF186	0.48	BC116	0.20	BC635	0.18	BD698	1.68	BF694	0.20	BU326	0.75	CD4517	1.06
2SA1027	1.15	2SC782	2.24	AF239	0.48	BC116A	0.53	BC636	0.18	BD699	3.17	BF757	0.59	BU326A	1.40	CP5521	16.20
2SA1076	1.78	2SC790	1.15	AF279	0.80	BC117	0.18	BC637	0.18	BD700	3.36	BF758	0.59	BU326S	2.25	CV-12E	2.49
2SA329	0.36	2SC806	10.26	AL100	3.66	BC118	0.18	BC638	0.18	BD702	2.94	BF759	0.30	BU406	1.35	CX034	10.75
2SA351	1.06	2SC814	1.26	AL102	1.75	BC119	0.30	BC639	0.18	BD707	0.55	BF780	0.59	BU407	0.74	CX095D	2.85
2SA489	1.06	2SC828	0.25	AL103	2.43	BC125	0.18	BC640	0.18	BD709	0.72	BF762	0.30	BU407D	1.29	CX104	8.49
2SA490	1.51	2SC867A	2.49	AL113	1.80	BC126	0.18	BC879	0.28	BD710	0.72	BF870	0.27	BU412	4.80	CX108	6.92
2SA493	0.95	2SC926A	1.29	AN208	3.22	BC132	0.12	BC880	0.28	BD807	0.60	BF871	0.84	BU426	1.95	CX109	6.92
2SA628	1.03	2SC930	0.49	AN210	2.07	BC135	0.12	BCX32	0.33	BD809	0.60	BF900	0.68	BU426A	1.67	CX121	10.75
2SA637	1.32	2SC935	3.75	AN214	2.05	BC136	0.15	BCX33	0.24	BD810	0.60	BF907	1.62	BU427	2.67	CX130	4.90
2SA673	1.11	2SC936	1.58	AN214Q	2.05	BC137	0.16	BCX34	0.36	BD879	0.64	BF959	0.38	BU500	1.61	CX131	10.75
2SA683	1.46	2SC937	3.25	AN231	5.56	BC138	0.30	BCX37	0.60	BD880	0.65	BF970	0.55	BU508A	1.33	CX134	10.75
2SA684	1.33	2SC940	4.25	AN234	5.02	BC139	0.32	BCY70	0.27	BD895	1.98	BFR39	0.36	BU526	1.65	CX136	10.75
2SA748	0.60	2SD1138	0.78	AN235	4.84	BC140	0.33	BCY71	0.19	BD899	2.25	BFR52	0.45	BU608D	1.42	CX137	10.75
2SA818	1.65	2SD198	3.51	AN236	3.02	BC141	0.28	BCY72	0.18	BD901	0.55	BFR62	0.36	BU806	1.29	CX139	10.75
2SA835	2.27	2SD234	0.42	AN238	4.98	BC142	0.30	BD115	0.29	BDV64B	1.14	BFR79	0.29	BU806D	1.35	CX157	4.40
2SA940	1.64	2SD235	0.54	AN239	3.95	BC143	0.28	BD116	0.63	BDV65B	1.14	BFR81	0.45	BU807	1.40	CX158	3.44
2SA951	1.23	2SD257	2.67	AN240P	1.60	BC147	0.10	BD124	1.19	BDX32	1.50	BFR86	0.98	BU826A	2.79	CX170	6.92
2SA966-Y	0.54	2SD291	2.67	AN241	1.55	BC147A	0.42	BD124P +KIT	0.62	BDX53	0.80	BFR89	0.39	BUV46	1.13	CX177	5.99
2SB325	3.51	2SD292	2.35	AN245	2.54	BC148	0.11	BD131	0.38	BDX53A	3.08	BFT41	0.27	BUV84	1.12	CX506	8.48
2SB337	1.65	2SD313	2.59	AN247P	2.62	BC148B	0.11	BD132	0.38	BDX54B	2.37	BFT42	0.39	BUN81A	3.15	CX507	6.92
2SB375	3.51	2SD315	2.67	AN252	2.33	BC148C	0.11	BD133	0.48	BDX62A	1.92	BFT43	0.39	BUN84	1.56	CX758	6.92
2SB400	0.36	2SD325D	1.36	AN253	2.70	BC149	0.10	BD135	0.32	BDX63A	1.95	BFT84	0.36	BUX84	1.47	D1693	2.35
2SB407	2.94	2SD350	7.03	AN262	1.58	BC149B	0.11	BD136	0.32	BDX64A	2.37	BFW10	0.79	BY126	0.11	DEC1	1.52
2SB411	3.80	2SD350A	2.08	AN272	5.36	BC153	0.12	BD137	0.32	BDX65A	2.37	BFX29	0.30	BY127	0.11	DEC2	1.52
2SB511	1.48	2SD353	3.25	AN281	5.52	BC154	0.12	BD138	0.41	BDX76	0.53	BFX30	0.59	BY133	0.11	E1222	0.36
2SB54	1.26	2SD389	2.19	AN295	5.01	BC157	0.14	BD139	0.27	BDY20	1.10	BFX84	0.33	BY164	0.50	E5024	0.25
2SB56	1.26	2SD401	1.57	AN301	3.30	BC158	0.09	BD140	0.33	BDY62/01	4.20	BFX85	0.25	BY176	1.38	E5386	0.22
2SB618A	1.40	2SD551	2.20	AN302	3.62	BC159	0.14	BD144	1.30	BDY81	1.07	BFX87	0.50	BY179	1.42	E5529	0.22
2SB681	2.44	2SD588A	1.25	AN303	3.25	BC160	0.36	BD150	1.08	BF115	0.36	BFX88	0.30	BY182	0.95	E8021	1.17
2SB695	1.70	2SD621	8.88	AN305	8.07	BC161	0.36	BD157	0.60	BF117	0.36	BFX89	0.36	BY184	0.42	E9003	0.41
2SB75	0.94	2SD657	2.54	AN313	3.10	BC167	0.32	BD159	0.48	BF118	0.60	BFY50	0.24	BY187	0.70	E9005	0.45
2SB861	0.88	2SD731	1.72	AN315	2.12	BC168	0.32	BD160	1.45	BF121	0.22	BFY51	0.24	BY189	1.20	ER1400	10.12
2SC1034	5.81	2SD811	3.86	AN316	5.58	BC169C	0.14	BD163	0.64	BF123	0.11	BFY52	0.24	BY198	2.38	ESN310BP	3.86
2SC1050	3.86	2SD869	2.40	AN318	4.75	BC170	0.14	BD165	0.56	BF127	0.11	BFY90	0.96	BY201/2	1.36	ESM432C	4.18

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Long-distance Television

Roger Bunney

This year's Sporadic E season was late in starting though there's been much exotic reception to compensate. There's a lot of news, so we'll give the log without further ado.

10/5/84 RTP (Portugal) ch. E2; TVE (Spain) E2, 3.
11/5/84 TSS (USSR) R1, 2.
14/5/84 SR (Sweden) E2; TVE E3; EPT (Greece) E3.
15/5/84 RAI (Italy) IA.
16/5/84 RTP E3; TVE E2, 3, 4.
17/5/84 TSS R1, 2; RTP E3; TVE E3.
18/5/84 TSS R1; TVE E3; EPT E3.
19/5/84 TSS R1, 2; TVP (Poland) R1, 2; CST (Czechoslovakia) R1; TVE E2, 3; RAI IA; ARD (W. Germany) E2.
20/5/84 TVE E2, 3.
21/5/84 SR E2, 3, 4; EPT E3.
22/5/84 TSS R1, 2, 3, 4; RAI IA, B; SR E2.
23/5/84 TSS R1, 2; TVP R1, 2; CST R1, 2; TVR (Rumania) R2; MTV (Hungary) R1, 2; RAI IA, B; RTP E3; +PTT (Switzerland) E2; TVE E2, 3, 4. Two Arabic signals were present from 1734-1800 BST on ch. E3, JTV (Jordan) Amman and the other unidentified. F.M. radio reached a m.u.f. of 100MHz.
24/5/84 TSS R1, 2; RAI IA, B; TVE E2, 3, 4; ORF (Austria) E2a; JRT (Yugoslavia) E3, 4; IRIB (Iran) E2 at 0920-0930 BST.
25/5/84 TSS R1, 2; CST R1; MTV R1; RAI IA; RTP E2, 3; TVE E2, 4; JRT E3.
26/5/84 TSS R1, 2; ORF E2a; +PTT E2; SR E2.
27/5/84 SR E3; YLE (Finland) E3.
28/5/84 TVE E2, 3, 4; RTP E3; RAI IA; +PTT E2; ORF E2a; CST R1; ARD E2; TSS R1, 2; TVP R1.
29/5/84 NRK (Norway) E2.
30/5/84 RUV (Iceland) E3, 4; NRK E2; RAI IA, B.
31/5/84 TVE E2, 4; RTP E2, 3; RAI IA; MTV R1.
1/6/84 TVE E3.
2/6/84 TVE E2, 3, 4.
3/6/84 TSS R1, 2.
4/6/84 RTP E2.
5/6/84 MTV R1.

Modes of propagation other than SpE remained generally quiet during the period. The solar disturbances towards the end of the month didn't lead to any sustained auroral activity unfortunately, at least not here in the south, and none has been reported from elsewhere.

Perhaps the most startling reception occurred on the 24th, when both Ray Davies (Norwich) and Cyril Willis (Cambridge) received the FUBK test card from Iran, with the identification "IRIB" and a digital clock insert at the bottom right-hand corner, via multiple-hop SpE. The clock was at +3½ hours BST: the signal was weak and slow fading, resembling tropospheric propagation. A quite remarkable and first achievement in the UK – our congratulations to the pair.

EPT Greece was received on three occasions by Hugh Cocks and Cyril Willis. The EBU lists Akarnaika (ERT-1 network) on ch. E3, with 1·58kW e.r.p. and horizontal polarization (20E59, 38N49). The PM5544 test pattern is used, with the EPT identification clearly visible.

May 23rd produced several sitings of Arab transmitters, with two stations floating between 1734-1800.

An increasing number of computer interference reports have been received and further information on suppression methods is being sought. Radio amateurs have been noted at 50MHz twice during normal 405-line broadcast hours – such operation is supposed to be confined to non-broadcast hours until January 1985.

During the afternoon of May 20th Cyril Willis logged a French system L, ch.2 (just l.f. of ch. E4) signal via SpE. This suggests that the Canal Plus service will be operational in Band I from Corsica.

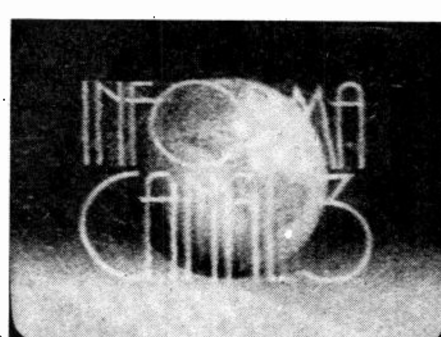
My thanks to Iain Menzies (Aberdeen), Hugh Cocks (E. Sussex), Cyril Willis (Cambridge), Paul Barton (Harrogate) and Brian Renforth (Newcastle) for sending in details of their reception to supplement my own log.

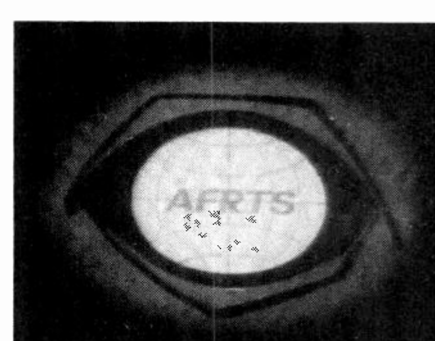
Nova TV

Following our request for information on Nova TV in the Dublin area, Peter Coghlan has written in with details. Test transmissions started on December 3rd on chs. E60 and E66, using system I with full specification PAL colour. The ch. E66 signal was transmitted from the studio in Herebert St., Dublin at 25W e.r.p. and was received and re-radiated at 100W from Three Rock Mountain. The test pattern consisted of colour bars with a central white band and the identification "NTV ch. 60/66". Programmes consisted of news, information and films. The equipment was seized on December 8th. Following this the Radio Nova v.h.f./f.m. radio programme was jammed, though transmissions continue at 102·7MHz (stereo) and 819kHz. Radio Nova can be contacted at PO Box 1433, Dublin 1 (telephone 01-931 710).

News Items

Faroe Islands: Ryn Muntjewerff reports that the following transmitters are now carrying out tests: Torshavn ch. E6 116-145kW directional, Sudbury ch. E9 5·6kW, plus one





Left and centre, two examples of DX-TV reception in the Falkland Islands – Argentina ch. A2 La Plata and A3 Rosario respectively. Right, the American Forces identification slide, received on ch. E70 by Ryn Muntjewerff.

700W ch. E10 relay. This could be an ideal source of Band III signals via aurora. The PM5544 test pattern carries the identification "SJONVARP FOROYA".

Private TV: A "private" TV service operated by a local newspaper is in operation at Vaesteraas, Sweden. Another private TV service is expected to start in Lower Saxony, W. Germany, in mid-1985.

In brief: RUV (Iceland) now transmits programmes on Thursdays ... SR-TV (Sweden) is using the PM5534 pattern with either TV1 or TV2 identification and no regional/transmitter identification.

Satellites: The Australian Homestead/ABC TV downlink service is due to start at the end of next year, using the PAL standard ... Hungary plans to establish a satellite TV receiving equipment manufacturing capability to exploit reception of neighbouring countries' TV services ... The discussions over alternative proposals for a Luxembourg satellite TV service continue.

Computer Interference

The problem of interference due to computers seems to be increasing rapidly. I've found that some Sinclair Spectrum computers radiate over 200ft. My own unit produces severe radiation which is very difficult to reduce. Experiments with a double ferrite toroid (two FX1588 units) and densely screened coaxial cable wound ten times around and through the toroids adjacent to the Spectrum's r.f. output reduced the problem only slightly. Toroids can also be used on the mains lead, but the main problem seems to be the plastic case. Removal of the cassette leads has no effect and advice from Sinclair is being sought.

Further problems have been caused by a neighbour who's started a part-time word processing operation using a Commodore VDU, keyboard, disc drives, printer etc. This produces an effect similar to short-wave overloading in a badly designed preamplifier. The interference is not as intense as that from the Spectrum (the equipment is metal cased) and the use of toroids provides a solution. A mains distribution extension box with filtering (see Fig. 1) has been provided to ensure that the r.f. doesn't flow into the immediate house wiring. The coil around the toroids consists of single-core PVC covered lead, though three-strand lead would suffice. I was fortunate in acquiring a short length of screened mains three-core.

The increasing use of cheap home computers is going to make matters worse and we'd welcome comments from readers with experience in dealing with the problem. Incidentally, the British Telecom Radio Interference Service is in the process of being transferred to the Department of Trade and Industry. I've heard that problems at v.h.f. in the Bournemouth/Poole area are being caused by r.f. heating in a biscuit factory that operates 24 hours a day.

The Future of Bands I/III

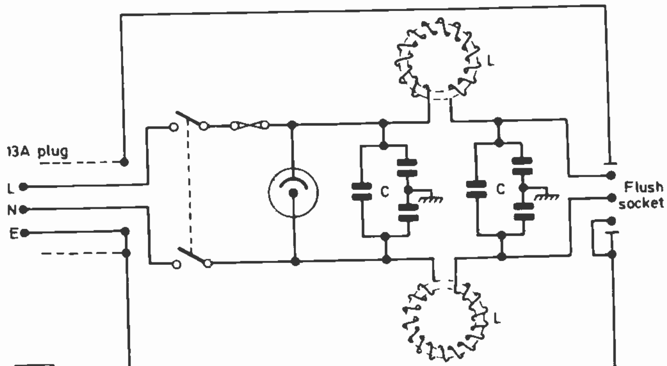
The DTI have released a study document entitled "Bands I and III" (Cmnd 9241) which is available from HMSO at £4·15. The document outlines various uses, systems and possibilities and it must be said that things look tough for the TV-DXer in the UK.

What could become a serious problem is the suggestion of frequency allocations for "low-power devices" – the plan is to exempt a range of such devices from the need for a transmitting licence or special permission. The paper comments that "many of these devices operate at 49MHz and it would seem appropriate to set aside a small band to be used with a minimum of restriction ..." – the vast number of 49MHz devices outlawed by the Telecoms Bill could become legal overnight. The possibility of land mobile operation in Band I is recognised and comments from the PMR industry are awaited.

The DTI has proposed that the 173·2-173·35MHz band is made available for wideband low-power alarms in addition to low-power telemetry/telecontrol.

From our Correspondents ...

Mel Thurlbourn (Leighton Buzzard) has sent us some excellent photographs he took whilst at Port Stanley – DX-TV Falkland Islands style. Whilst in the area he met Mike Peake who's had considerable success there over several years. Apart from stations in Argentina he's



D924

Fig. 1: Simple mains filter. Suitable ferrite toroids (FX1588 etc.) are available from Bredhurst Electronics, High Street, Handcross, W. Sussex RH17 6BW at 40p plus postage. Wind on ten turns of PVC covered wire. C = RS238-299 suppressor capacitor pack. An RS509-995 diecast box was used.

received Cuiaba ch. A2 (system M) in central Brazil and Santiago (Chile). Another distant reception was Rosario in central Argentina. Transequatorial skip reception of system M signals has been seen but identification is impossible.

Commercial Corner

M. Barson informs us that reinforced polyester masts are available from Met Antennas, 12 Kingsdown Road, St. Margarets at Cliffs, Dover CT15 6AZ (telephone 0304 853021). These enable optimum performance to be obtained from aerials (especially if vertically mounted) that would be affected by the use of a metal mast. A 1·5m or double 1·5m kit is available with 1·5in diameter.

Allan Latham (G8CMQ) can supply ATV converters for 23/24cm (1·3GHz) in either kit, partial or wholly assembled form, also u.h.f. f.m. receivers (i.e. video f.m.) and a low-power 23/24cm source for test/alignment purposes (though a four-mile range has been attained). For further information send s.a.e. to Solent Scientific, 75 Chalk Hill, Southampton (telephone 0703 464 675).

Transmitter Information

Belgium: Brussels-RAC BRT-2 ch. E25 10kW e.r.p. horizontal. Wavre chs. E25/28 now listed as taken out of service.
Egypt: The transmitting authority is now known as the Egyptian Radio and Television Union (ERTU). The first service is being transmitted on ch. E4 and the second service on ch. E2 from Dumyat at 0·9kW.
Switzerland: The sound e.r.p. for all transmitters is now 5 per cent of the vision e.r.p. (formally 10 per cent).

TV Fault Mechanisms

Tony Thompson

Despite the apparently endless variety of the faults we encounter in TV sets their basic causes are few in number, consisting of weak spots in circuit design, poor physical construction and layout, the use of unsuitable components, and inadequate quality control during all or some stages of manufacture. Added to this there's the problem of adverse operating conditions, also the use of poor repair methods.

Basic Design Problems

Let's consider these in practical terms. There's inevitably an element of compromise in circuit design. Often it's the availability of certain key components that dictates the final form the circuitry takes. The average viewer sees nothing of the latest i.c.s etc. buried deep within his set, but can't fail to be impressed by the latest tuning systems with digital displays and so on. Appearance and price are key factors in selling sets, and styling is arguably the most important aspect of the design brief.

There's nothing new about this. The demands of styling seem on occasion to have called for technology to fit – as with the case of wide-angle deflection tubes to reduce cabinet depth. The situation in the industry in the early sixties was so bad that many companies, in desperate bids to remain in the field, cut production costs and technical quality while placing the emphasis on appearance. Reliability and accessibility both suffered. Many of these sets were troublesome from the time they were installed – tuning the biscuit cores on an awkwardly placed fireball tuner was a matter of hit and miss (and watch out for the mains switch with your hand in the back!). But the sets looked good and sold in millions, creating a boom that was equalled only when colour became popular in the early seventies.

The latest solid-state designs with their low component counts make it easier to reconcile such contradictory factors as those mentioned. It's no longer necessary to try to cram a quart into a pint pot. In fact a glance in most new sets will reveal that the situation is quite different. The crowded days have gone forever, and because of this and advances in the technology used reliability has increased in leaps and bounds.

There remains however a vast quantity of middling sets that though reliable in any sensible interpretation of the term were built at a time when chassis were more massive, more delicate and consumed more power. It is these that are likely to fail, simply because the design problems at the time of their manufacture didn't allow for maximum reliability over an extended lifetime. Some manufacturers regarded the average lifetime as about five years – this for an average colour set of the early seventies! Most such sets are still running, but few reliably. It's usually the critical components that give up, apparently suddenly.

Mechanical Considerations

Take mains droppers. Like all resistors they function by dissipating power in the form of heat. A dropper dissipates a considerable amount of energy and gets very hot as it does so. It follows that they should be sufficiently substantial to do the job asked of them and that they should be mounted where air can circulate freely to carry away the heat. In addition they shouldn't be sited in areas likely to be affected by this heat. If on a board they should be mounted well above the surface. The lifetime of most electronic components is reduced by the presence of high ambient temperatures.

Remember too that the connections to such high-power resistors are likely to become hot due to thermal conduction. Dry-joints are likely unless some provision is made for this. In the past some manufacturers advocated the use of high-temperature solder alloy, but this was inconvenient for field servicing. Most cheap irons had to struggle to melt the stuff, with the result that normal solder and hefty wire wrapping came to be adapted – which is o.k. for loom-connected droppers. The body of the dropper must of course be of a high-grade insulating and heat-resisting material. Fortunately the ideal material exists – ceramic!

Large electrolytic capacitors should be mounted either by means of a stout metal fixing such as a clip to a chassis member or, for economy, directly into the board with extensions from the outer casing soldered firmly into earthed print areas for support. It's undoubtedly wrong to mount such components upright, i.e. with the tags down, as electrolyte can leak and cause damage, possibly quite extensive. Similarly they should not be mounted in hot spots or above the dropper.

For reasons basically the same as those given for electrolytics, careful thought about the placing of transformers is necessary. They should not be mounted on panels without support, especially in the case of a vertical panel, or their weight will strain the soldered joints and lead to cracked print, arcing at the tags and intermittent operation.

The placing of triplers seems on the face of things a simple matter. Keep them well clear of the chassis metalwork by means of high-grade plastic stand-offs, and make sure that there's a hazard-free path for the lead to the tube's anode cavity.

Most of the foregoing is common sense, but it's amazing how many sets can be found in which one or more of these guidelines have been ignored.

Poor performance due to such mechanical problems is commonplace in most makes of receiver, but some models seem to have more than their fair share. It would appear that manufacturers are sometimes slow to learn from their mistakes. Take valveholders for example. Charred panels and poor or corroded pin contact often occur with output valves, resulting on occasion in the issue of modified panels with stand-off holders. Why were they not fitted in the first place? Possibly because the man who designed the panel didn't know where it would be mounted in the set. All right, it's easy to be wise with hindsight. But these people were not new to the game. Valveholders in monochrome sets had been giving similar trouble for many years.

Again, what looks elegant in the scaled up panel drawings becomes dangerously thin print tracks on the finished board. Much trouble was and still is caused by panel flexing with heat/cold cycles, as a result of which the flimsy print goes intermittent.

Valves have a tendency to develop electrode sag when horizontally mounted, but in practice only the less robust types suffer from this malady. These of course were the frame grid types with their ultra-close electrode spacing. I have a suspicion however that the heaters of power valves are more likely to go open-circuit when the valve is not vertically mounted, possibly due to heater-cathode shorts in situations where the cathode is at a high potential.

Practical Example

It's interesting to take a particular well known chassis from the past and consider the design/reliability aspects. We'll take the Thorn 1500, a popular single-standard monochrome chassis that was produced in vast numbers over several years and was the mainstay of many a rental company on the monochrome front.

First impressions are a little mixed, though there's a good spot for the dropper – horizontally mounted along the top rear edge of the vertical, single-panel chassis. Couldn't be better for heat dissipation. Being horizontal, the heat from a lower section can't affect the higher sections. The dropper is linked to the print by long, slender tags – sufficiently long to limit heat transfer, so few problems at the board joints.

The big panel has plenty of metal support. Being vertical, the few valves are of necessity mounted horizontally. Accessibility is good and the valves are in an updraught. The main electrolytic is also mounted horizontally: it's purpose designed for this, being a short, stubby type with substantial mounting lugs. This minimises leverage on the panel, and in practice few dry-joints develop at the capacitor's leadouts even with sets that have seen a lot of service.

One snag we've often had with this chassis is poor valve-to-holder contact. The holders seem to be inadequate for the job and are best replaced if trouble persists.

If all is well with the electrolytic, it certainly isn't with the field output transformer. The slender tags take the weight, with the result that dry-joints giving intermittent field collapse are quite common. Additional support should have been provided at this point.

Lastly, quite a reliable four-button manual tuner is made a nuisance by the fact that the spring-loaded bar used to rotate the tuner vanes is crudely soft-soldered into retaining forks and, as there's no damping during channel changing, the physical blow it receives practically guarantees fractured joints and the sudden loss of one or more of the preset channels. We resolder to repair – until the next time.

The foregoing should not be taken as condemnation of the 1500. It was and still is a successful design of its type, easy to work on and predictable in its fault patterns. There's evidence of compromise, but no more so than in any other set – if you look. It seems then that the designers managed to balance the requirements of their brief with medium-term reliability and cost. But even if you get everything right mechanically, there will still be the occasional electronic component failure. Let's take a look at the problems that arise with different types of components.

Resistors

Resistors fail by going open-circuit (permanently or intermittently) or by changing value. Burn-ups occur most often with low to medium values, usually resulting in reduced resistance. The process may be slow initially therefore but the effect will gather pace, and will begin to affect other components, perhaps loading a power transistor or valve. Resistors in such locations often show evidence of distress in the form of discolouration – sometimes to the point where their value is no longer readable. The component may disintegrate on being removed from the panel. The inference is that the rating was adequate in the short term but not in the long.

Wirewound resistors rarely change value – though this is not totally unknown. The main malady affecting this type of resistor is of course dry-joints, especially when they are of the printed circuit type with short, rigid leadouts so that the component has to be mounted close to the soldered joint. The link on the fusible type often becomes brittle.

Resistors that are subject to high voltages lead a hard life, especially if they suffer from spiky transients or have a high potential difference across them. This is why many megohm value resistors go open-circuit with no external sign of distress – though the types used in early focus chain circuits, for example those in Autovox sets, are often found with a neat, circular burn mark right around their bodies. Many sets use special high-voltage resistors in such applications: you can spot them by looking for the spiral track.

Presets give trouble in several ways, not least of which is intermittency due to a gradual loss of springyness in the slider construction. Most seem to be not robustly enough made. Convergence potentiometers on the other hand are generally well made, failure being more often due to poor circuit design. Carbon track rotary or slider type controls often give trouble in solid-state circuitry. The reasons for this seem to be twofold. First the values used are often smaller than the values used in the equivalent valve circuitry, so that the component is more likely to add its own noise as the slider is shifted along the track. Secondly, in order to obtain adequate coupling under low-impedance conditions the designer usually employs electrolytics which by their nature tend to have slight leakage currents, causing a current flow through the potentiometer. This produces an audible rustling as the slider is adjusted, so if you've just changed a noisy potentiometer and not cured the problem, check the coupling components.

Capacitors

Capacitors of the electrolytic type seem to have a limited life, often drying up and going down to a fraction of their original value or going short- or open-circuit. Paper or mixed-dielectric types, usually used in medium to high voltage positions such as for mains and boost line filtering, often short out in a very definite way. If you can't see it from the outside, dismantling the faulty capacitor will show a hole punched through the tubular layers of foil and dielectric. The reason for the failure is often that the component rating is too tight, i.e. boost capacitors rated at 600V when at least 1kV should have been chosen. Capacitors used for line output stage harmonic tuning should be above reproach. When they fail the result can be a dramatic rise in the e.h.t. voltage. If they've gone open-circuit that is: shorted ones cause fires . . .

Working Environment

Atmospheric conditions affect sets considerably. Dampness in particular causes tracking around the tube's e.h.t. cavity connection and "spray" from sharp points on line output transformers, c.r.t. bases and other high potential areas. In some sets this can lead to violent discharges that deal death blows to vulnerable components that are, due to lack of foresight by the designer, within range. This is not to mention the hapless service engineer's feelings when confronted with such a set. I well remember some of Les's comments on a Rank Z718 chassis where there was a truly spectacular e.h.t. flashover, apparently causing a vast area of air between the cavity connector and the power supply panel to ionise. You're not alone Les: I've also been practically blinded by the same problem, and the cost of the repairs to the power supply and decoder panels didn't exactly please the customer.

High-frequency coronal discharge can damage components such as tuning capacitors that may be mounted on the transformer's tags, but it's my belief that far worse damage is done by the e.h.t. potential developed after rectification. It can puncture the tripler itself, flash through wrongly dressed leads and cause a blaze, or track from the cavity connection across the glass to the Aquadag coating so severely that not only is the e.h.t. cap damaged but the tube glass can become badly scarred, rendering the tube unusable. The remedy is to clean and dry the area thoroughly, fit new anti-discharge capacitors that have a high air-spaced construction, and treat the area with silicone grease. Coronal areas on the transformer can be treated with grease too, or use a sealant. Don't forget to position the e.h.t. lead with care, using any plastic locating clips to keep it firmly out of harm's way. The same comment applies to other wiring looms, especially any that might swing near the tripler or line output transformer, or the dropper units.

I've said it before, but it gives me the creeps to see top-heavy vases of flowers adorning set tops. Educate the customer if you can.

Then there's the tendency of some folk to put the set into a space that just fits it, such as a niche alongside a custom-built fireplace. This, and where curtains muffle the back of the set, restricts the natural flow of air, producing a heat build up. The life of any component or even the entire set can be shortened by this – design tolerances can be only so wide.

Sets used in smokey atmospheres, such as in pubs and clubs, get gummed up, but the only real problem that this causes is where sets have touch tuning or remote control – the tarry build up may interfere with the action.

Semiconductor Devices

Diodes used for power rectification may be found mounted hard against a panel – in fact some types of diode packaging allow for this. I contend that it's wrong: the component is sure to warm up in operation and should be allowed to breathe.

Hot spots can cause failure. Transistors are often sat on a panel, soldered firmly in place with a substantial heatsink attached. This is typical with a group of RGB output transistors. The design has allowed for heating with the heatsink, but it seems that nobody has considered that the leadout/casing joints could become strained and intermittent. Such transistors should be mounted a little way above the panel to allow the wires a little flexibility and prevent any heating of the soldered panel joints leading to dry-jointed connections.

Fairly substantial components such as thyristors will often be found fixed in such a way that their only support is the soldering on their leads. Add heatsinks and you've got potential trouble. In the main however designers seem to have given thought to such components and other than natural failures little trouble of an avoidable type is experienced.

Hints and Tips

When it comes to replacing components such as resistors, transistors and diodes in vulnerable positions, leave a little space between the component and the panel. Where there's a considerable voltage difference across a resistor supplying a valve screen grid or in a boost line it doesn't hurt to increase the rating a little – say from ½W to 1W – though the manufacturer's specifications should be observed when it comes to safety rated components.

Make sure you refit heatsinks – manufacturers don't fit anything that's not needed! It's worth checking the tightness of fuseholders in older sets, or where adverse conditions have turned all the normally bright bits such as preset sliders a dull browny yellow. On/off switches are often responsible for intermittency or the dead set condition: if they don't feel right they're best changed. Badly fitting mains plugs and loose wiring in them can cause faults that damage power supply components – it's always worth a quick look. E.H.T. settings are often incorrect and should be checked to ensure reliability – even a slight increase in the h.t. voltage can affect the life of a set and its tube.

Finally, many faults don't just happen – they spend years developing. But with the improved design of present day sets it's likely that an ever larger percentage of our future service calls will be to deal with problems of a mechanical rather than an electrical nature, such as broken knobs and switches, damaged panel mountings, intermittent aerial sockets and the like. I wonder what the field engineer's toolbox will contain in ten years' time?!

Letters

SHARP VC7300

A problem with the Sharp Model VC7300 was mentioned in the March VCR Clinic. I've had experience of this fault and would suggest that lubrication of the main solenoid plunger will not provide a permanent cure. The cause of the trouble is side tension on the plunger due to the length of the cotter pin, making the plunger jam in the solenoid cylinder. The fault is intermittent and can be dealt with as shown in Fig. 1. Remove the spring and refit it directly in line with the solenoid plunger – a hook can be made by cutting off a lead from an old 10W resistor, doubling it over to form a loop and pushing the ends into the split cotter pin. Hook the other end of the spring into the fast forward/rewind solenoid.

Bob Jones,
Perth, Western Australia.

BATTERY ELIMINATOR FOR THE AVO 8

Though RS Components now have available a 15V battery for the AVO Model 8 an alternative solution is this simple battery eliminator which can easily be fitted. The circuit is shown in Fig. 2. It can be built on Vero board and mounted between the shunt boards. The 15V outputs and the inverter positive are wired to the battery contact studs while the inverter negative connection is made to switch contact N on the d.c. ranges switch cam. The lead from switch contact N goes to a pin marked D on the shunt board.

Les Harris,
Church, Accrington, Lancs.

TUNING TROUBLES

When a Philips G8 tuner push-button unit becomes "rather fiddly to tune" (Tony Thompson, June) a common cause is rotary backlash between the potentiometer spindle and its small plastic bevel wheel, whose boss splays and cracks. In advanced cases tuning becomes impossible, but even then there's an effective and simple remedy. A 6BA nut, drilled and tapped 4BA, is of suitable size to serve as a collar that can be forced over the splayed boss, making it grip the spindle flats firmly ever after. Getting at these little black bevels may seem to be a daunting puzzle, but they give in to a logical attack. Note precisely how the metal bracket comes away, to save time and temper later, and watch the Y-shaped switch blades which are easily lost.

Elderly GEC 2040 mechanical tuners are prone to two common faults that are also curable by simple means. If a depressed push-button can be shaken sideways far enough to disturb the tuning, this is due to wear of the spindle hole in the rear plate which is detachable (two screws) without removing the tuner. A few well aimed centre punch indentations will deform one side of the hole inwards, and careful trimming with a round file can restore the hole to a close, freely sliding fit – best kept that way by greasing the spindle.

If the frictional grip of the tuning nut on its screw becomes slack the result is annoying, inadvertent detuning when switching channels. The friction can be increased by fitting a spring collar to compress the nut. To take out the spindle, detach the rear plate, the front plate (four screws), the small circlip, washer, spring and spacer – but leave the nut on the screw. This resilient plastic "nut" is basically of C-shaped section, with a projecting boss of approximately 5/16in. diameter, over which a spring collar can be fitted. The latter can be made from a single-coil spring washer (nominal ¼in. bolt size) by grinding away about a quarter of its circumference so that its gap passes over the screw. The boss, being rounded and tapered, may tend to throw off the collar, but a few strokes with a file to make a reverse taper undercut will make the boss retain it. The spring collar can be bent by trial and error until the degree of frictional grip is satisfactory. During reassembly, fifth and sixth buttons can easily be added if desired, taking spindles from a scrapped tuner. The extra holes are easy to cut in the cabinet trim.

L. A. C. Dopping-Hepenstal,
Ampthill, Beds.

BASEBAND LINKS

There was mention last month of signal degradation due to PAL encoding/decoding and the use of a u.h.f. link between a TV set and equipment such as computers, games and VCRs.

When the signal is locally generated in RGB form I agree that baseband links have much to recommend them – for data and graphics involving colour the use of PAL

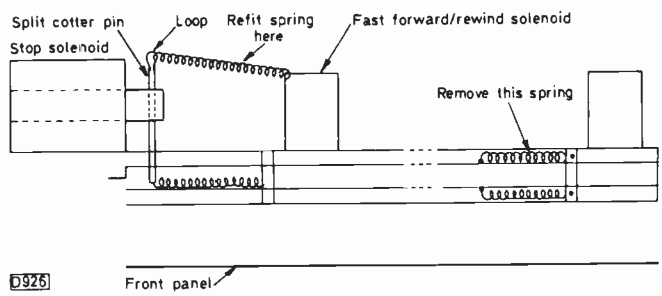


Fig. 1: Suggested modification to the Sharp VC7300.

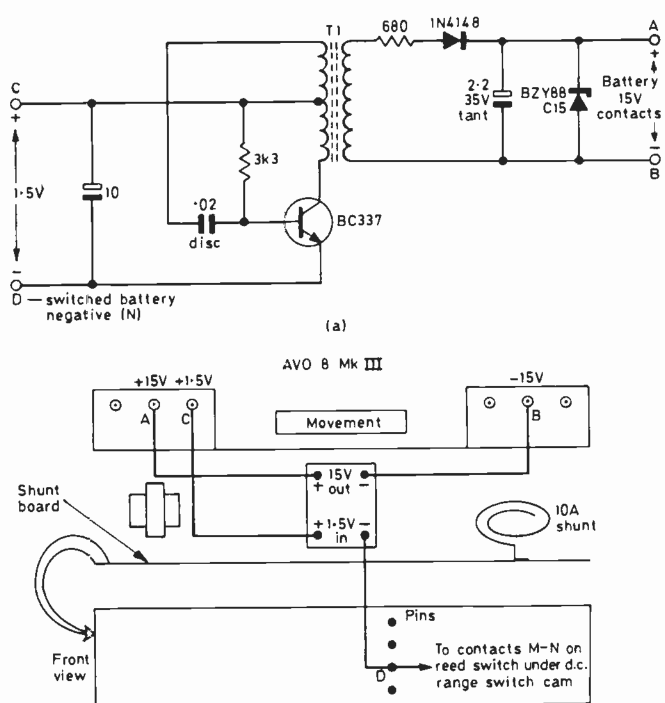


Fig. 2: Battery eliminator for the AVO Model 8. T1 is an audio driver transformer from a Japanese transistor radio.

coding and decoding is little short of disastrous. In the case of VCRs and video disc players however the signal is already PAL coded, in most cases with bandwidth limiting, i.e. 2·5MHz luminance and less than 500kHz chrominance. In this case baseband linkage is of very little advantage, especially in view of the spaghetti web of wires involved, and the tremendous problems encountered (with some TV/VCR combinations) by setmakers and the retail trade due to "bleed" of the audio signal from the TV receiver into the VCR's sound recording system.

Regarding modulator performance, I've yet to encounter any drift in VCR u.h.f. modulators, even with sets (like Finlux) that have synthesis tuning without a.f.c. In my experience a correctly adjusted modulator will on any make of VCR give pictures and sound that are indistinguishable from off-air transmissions, even in an A-B comparison test. Save your leads and AV/RGB sockets for computers and MAC-C satellite tuners.

E. Trundle,
St. Leonards on Sea, Sussex.

Servicing the Grundig 2×4 Super

Part 2

Mike Phelan

This time we'll take a look at the signal sections of the machine – where better to start than at the aerial?

HF Sections

The aerial amplifier/splitter and r.f. modulator are combined in one unit and any suggestion of a snowy picture in the E-E mode and/or with loop-through throws suspicion on this (we'll refer to it simply as the modulator). If E-E operation only is noisy, connect the aerial directly to the tuner through a suitable adaptor as the tuner could be faulty.

Before condemning the modulator, check that the −22V supply is present at pin 6 of the edge connector. This comes from pin 22 of the power supply and is usually o.k. there, but the print that runs all round the edge of the mother board tends to crack where the latter is attached to the cabinet. Unless you relish the job of removing all the modules, the tape deck and finally the board itself, take six inches of wire, nudge, wink, say no more! There's also a 33V supply to the KE (set channel) control. If this is absent the monitor will have to be tuned down to ch. 21 or thereabouts – see the power supply notes last month. 15V supplies should be present at pins 4 and 5.

The tuner is the same unit that's used in most Grundig colour sets produced during the 70s. It's very reliable and to date the only problem we've had has been leakage in the feedthrough capacitor that carries the tuning voltage – this results in drifting.

We haven't had any problems with the i.f. strip, which is as well since the unit cannot be worked on while it's in the machine.

Luminance Module

A block diagram of the luminance module is shown in Fig. 3. Briefly, during playback the switch in IC731 is normally in the position that allows the direct f.m. signal through for processing. In the slow, still and search modes pulses from the DTF board operate the switch on alternate fields so that the signal via IC705 and the 64μsec delay line (equal to the head offset) passes through. This obviates the need to add a dummy vertical pulse. IC731 also contains the dropout detector and switch – the dropout channel has its own f.m. limiter and demodulator, with a 128μsec delay line in the signal path. When a dropout occurs, IC783 is switched off and IC741 on so that the delayed signal passes to the following stages. For dropouts of more than one line duration the same line is continually recycled and fed out, giving a series of vertical random bars that disappear gradually as losses occur.

Both the dropout threshold (DS) and insertion level (YAD) are adjustable. There's a test tape available for these adjustments, but we made our own. Purists please ignore the following! We put a small piece of adhesive tape half way round the machine's lower drum and made a recording of monochrome grey-scale bars containing a horizontal noise band. DS can then be adjusted so that the noise is just replaced by inserted video and YAD so that the level corresponds with the mid-grey of the grey-scale wedge.

The crispener circuit works in the same way as that used in certain Philips machines – by differentiating the signal twice, inverting it and adding it to the delayed original signal. There's a control at the front of the machine to enable the crispening level to be adjusted.

The record circuit is straightforward.

To date, the only troubles have been total lack of E-E signal due to failure of IC860, no playback due to failure of IC731, and one or two instances of strange cogging and clipping caused by failure of various small capacitors associated with filters. Sync pulling coupled with low contrast on playback and E-E is normally due to someone having had a go at the video modulation depth potentiometer in the r.f. modulator (this is accessible through a hole in the cabinet).

Chroma Module

A block diagram of the chroma module is shown in Fig. 4. Fortunately there have been no chroma faults in the few hundred of these machines that have passed through our hands!

An interesting feature is the separation of the chroma and luminance signals and their recombination to give the E-E signal on record. The usual 625kHz oscillator locked by the line sync pulses provides the a.f.c. loop. In the playback mode the output from this is mixed with the output from the 4·43MHz crystal oscillator T503. The 4·43MHz oscillator is inoperative in the record mode. Instead the output from the 8·86MHz oscillator, which is locked to the burst, is used after division by two. This is in effect the opposite of the VHS method, i.e. there's no playback a.p.c. loop.

There are a few more peculiar features. For example the burst amplitude is boosted by 6dB when recording and

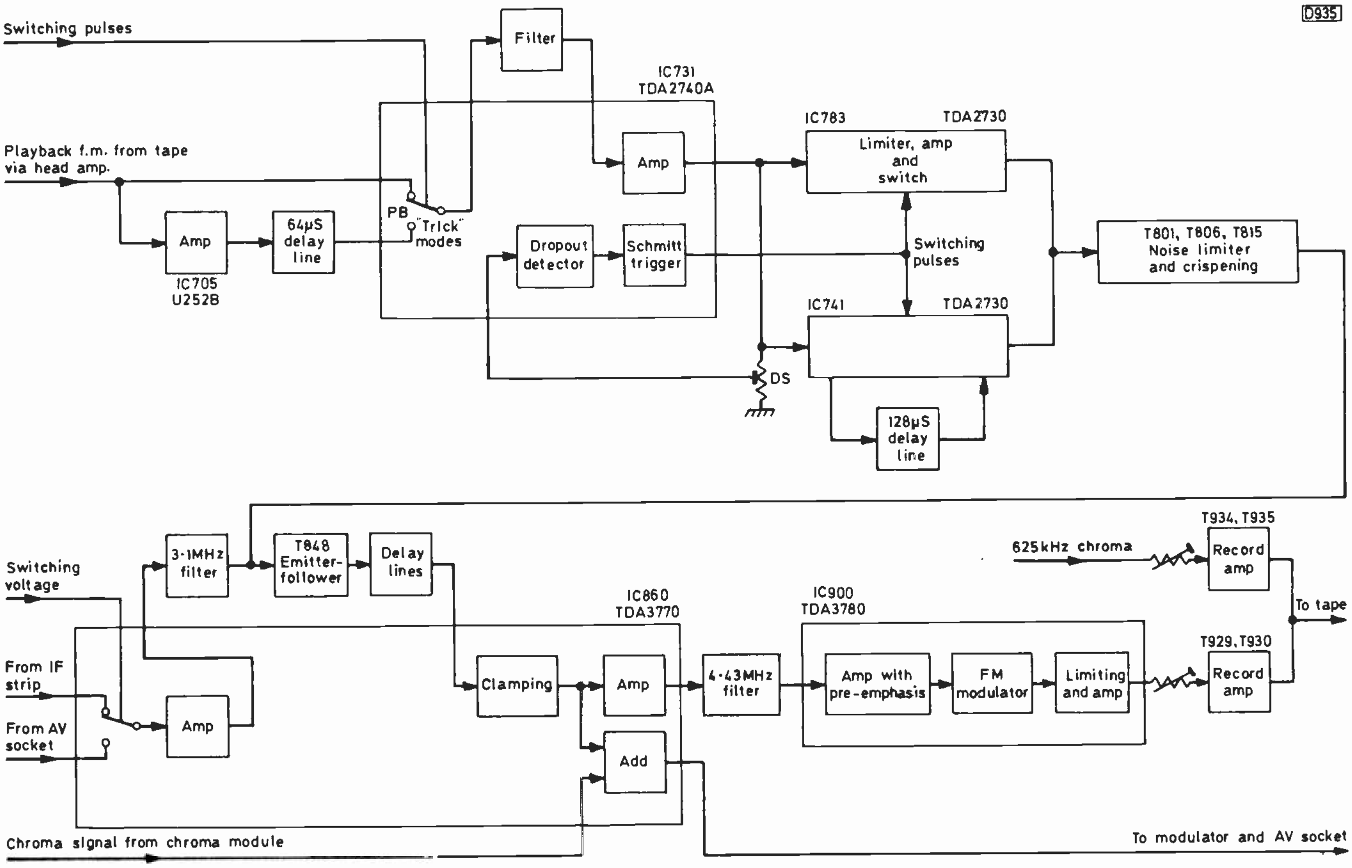


Fig. 3: Block diagram of the luminance module.

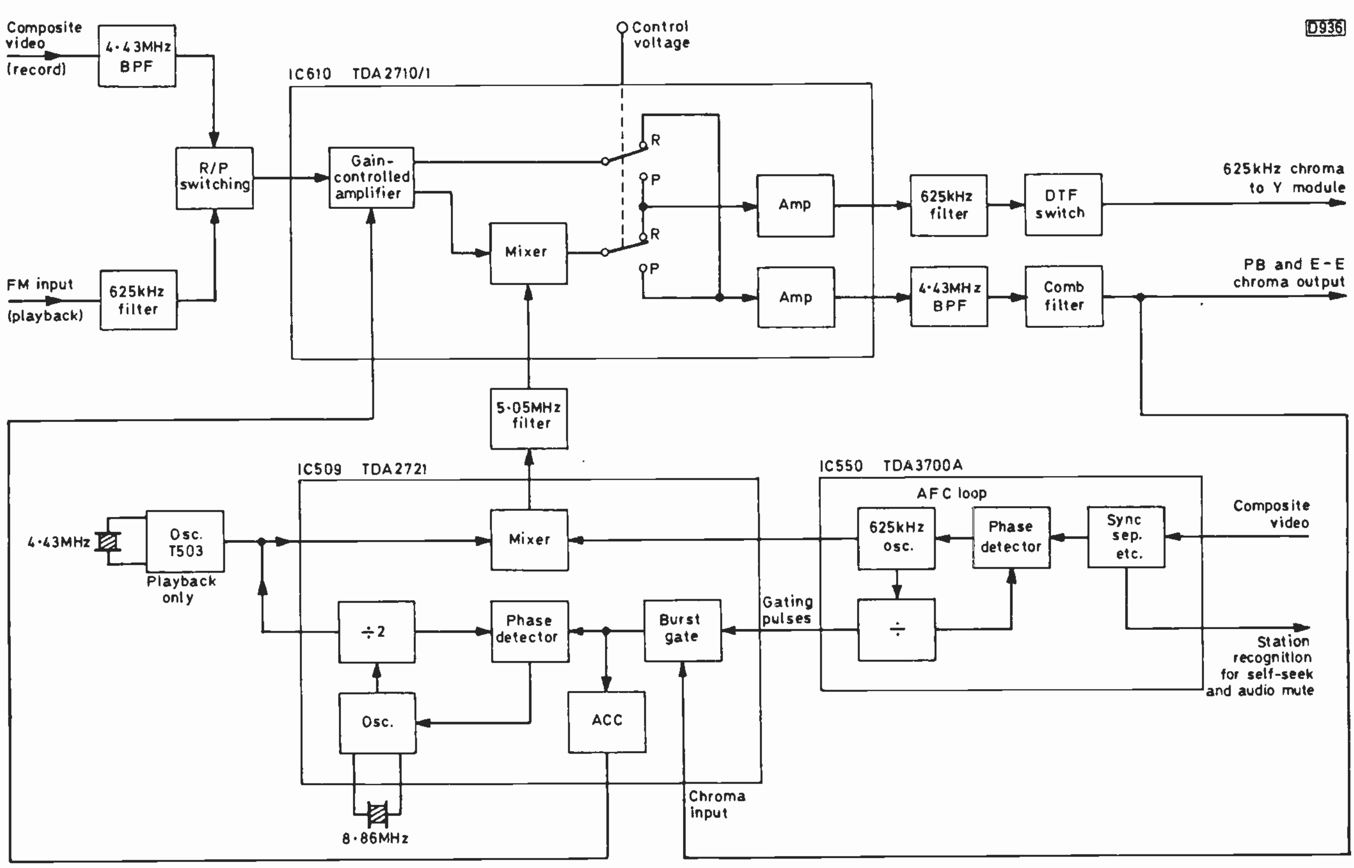


Fig. 4: Block diagram of the chrominance module.

reduced by the same amount on playback, and the chroma channel is muted for 90µsec after the field sync so that the DTF burst (more on this next month) does not interfere with the chroma signal on playback. The chroma is remarkably noise-free on this machine, and there's none of the edge patterning effect found on others.

In Part 3 we'll be covering the servos and the DTF (dynamic track following) system.

A Vintage Hi-Fi TV Sound Unit

Chas E. Miller

A common complaint from TV viewers over the years has been that the sound quality produced by a receiver doesn't match the picture quality. Anyone who watches a jazz concert for example will be familiar with the sight of a bass player plucking away like mad to no audible effect whatsoever from the TV set's "super hi-fi full-range 2¼in. speaker"! The general design of the audio output stages used in hybrid colour sets followed much the same lines as those found in the "midget" radios of thirty odd years ago. The tiny output transformers and under-sized speakers live on, producing noises that are no more acceptable than they were long ago.

One obvious solution would be to extract the TV sound and feed it to a decent audio system. Various ways of doing this have been described in past articles. There are problems with this, not the least of them being the live TV chassis. For a long time I toyed with the idea of producing a small add-on unit that could be plugged into the audio output valve socket in a hybrid receiver to give reasonable quality sound with a minimum of trouble. The targets I set for the design proved rather difficult to achieve however.

Requirements

First and foremost there had to be a push-pull output stage, with all the attendant advantages such as cancellation of hum voltages and magnetizing currents in the output transformer, permitting the use of a modestly sized unit without incurring other penalties. It had to be a true plug-in replacement for the standard output valve (usually a PCL86), drawing the same heater and h.t. currents. This implied no more than 13·3V at 0·3A for the heaters, and around 230V at 45mA for the h.t. supply. A minimum of two triodes and two pentodes would be required (a.f. amplifier, phase inverter and push-pull output), but even the use of double valves seemed to be ruled out since most triode-pentodes require some 12·5-16V each for the heaters for a start. The idea remained no more than that for a long time, until I found the complete answer during one of my trips down memory lane for a vintage TV article.

I was browsing through some ancient service manuals – they must have been literally thrown out by someone, since my son rescued them from a rubbish tip – when I came across one for the Ferguson Models 983T and 988T. These were Band I only receivers released in early 1951. The 988T was a 12in. table model while the 983T was housed in a console cabinet. This made it possible to employ an 8in. speaker in the 983T. It was complemented by the addition of a push-pull output stage – they did things like that in those days! It was evident that this had involved the same design problems that had been exercising my mind, and it was highly satisfying to discover how they'd been overcome.

The valves chosen were ECL80s, small triode-pentodes that were originally designed for use as the field blocking oscillator and output stage but which came to see service in all sorts of applications – in audio, sync and multivibrator circuits, even as the frequency changer in some sets. Their advantage was the modest heater requirements – 6·3V at 0·3A – though for some applications there was the disadvantage of a common cathode for both sections of the valve. The total h.t. consumption for a pair of them would amount to very nearly the 45mA mentioned earlier, with a 200V h.t. rail.

Circuit Description

The circuit used in the 983T, modified very slightly for this add-on unit, is shown in Fig. 1. V1A is a voltage amplifier and, to overcome the common cathode restriction, V2A is an inverter with unity gain (controlled by

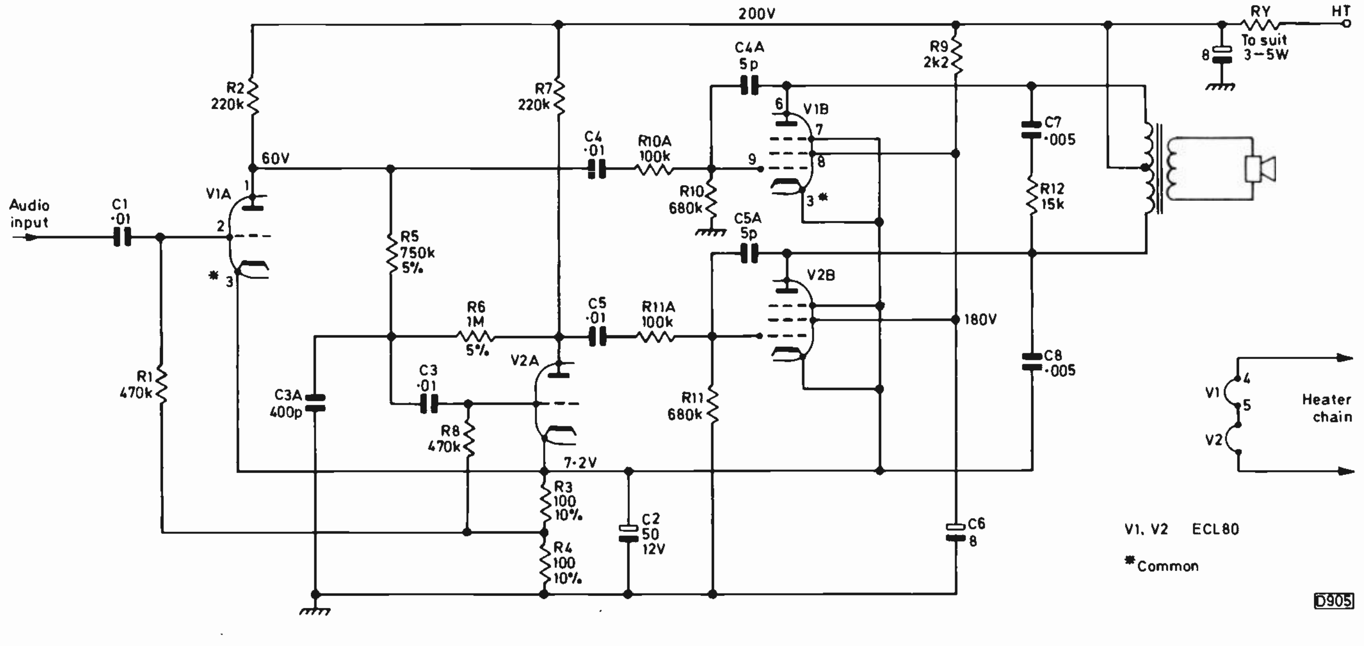


Fig. 1: Circuit of the vintage hi-fi sound adaptor module.

feedback via R6). The antiphase outputs obtained at the anodes of the two triodes drive the push-pull output pentodes. It's a delightfully simple circuit that can be built up quickly and easily.

Construction

Literally everything required was already to hand – in some cases from the junk box! The valves in particular were no problem, since the ECL80 was an extremely popular valve and a dedicated hoarder such as you-know-who is bound to have quantities of them stashed away. The chassis consists of a standard two-gang metal box, switch sockets for the use of, which was conveniently stamped on its base to give knock-outs for conduit entry. Two of these knock-outs were just the right size for B9A valveholders. A standard twelve-position tagstrip was rivetted down the centre of the box to carry much of the wiring, the box itself being inverted so that all components except the valves and the output transformer are contained within it.

The transformer is a standard RS multi-ratio type – I'd several in stock from way back. As I couldn't find any reference anywhere to the correct matching for a pair of ECL80s in push-pull, I adopted the reasonably reliable formula of multiplying the anode resistance of a single valve by 1·4. In many cases this gives an acceptable approximation, as was confirmed by the results achieved with this unit. The ECL80's pentode section has an anode resistance of 11kΩ, indicating the need for a 15·4kΩ anode-to-anode load for a pair. This was satisfied by using primary tappings 1 and 4, with 2 as the centre tap. As I was using a 3Ω speaker, the secondary tappings were C and D.

Modifications

Simple though the circuitry is, it will be apparent at even a quick glance that if anything should go wrong the circuit has the makings of a very efficient cathode-coupled multivibrator. With hindsight, it seems likely that stray capacitances formed by the wiring in the original Ferguson sets had some beneficial stabilising effects. During the initial testing of my version I found that there was supersonic oscillation, the only direct confirmation of this being a heavy negative voltage at the grid of V2A. It was suppressed by adding a 400pF capacitor (value selected at random) between the junction of R5/6 and chassis. The oscillation was caused by positive feedback, which degraded the frequency response. Fitting C3A greatly improved matters. It transpired that Ferguson subsequently modified their circuit, adding 100kΩ grid stoppers and 5pF feedback capacitors in the output stages (R10A/R11A/C4A/C5A). I didn't find this necessary, but these components could be added if instability is experienced.

Interconnections

All connections to the TV set were made via a B9A plug, itself very old new stock – if you see what I mean! Ordinary thin flexible leads were used for the h.t. and heater supplies and for earthing, with a fine screened cable for the audio input. The exact connection will depend on the set being adapted. In most cases the input from the slider of the volume control is taken to the grid of the triode section of the PCL86 (pin 1). Thus the amplifier's input will be tapped from this pin. In GEC hybrid colour sets however the volume control is connected between the triode and pentode sections of the PCL86, so in this case pins 1 and 9 of the adaptor must be connected together and the a.f. taken from pin 8. The earth connection (an ordinary cable plus the screening) is taken to pin 2, which in GEC sets is connected directly to chassis. In other sets it will be necessary to add a shorting link beneath the valveholder. The h.t. is tapped from pin 6 (pentode anode). If it's necessary to reduce the h.t. voltage (in general 200V should not be exceeded) this can be done very conveniently by removing the h.t. and anode leads from the original audio output transformer and linking them via a suitable resistor with decoupling – if the rail is already at about 200V, simply bridge across the transformer. For sets using a PCL82 audio valve the connections are the same for the audio input and h.t. (pins 1 and 6 respectively), with either pin 2 or 8 used for earthing via a link inserted in the set. The heater connections are 4 and 5 in both cases.

Results

The results were most satisfying and made the whole project worthwhile. The most noticeable improvement is with music that's been heard many times before, for example that with the test pattern or commercials. The sound has that elusive and hard to describe quality that makes for listening pleasure: the frequency response seems to be even throughout the range, with the lower notes clear and the treble free of tinniness. The sound will be enhanced even more if a good external speaker is used. At present I'm using (not unnaturally) a vintage 8in. unit taken from a Bush TUG68. Do try this little amplifier: it's very easy to build and will repay the time spent.

Service Bureau

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TOSHIBA V5250B/SONY SL8000UB

The problem shows up with prerecorded tapes. Red lines streak across blue areas of the picture, making it unstable from a colour point of view. Turning down the colour produces a normal monochrome picture while adjusting the tracking control produces head switching noise at one extreme and a slight improvement of the colour at the other. The machine plays back its own recordings perfectly.

We've encountered this sort of problem on several occasions. In each case it's been solved by cleaning the tracks of all the presets associated with the chroma circuitry, then realigning the chroma section following the procedure given in the manual – this either cures the trouble directly or pinpoints the fault area. An accurate oscilloscope and frequency counter are required for alignment.

PHILIPS G8 CHASSIS

When the Channel 4 test pattern is viewed the top two inches or so of the verticals can be seen to oscillate slightly. There's also slight tearing towards the bottom of the picture, over just a few lines.

The usual cause of this trouble is failure of the electrolytic C4518 (47μF) that decouples the supply to the line oscillator.

RANK A823A CHASSIS

The trouble started as intermittent loss of colour, then after a few days there was complete loss of colour. Changing channels would produce the colour momentarily, and adjustment of the ident control 3RV4 has now restored the colour except during the first ten minutes after switch on, when it's intermittent and smeary in the top half of the picture. Tuning for colour seems to be very critical.

Check that the line hold control setting is correct. Trouble here will upset the burst gating and thus the colour. Items worth checking in this area are the 15V zener diode 5D3 and the smoothing electrolytic 5C31 (400μF). The cause of the trouble could be on the i.f. panel: try careful adjustment of the i.f. gain control 2RV2 and the preset colour control 2RV6.

ITT CVC25 CHASSIS

One of the scan-correction capacitors (C69) had to be replaced due to a width fault, but within two days the set was back with a burnt out EW correction transformer (L22/3). C69 and the transformer were replaced but continue to run hot.

Assuming that the EW controls have some effect on the picture and that the EW correction driver transistor T13 is not leaky, we suggest that you disconnect L26 in the shift circuit. If this appears to cure the problem, replace the shift transformer L26/7. If not, it's likely that one of the EW modulator diodes D24/5 is in trouble or that the EW loading coil L24 has short-circuit turns.

PYE 697 CHASSIS

All of a sudden the picture went very bright, then very dull with loss of colour, though the raster is still full sized and the geometry correct. The decoder and CDA panels have been replaced with known good ones and the tube is o.k., but the fault is still present.

Loss of the line pulses used for gating is the most likely cause of the trouble. This could be quickly checked with a scope. The edge connectors on the timebase panel are a frequent cause of this sort of trouble.

ITT CVC8 CHASSIS

It seems that the e.h.t. system is tiring. Any pictures with a significant amount of light area now defocus quite badly and there are two related effects – a billowing inwards of the right-hand side of the raster on some very white shots, and a fair amount of change in picture size dependent on brightness. I assume that the line output stage valves require replacement. Any other suggestions?

Fitting a new PY500A and PL509 could well do the trick. If the fault is still present after this, check the harmonic tuning capacitor C308 and the damping network components C306 and R422. If this doesn't help and the h.t. voltage is constant, the tripler is suspect.

RANK A823 CHASSIS

I have three of these sets, all suffering from the same complaint to a greater or lesser degree – reduced width on scenes with a dark content, varying from half to one and a half inches on each side of the raster. The reduced width is present only in the areas of dark picture content. The h.t. and e.h.t. voltages are correct on all these sets and new line output transformers and triplers have been tried without success.

The symptom could be due to problems with 6R8/6C6, which are in series with the tripler, or the clipper diode 6D1. Check these items first. The e.h.t. regulation will be poor unless the line output transistors are balanced. Adjust the balance coil for minimum width after reducing the h.t. voltage in the way described in the manual.

HITACHI NP8C CHASSIS

Initially the problem was intermittent colour which returned when the crystal was touched. Replacing the crystal restored the colour for only a week, so the decoder i.c. was replaced. Two weeks later the colour disappeared again.

It seems likely that there's a dry-joint on the decoder board – check for this and make sure that there's 12·5V at pin 22 of the chip and that line-frequency pulses are present at pin 13. If so, link TP502 and TP503 and earth TP504 via a 22kΩ resistor. Adjust R514 (colour sync) for zero beat, then remove the test link and resistor.

ITT VC400 CHASSIS

There's a raster but no picture – the fault occurred suddenly. The sound is tunable throughout each channel but is very distorted at all volume levels. Voltages have been checked and the only discrepancies are no d.c.

voltage at pin 7 (input) of the TDA1330 demodulator i.c. and low voltages around the TDA1352A i.f. amplifier i.c. The TDA1330 i.c. has been replaced.

Ensure that the 11V and 24V rails are correct, then check the components in the a.g.c. gating pulse feed to pin 5 of the TDA1352A – resistor R92 (18kΩ), and the two clipper diodes D3 (ITT44) and D2 (8·2V zener) for leakage. If these are in order and you're sure that the replacement TDA1330 is o.k., the TDA1352A is suspect. This assumes that there's little or no noise on the raster – if there is, suspect the aerial, the tuner or the BC252B i.f. preamplifier transistor T4.

TEST CASE

260

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

"Whaur's yer local, laddie?" Framed in the doorway stood a huge Scotsman, looking and sounding like Rob Roy himself – apart from the colourful Bermuda shorts.

"The Queen's Head. Down the road – they're closed till half past twelve though."

"Och, no' the pub . . . the local transmitter. Ye ken?"

"Heathfield, up the road. There's a relay at Walmington-on-Sea. Where are you?"

"Parked in yer yarrrd. Are these transmitters no' verra good? Thaur's terrible interference and we've tae pit the lichts oot befaur we can watch at all. Even the water tap interferes wi't".

The subject of this strange conversation turned out to be a JVC CX500GB, a remarkable set with colour TV, radio and a cassette recorder. As we soon discovered, it lived in a twenty-two foot caravan towed by a Jaguar, the like of which was far beyond the ken of the real Rob Roy. In fact his name was Man-Andra – or so his wife (Meg-wumman?) called him. When we tried the little set in the caravan up came a noisy raster only, which was not surprising since the only signal source was its built-in telescopic aerial.

Man-Andra was busy outside, struggling not with a caber but a slim pole on which he'd lashed a u.h.f. aerial. This produced a noisy, ghosty test card falling a centimetre or so short all round the screen. The Caledonian couple poured out their troubles. The radio worked all right, and the tape section was o.k. provided they weren't recording TV sound. If they were, the results were marred by incorrect speed and wow. Meg-wumman turned on the tap and the picture got worse. Switching from TV to tape replay seemed to cure all the ills, even with the tap on. Further demonstrations involved pulling the curtains and turning the lights on and off, then starting the engine and revving it alarmingly. The TV section behaved differently under these various conditions, though the ghosting and snow remained throughout.

The upshot of this encounter between Scottish affluence and English logic was not a screwdriver and meter exercise. Though we got the manual out for interest (it's an ingenious design) we didn't need to use it. No, Andra and Meg were directed to our local retail department for one of those and some of that. Andra lost one evening of his holiday busily working while Meg-Wumman fretted and scolded. A nice sequel to the story was the arrival, at the end of the week, of a "wee dram" of whisky (down, Les!) for their mentor – it's with me as I write this. Back to the point however. What did they buy in the shop? What basic problem did it solve? And how on earth did the water tap get involved? We'll reveal all next month.

SOLUTION TO TEST CASE 259 – page 502 last month –

All very mysterious: an ITT CVC20 with its screen as bright as a searchlight, the tube's cathodes virtually grounded and a whopping 9V coming from the TCA800's RGB output pins. The other voltages around the chip were about correct – but it wasn't the chip itself. What the block diagram of the i.c. in the manual doesn't show (though it's obvious perhaps with a little thought) is that the RGB clamps need line frequency drive pulses – the same pulse that triggers the PAL bistable is used. It enters at pin 8, after a bit of delay and shaping by the *RC* network between this pin and the relevant winding on the line output transformer (pin 12). The pulse at pin 8 should be a positive-going one of 15V peak amplitude. Our scope revealed the presence of a 7V negative-going pulse. This was mucking up the clamping, thus accounting for the trouble.

The pulse at pin 12 of the line output transformer should be of 70V peak amplitude. In fact we found a negative-going 100V pulse at this pin. This was because the winding was open-circuit, as a result of which negative-going pulses from the NS transductor drive winding were being fed back to pin 12. This would have affected the NS raster correction – also the flywheel line sync – but these effects weren't visible with the bright blank raster present. A new line output transformer was fitted – after we confirmed that the fault was inside the winding rather than at the earth connection.

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TELEVISION AUGUST 1984

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BF241	10p
BF255	12p
BF256	18p
BF257	18p
BF258	18p
BF259	18p
BF336	20p
BF337	20p
BF338	20p
BF362	30p
BF422	21p
BF458	19p
BF459	19p
BFX29	20p
BFX84	20p
BFX85	20p
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BU104	100p
BU105	80p
BU108	100p

BU110	110p
BU111	140p
BU126	70p
BU204	75p
BU205	70p
BU208	75p
BU208A	80p
BU208D	120p
BU326	85p
BU406	85p
BU407	75p
BU408	100p
BU500	110p
BU526	80p
C106D	23p
MJ2500	100p
MJ2501	110p
MJ2955	55p
MJ3000	115p
MJ3001	115p
MJE29A	30p
MJE30A	30p
MJE340	25p
MJE350	80p
MJE520	30p
MJE2955K	90p
OC28	100p
OC29	80p
OC35	100p
OC36	120p
OC45	50p
OC71	30p
OC72	50p
OC200	180p
R2008B	80p
R2010B	80p
TAG06-60	42p
TAG521-200	72p
TAG4443	76p
TAG4444	76p
TIP29	15p
TIP29A	22p
TIP29C	25p
TIP30	16p
TIP31A	24p
TIP32	24p
TIP32A	24p
TIP33	50p
TIP34	50p
TIP41A	22p
TIP41C	25p

TIP42A	22p
TIP42C	25p
TIP47	40p
TIP48	40p
TIP110	47p
TIP112	54p
TIP115	45p
TIP117	56p
TIP120	43p
TIP121	46p
TIP122	47p
TIP125	47p
TIP126	56p
TIP127	56p
TIP147	100p
TIP2955	34p
TIP3054	38p
TIP3055	34p
TIS43	45p
TIS44	40p
TIS61	15p
TIS88A	45p
TIS90	15p
TIS91	18p
TIS93	20p
VK1010	88p
VN.10KM	60p
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VN.66AF	100p
VN.88AF	115p
VN.89AF	110p
ZTX107	11p
ZTX108	11p
ZTX109	12p
ZTX212	27p
ZTX300	13p
ZTX301	16p
ZTX302	16p
ZTX303	24p
ZTX304	17p
ZTX320	29p
ZTX326	29p
ZTX500	13p
ZTX501	13p
ZTX502	18p
ZTX503	18p
ZTX504	25p
ZTX550	24p
2N.1131	28p
2N.1132	28p
2N.1613	24p
2N.1711	24p
2N.2218A	24p
2N.2219	24p
2N.2221	23p
2N.2222	23p
2N.2369	15p

2N.2484	20p
2N.2646	38p
2N.2904	20p
2N.2905	20p
2N.2906	18p
2N.2907	18p
2N.2926	8p
2N.3019	28p
2N.3053	18p
2N.3054	35p
2N.3055	32p
2N.3055H	38p
2N.3440	58p
2N.3442	85p
2N.3702	9p
2N.3703	9p
2N.3704	9p
2N.3705	9p
2N.3706	9p
2N.3707	9p
2N.3708	9p
2N.3771	85p
2N.3772	90p
2N.3773	100p
2N.3819	29p
2N.3866	68p
2N.4031	25p
2N.4036	25p
2N.4037	25p
2N.4443	76p
2N.4444	76p
2N.5061	20p
2N.5294	30p
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BY103	32p
BY126	6p
BY127	8p
BY133	8p
BY164	22p
BY176	85p
BY179	35p
BY182	32p
BY184	32p
BY187	32p
BY196	20p
BY206	11p
BY207	11p
BY208	18p
BY210	22p
BY223	72p
BY225	120p
BY226	18p
BY227	19p
BY228	32p
BY296	20p
BY298	26p
BY299	28p
BY476	90p
BYX10	15p
BYX55/350	30p
BYX55/600	30p
BYX55/800	32p
BYX70/300	29p
BYX70/500	31p
BYX70/800	36p
BYX71/600	80p
DA47	6p
OA90	4p
A091	4p
OA200	7p
OA202	7p
IN.914	2p
IN.4001	4p

IN.4002	4p
IN.4003	4p
IN.4004	4p
IN.4005	4p
IN.4006	4p
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ECL80	57p
ECL82	59p
ECL84	57p
ECL85	57p
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EF80	31p
EF85	34p
EF89	43p
EF183	45p
EF184	53p
EL34	190p
EY86	31p
EY87	31p
PC97	100p
PCC85	42p
PCF80	58p
PCF200	135p
PCF801	110p
PCF802	57p
PCF806	115p
PCH200	100p
PCL81	54p
PCL82	63p
PCL84	50p
PCL85	55p
PCL86	55p
PCL805	55p
PFL200	85p
PL36	80p
PL504	95p
PL508	190p
PL519	450p
PY81	70p
PY88	48p
PY500A	160p

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4000	27p
4001	27p
4002	27p
4006	80p
4007	27p
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4009	50p
4010	50p
4011	27p
4012	27p
4013	50p
4014	60p
4015	60p
4016	45p
4017	65p
4018	60p
4019	60p
4020	75p
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4060	72p
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4082	27p
4093	45p
4094	85p
4098	85p
4099	82p
4501	40p
4502	55p
4503	52p
4504	75p
4506	110p
4507	45p
4508	125p
4510	57p
4511	57p
4512	57p
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G11 Split Diode £12.00
CVC820 Split Diode ITT £10.00
Thorn B/W AD5308F + Stik + Lead £1.50
GEC 2040 £3.00
GEC 2110 £7.00
Mullard AT 2036 £1.50
Pye 169 Line Trans £3.00
Pye mono £3.00
Rank mono T704A £3.50
CVC32 ITT £7.50
GEC Portable G1OT2041 £3.00
GEC Portable G1OT2046 £3.00
EHT Split Diode Leads £1.00
EHT Cable/Metre 20p
Ex panel "14" Fidelity portable £5

Triplers

11 TEZ Rank £3.00
G9 Philips £4.00
GEC 2110 £4.00
9000 Thorn £6
9500 Thorn £4.50
2040 GEC £3.50
GEC TVM25 Tripler £2.00
Universal Tripler £6.00
TVK 76/9 £3.00
G8 Philips (Mullard) £4.50
Decca 80 100 £4.50
Grundig TVK 52 £2.50
11TBQ Pye 731 £3.00
11THY £4.00
D22 for Pye 18" colour portable £4.00
LP 1193/63 £4.00
BG 100/41 £3.25
BG 100/61 £3.25
KT3 BG200/43 £3.50
T/text ultrasonic rec'r panel £14.00
Video cassette lamps on lead. 12-14V. 50p or 3 for £1.00
GEC 8 touch unit assy complete with all I.C.'s + pots £4.00
G11 E.W. coils £1.00
G11 Transient Suppressors 245V 10 for £1.00
G11 Scan Coils £5.00
G11 100K tuner pots 12 for £1
KT3 IF panel £6.00
KT3 line OSC transformer £1
KT3/K30 infra-red receiver head £3
K30 drawer unit with IC's (home) £10
K30 drawer unit with IC's (export) £10
KT3 AE Sockets 25p
KT3 receiver panel £8
KT3 line driver transformer 50p
Decca 80/100 IF panel £5
NPN PNP 80V 6 Amp TO66 O.P. Trans. pair 25p
5 button touch tuner BBC1/2 ITV1/2 video with ic SAS 560T/570T £7.00
Control panel 5 sliders + mains lead £1.50
G11 8 touch button unit replaces old 6 P.B.U. £24
Tube base + base unit for 820 Euro chassis £4.00
GEC Line O/P Trans. & Rec Stick for Portable £3.00
CVC 20/25/30/35/40 decoder panel £10
CVC 20/25/30/35/40 decoder panel (untested) £5
CVC 40/45 IF panel £5
40K Transducer 50p
PHILIPS NE511N £1.20
LM337M Reg. 30p
20 GEC Black Spark Gaps £1.00
G11 Line Driver Transformer 35p
BTW 30/50 50p
G770/HV34 6KV 3 for 8p
BTW 92/800R £3
25A473 PNP C/P 10p

Complete new GEC portable chassis M1201H/M1501H with P.B.U./v.cap/LOPTI £10
Field + Jungle panel for GEC 3133,3135 £1.50
GEC 2110 line panel with transformer £7.00
GEC 2110 tuner unit + IF Panel £12.00
Pye/Chelsea Line op panel £12.00
Pye 713 IF panel and tuner £7.00
Pye 713 Chroma £10.00
Pye/Chelsea Timebase panel with LOPTI £10.00
Pye 731 Frame Panel £5.00
Pye 731 Convergence Panel £5.00
Pye 731 line O/P panel with transformer + tripler £12.00
Pye 731 Chroma £10.00
Pye 731 IF panel + tuner £10.00
Pye 607/205 Line panel with transformer £10.00
Pye CDA/205 panel £6.00
GEC portable chassis + LOPTI 2114 New £4.00
Thorn 1613/1713 chassis 9.75
Hills 520 multimeter + case. 20,000Ω/volt, fuse diode protected + logic test facility. 10meg/1200 volt £19.50

NEW MULLARD TELETEX

Decoder Panel (VM6230) £15.00
Panel 6101 £15.00
Panel 6330 £15.00
G8 Tuner Unit + Panel £8.00
G8 Convergence Panel (late type) £12.00
G8 Line O/P Panel £12.00
G8 Power Supply £6.00
G8 6 Sloping PBU £12.00
G8 IF & Chroma £12.00
G8 Chroma £6.00
G11 IF Detector £3.00
G11 Selector gain module £3
Complete CVC 825 Chassis (both panels) £40.00
AEC V/Cap Resistor Unit UHF with IC SAS660 SAS670 £3.00
Z714 RANK IF Panels 6MHz 1 I.C. SL437F £3.00
Z909B RANK IF Panels Export 5.5MHz 2 I.C.'s TBA1205B TCA2705Q £2.50
Z743 RANK IF Panel Export 5.5MHz 3 I.C.'s TBA750+SC9504P+SC9503P £1.50
Pye G11 Front panel with transducer, pots, tuner pots, 6 pb switch+lead £5.00
GEC V/cap VHF/UHF tuner and IF+ sound O/P PC 706B3 (Export) £12.00
GEC Line O/P PC 659B3 £10.00
GEC Power Supply (Export) £10.00
G11 dynamic correction panel £6
CVC 20 Front panel with sliders + mains input panel £4
CVC 40 PUSH BUTTON ASSY with sliders: complete with lamp assy + pots £14
CVC 5 Mains on/off + 5 pots £2
GEC Convergence panel £1
Universal Focus. Fits Pye, Thorn and Decca Units.
Large Type 75p
Decca Small 75p
KT3 Focus Unit 75p
K30 Focus Pot 75p
CVC 32 Focus Unit
Focus Rod 25p
G11 focus £2.00
ITT Small for use with Split Diode 50p
TV11 50p
Remo TV12SP 50p
TV13 50p
TV14 50p
TV18 60p
TV20 £1.00
TV45 50p
Thorn 4/1500 rec stick 5p
16 Button Key Pad 1 to 0 + * + # + 4 blank (Cherry) £3.00

Condensers

470/16 6p
1500/16 20p
3300/16 20p
10000/16 25p
15000/16 50p
3300/18 20p
47/25 5p
470/25 5p
680/25 5p
1000/25 Radial 10p
1500/25 10p
3300/25 20p
4700/25 25p
5000/25 25p
3500/30 20p
470/35 6p
2200/35 25p
100/40 5p
220/40 5p
400/40 20p
1250/40 20p
1500/40 20p
2500/40 25p
1000/50 20p
1250/50 25p
2000/50 20p
3000/50 25p
3300/50 25p

TELETEX DECODER

I.C. SAA 5051
I.C. SAA 5042
I.C. SAA 5030
I.C. SAA 5020 etc. £18.00

DISPLAYS

4040 Clock £1
7seg Red LED 50p
4 digit LCD 88:88 £1.00
2 digit LED 8.8 50p
2 digit LED ÷ 1.8 with panel + MC14511 £1.00
4700/63 £1.50
250/64 10p
3300/70 50p
.1/100 5p
1/100 × 10 30p
22/100 10p
4.7M/100 5p
470/100 20p
2000/100 70p
4700/100 75p
47/160 10p
800/160 50p
.1/250 Pulse 5p
G11 0.47/250 10p
2.2 250v 10p
3n3/250 A.C. 10p
.39/250V 15p
4n7/250 tested 5KV 25p
.91/400 30p
22/250 15p
47/250 10p
100/250 20p
G11 470/250V £1.75
500/250 50p
GEC600/250 60p
700/250 £1
800/250 40p
32/300 20p
4/350 5p
8/350 8p
12/300 10p
4.7M/350v 10p
16/350 25p
33/350 20p
50/350 10p
220/350 30p
300/350 40p
400/350 50p
10/375 10p
22/375 15p
220/385 75p
330/385 CVC 820HT 60p
0.1/400 15p
KT3 E/W .39/400 20p
.56K/400v 20p
4700pf/400 10p
.22/400 10p
8/400 15p
33/400 20p
400/400 40p
394K/400V 20p
220/450 40p
.47/500 25p
0.1/600 15p
.047/600 15p
0.047/1000 10p
0.01/1000 10p
0.1/1000 10p
.15/1000 20p
.47/250V A.C. 10p
.001K/1250 10p
0.0047/1500 10p
.005/1500 10p
.0105/1500 10p
1n8/1500 15p
2n0/1500 10p
2n2/1500 15p
G11.1000/1500 15p
.01/1600 15p
G11.8200/2KV 15p
0.1/2KV 20p
10n/2KV 15p
3n9/2KV 15p
0.0015/2KV 10p
5n2/2KV 10p
6n2/2KV 15p
2n0/2KV 15p
2n2/2KV 15p
7500pf/2KV 10p
4n7/2KV 15p
8n2/2KV 15p

Infra Red and Ultrasonic G11 Teletext Decoder Panel £30
RANK & ITT Mains Remote On-Off Switch (720R) £1.50
RANK & ITT Mains Remote Switch 2865 ohm £1.50
RANK & ITT Remote Switch 2800 ohm £1.50
G11 Mains Switch 50p
4 amp Mains Switch 25p
GEC Mains Switch 4 amp 30p
KT3 Mainswitch £1.00
THORN Rotary Mains Switch 50p
G8 Mains Switch 75p
Thyristor 600/4 amp C106/2 24p
G11 Preh Red LED P/Button for C.H. Change 30p
RANK TOSHIBA Transductors TPC-2011 50p
CVC 5 Mains on/off
+250K+100K+500K+50K+500K Pot on Panel £2.00
Thorn 12 or 24 volt battery convertor for portable colour T/V £12.00 Post £1

20n/2KV 15p
0.0082/2500 15p
150/3500 10p
1800/4KV 5p
4.7nf/5KV 10p
170/8KV 10p
180/8KV 10p
210/8KV 10p
1000/10KV 10p
210/12KV 10p
1000/12KV 10p
1200/12KV 10p

Multi-Caps

Thorn 3500
175/100/100/350v £1.75
KT3/200/25/25/385v £1.00
300+300+150+100+50MFD 350V £2
47/220/350v 60p
150/150/100/100/100/320v £2.00
2500/2500/63v 50p
470/470/250v 50p
150/200/200/300v 70p
400/400/200v £1.70
300/100/100/16/275v £1.50
100/200/325v 40p
150/150/100/375v £1.50
300/300/100/32/32/300v 2.00
1500/2000/30v 50p
Jelly pot Thorn 00D4/013 £3
150/150/100/100/320v £2.00
100/350 + 300/200/100/16/275v £2.00
300+300/300 £1.00
225+25/380 70p
200/100/100/350v £1.50
500/500/25v 50p
150/150/100/300v 75p
200/150/150/300v 1.00

ITT Panels

ITT 8 & 6 Push Button Unit £1.00
CMA 10 £2.00
CMA 11 £2.00
CMA 30 £2.00
CMA 40 £1.50
CMC 10/2 £5.00
CMC 16 £4.00
CMC 38 £8.00
CMC 45 £1.50
CMC 47 £1.00
CMC 52 £15
CMC 57 £6.00
CMC 58 £8.00
CMC 59 £8.00
CMC 67 £3.75
CMC 67/2 £4.00
CMC 68 £4.00
CMD 12 £10
CMD 32 £5.00
CMD 33 £5.00
CMD 40 £5.00
CMD 41 £5.00
CMF 25 £2.00
CMF 26 £2.00
CMF 31 £1.50
CMF 40 £2.00
CMH 10 £1.50
CMH 31 £1.00
CMK 12 (untested) £4.00
CMK 30 (untested) £4.00
CMN 20 £1.50
CMN 21 £1.50
CMN 40 £1.00
CMN 45 25p
CMP 10 £2.00
CMP 11 £4.00
CMP 30 £2.00
CMP 40 £2.00
CMS 11 £2.00
CMS 40 £2.00
CMU 12 £10.00
CMU 14 £8.00
CMU 30 £7.00
CMU 40 £7.00
CMU 45 £7.00
CMZ 30 £5.00
GMA 90 £5.00
GMC 120 £2.50
GMR 64 £5.00
TMN 2 £2.00
VCA 20 £10
VCA 21 £10.00
VMC 26 £3.00
VMC 34 £5.00
VMC 44 + 45 £4.00
VMC 51 £5.00

Hand Sets

Transducer Hand Set Insert, crystal, transducer, SAA 1124 & lead £3.50
8 C.H. Ultrasonic GEC Full Remote C2014H/C2219H £15.00
New Replacement for G11 Ultrasonic Full Remote £15.00
Thorn 4000 insert with 7 buttons £5.00
Decca RC 11 £14.00
Decca RC 12 £14.00
G11 Infra-red full teletext £19.00
C11 Ultrasonic full teletext for G26c 674/02 and G22c 66/02 £16.00
Philips, 2 button £8.00
Rank. Infra-red £10.00
Dynatron-Full remote CTV 62, 63, 64 £19.00
Philips full remote KT3, 16C928/20C934; 7228/7324; K12 26C 797/1ST 66K 1826 £12.00
G11. Full remote top button assy. £12.00
G11. Full remote repair service (exchange unit) £12.00
Philips infra red full remote 9 channel for 60 CP2605 £6.00
Philips infra red full remote 12 channel for 60 CP2605 £12.00
KT3-30 Push Button Kit £3.00
KT3/K30 T/Text £15.00
KT3/K30 Full remote £15.00
KT3 Power supply £4.00