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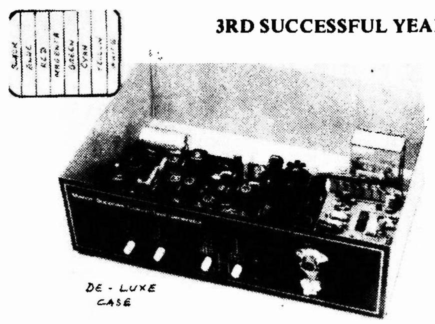

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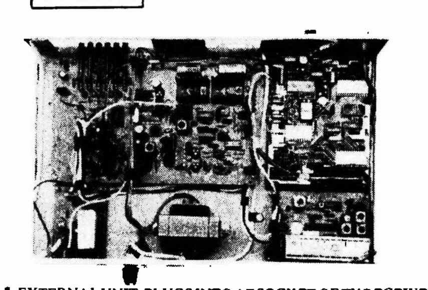

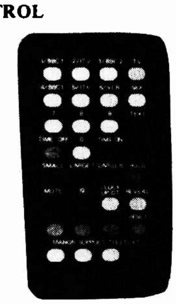

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We don't need no educashun

Education is one of those things about which everyone claims to be something of an authority. After all, we all get involved in it at least once in our lives. It's not a subject we often comment upon in these pages, though when we do we usually receive a few quick brickbats since one of the things teachers seem to have plenty of time for is writing letters to editors. That should get a few of 'em going for a start.

OK, so what business is it of ours? Well, we're concerned with industry and its welfare, things on which the state of the country largely depend, and education/training are key aspects in industrial development. A number of questions can be put to the educationalists then. How, for a start, do you manage to turn out a proportion of illiterates after several years' schooling? That's an unfair question perhaps, since the educational industry's input must inevitably include some rather unpromising material.

"Educational industry?" Well yes, it's one of the service industries really, isn't it? Certainly there's an input and an output, a lengthy and rather expensive process intervening between the two. So the real questions are does society get value for the investment it makes, and is the product wanted/relevant/usable?

Oh dear, oh dear! That's not the way to look at it at all, is it? Education is an end in itself, something to which we all have a right – advanced education too, according to a car sticker I saw only the other day. That's the extreme opposite view, and we'd go along with it to some extent, emphasizing only that a balance has to be struck between these ways of looking at things, and that if education really is as all important as those involved in it are apt to maintain then its effects on our society and economy are things that must be kept under review.

So, are we directing our investment in education to the best advantage? Does the educational process cost too much and take too long? Are we getting the right mix of arts/science/management etc. output? One thing that has never ceased to stagger me personally is the number of people who attain high qualifications in some subject or another and then go on to do something totally different, sometimes though not always due to limited opportunities. This isn't a case of one or two isolated examples: it seems to happen quite often, and leads one to ask whether something somewhere might be a little wrong? You can't get the equation exactly right of course. Only in a rather nasty sort of totalitarian society could you decide exactly who studied what for how long, then ensure that professions are followed come what may. It wouldn't work very well either. But it does tend to raise the question as to what education is *for?*

These questions are not new of course. So long as I can recall there's been concern about too many/few scientists, doctors, arts graduates and so on. One thing that everyone's been sure about is that we've always produced too few engineers. It would be ironical if we got this right just when there's little engineering left to be done as a result of our economic decline.

It's easy to ask awkward questions and to point out deficiencies. Technical magazines tend to have something of a vested interest in the educational system's shortcomings, since they survive in part through filling the gaps in the formal educational system. In fact there exist side by side formal and informal educational systems, technical journalism forming part of the latter. This means that journalists share some of the educationalists' problems – in acquiring and putting over knowledge, especially where a fast developing technology is concerned. One advantage the journalist possibly has is that through operating in an informal way he can see these common problems in a different light.

Let's consider educational taste for example. Educational what? Well, taste plays a major role in most aspects of life, so why not in education? Some, especially the extroverted, find that they do best in a class, learning on a group basis. Interaction and questioning and so on and so forth. Others may find it difficult to get anywhere unless left largely to their own devices. Between these extremes there no doubt lies a wide range of educational tastes, and the problem is can a formal educational system even begin to cater for them?

This and our other questions are not the sorts to which simple answers are possible. They are nevertheless worth asking. Especially as one has this feeling that education could and should have been doing rather better than it has, and that some at any rate of our misfortunes are due to educational failings that have persisted over a very long period of time. Shove up the shutters someone quick, and let's see what response we get!

THE LLJ COLUMN

The good folk of Gravesend – and their TV sets – kept Les Lawry-Johns rather busy during the Christmas period, when this issue was being put together. Never fear, he'll be back again next month.

Mosfet Band III Preamplifier

Hugh Cocks

DXERS using bipolar transistor wideband preamplifiers for Band III reception have over the years been plagued by breakthrough from various non-Band III sources. The main offender is a splatter effect, caused by the intermodulation products of f.m. broadcast transmissions, over channels E6/7 (B7/8). The effect is quite noticeable at the writer's location some 25 miles from the Wrotham transmitter. Another problem, higher up the band on ch. E9 (B11), is breakthrough of local police transmissions if these are nearby. Local u.h.f. TV transmissions also tend to appear at various points throughout the band.

These gremlins can be largely removed by using acceptor/rejector filter circuits, but these can (and do!) cause an unacceptable loss. The main problem is that the f.m. intermodulation is present over a bandwidth of 88-97MHz, and a single filter can't cope with this. If you're very near an f.m. transmitter a filter won't help much anyway. I've seen f.m. breakthrough directly with a valve tuner at about 200 yards from the transmitter.

The basic problems can be removed by using a mosfet instead of a bipolar transistor preamplifier – I think that the last problem mentioned could be cured only by moving house or a large dose of TNT! The mosfet used in the preamplifier circuit presented in this article is the relatively new BF960, which has a gain of over 20dB at 200MHz with a noise figure claimed to be well under 2dB – off-air results certainly seem to confirm this.

The circuit is shown in Fig. 1. The input signal is coupled to gate 1 of the mosfet via C1 and the tuned circuit L1/D1, gate one being earthed from the d.c. point of view by L1. C2 provides d.c. isolation of the tuning bias voltage applied to D1. Gate 2 of the transistor is decoupled by C5 and biased at 4V, for maximum gain, by the potential divider R2/3. The mosfet's drain is connected to the 12V supply via L2 and R5, C4 earthing the upper end of L2. L2/D2 form the output tuned circuit, with C6 providing d.c. isolation. The output signal is taken via C7. C3 decouples the tuning voltage, whilst R1 and R4 isolate the varicap tuning diodes from the tuning potentiometer.

R5, which provides current limiting, could have been placed in the transistor's source lead. An extra decoupling capacitor would have been required however, while stability is improved by earthing the transistor's source directly. The input and output circuits are screened from one another to avoid instability.

A suitable 12V power supply circuit is shown in Fig. 2 – it's not worth using batteries nowadays. The current consumption is approximately 20mA, which is higher than would be required with a bipolar transistor design.

Construction

The layout used in the prototype amplifier is shown in Fig. 3, and those with experience of building preamplifiers should have little difficulty. Use a good screen between the input and output circuits – a suitable material is the copper foil found inside the lids of old rotary u.h.f. tuners. The subchassis can be made of tinplate or PCB material.

Anchor the tinplate subchassis to the main chassis (an aluminium box in the prototype) via the coaxial socket nuts and bolts. Position the mosfet on the input side of the screen, with only its drain lead going through to the output tuned circuit.

The coils consist of two turns of coaxial cable inner conductor, with centre taps to the input and output coupling capacitors. Spread the coils over the entire length (about ½in.) of the ¼in. diameter former.

Testing and Setting up

When construction has been completed, switch on and check the operating conditions. Gate 2 of the transistor should be at about 4V (give or take 0·3V), while the drain should be at about 10V. Be *very* careful not to short out the supply accidentally with a meter prod/screwdriver blade – the transients set up when I did just this destroyed the first BF960 I used ... CMOS i.c.s seem to go the same way, due to the writer's shaky screwdriver!

Tune the TV set to 175MHz (ch. E5/B6) and swing the tuning potentiometer. A noise peak should be seen, at the bottom end of the tuning range, if all is well. Next tune the set to the top of the band and repeat the process. The noise peak should this time be near the top. If the l.f. peak occurs near the middle of the control's range of travel, the coils have too much inductance and should be spread out a little more. Conversely if the h.f. peak is too near the bottom end of the range the coils should be squeezed together or a ferrite core added to increase the inductance. Keep the size of the input and output coils identical.

Next plug in an aerial (or signal generator). Signals should now be seen. To check the tracking, tune for the strongest signal at the l.f. end and expand/contract the input coil. Repeat the process at the top end of the band. I found that the input coil had a very broad peak, and no tracking problems were experienced.

If blips of oscillation/instability are seen on tuning through with the aerial disconnected, plug in an aerial. If the

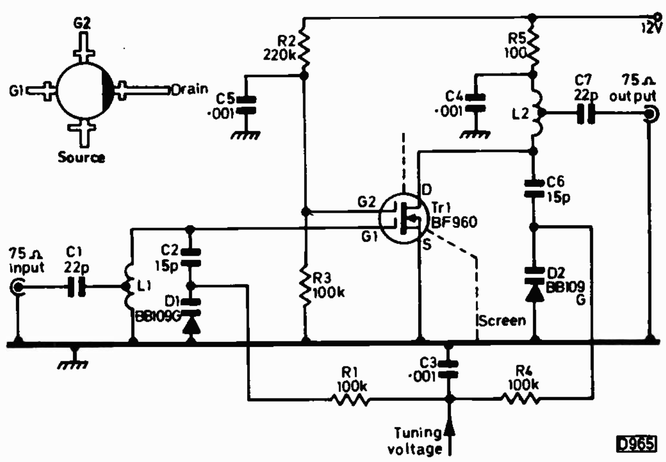

Fig. 1: Circuit of the mosfet Band III preamplifier. Use ceramic capacitors and ¼W, 10% resistors. Diodes from Electro-value, Tr1 from Ambit International.

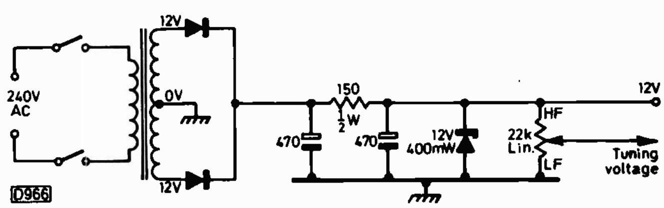

Fig. 2: Suitable power supply circuit.

instability goes, well and good. If not, check the screening between the input and output circuits – ensure that the soldering to the tinplate subchassis is good at all points. It should go without saying that all connections should be kept as short as possible.

Results

In these days of low-noise tuners, a preamplifier makes a less dramatic improvement than in the days of PCC84/PCF80 tuners-cum-noise generators (for DX use they did't need a preamplifier so much as a predriver). A good increase in sensitivity/decrease in picture noise was nevertheless noted. Using an audio tone from a good quality signal generator, the signal could be heard down to $0{\cdot}5\mu V$ without the preamplifier: with the preamplifier in circuit, the tone could still be heard very weakly at $0{\cdot}1\mu V$! The tuning peak is fairly broad, and no problems should be found when tuning across Band III in a hurry.

Although the prototypes were built for set-side use, a masthead version could be employed, with suitable weatherproofing to house the unit. A third wire will have to be run up the mast for the tuning voltage – ensure good decoupling of the tuning voltage at the amplifier end, as the line can be a source of hum/shortwave breakthrough.

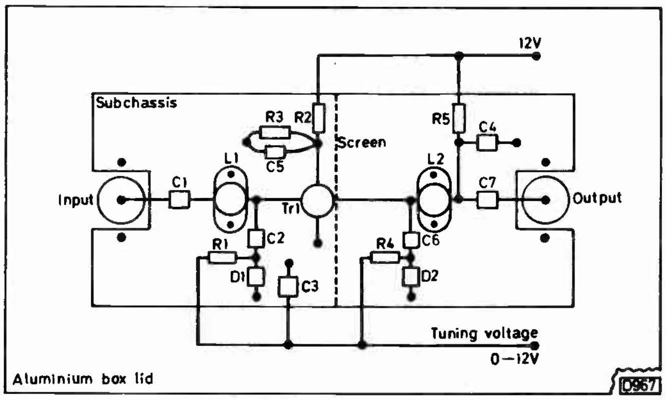

Fig. 3: Suggested layout.

Band III is rather neglected by DXers, which is a great pity. Using a good aerial, it's surprising what can be received on a daily basis over the noise – let alone what can be received when the conditions are good. A colleague observed Arabic SpE signals in Band III last July.■

Letters

TRANSISTOR TESTS

In connection with S. Simon's comments in the January issue on carrying out conduction tests on transistors, I'd like to point out that not everyone will be using an AVO Model 8 and that different meters, even if of a similar specification to the AVO 8, can give totally different results. For example, with my USSR made 20kΩ/V meter on the low-resistance range *all* silicon transistors read open-circuit, regardless of polarity. Forward biased junctions of typical germanium transistors such as the AC128/AC178 etc. all read about 70Ω. On the next resistance range, normal silicon transistors read 100Ω for the BC108 etc., 120Ω for the BF194/5/7 types and 250Ω between the emitter and collector of a BF196.

None of this matters as long as you know your meter, but the beginner could easily be confused, especially if he takes S. Simon's notes to mean for instance that a BF196 which does not read between 50-100Ω is therefore faulty.

Alan J. Gamble,
Ormskirk, Lancs.

Editorial note: The AVO Model 8 was quoted because it's generally regarded as a sort of "standard" for television servicing. Alan Gamble's warning is important, and we suggest that those using other meters regularly should try them out on known good transistors of various types in order to check on the sorts of readings they should expect to get when making such tests.

VINTAGE MATTERS

Writing about the pre-war HMV Model 901 in the *Letters* column in your December issue, E. Kendal says "there were no ferrites that could operate at 45MHz in those days". There were dust cores however, and these were a neater solution than brass eddy-current slugs. I expect that many readers now approaching retirement age will remember the Pye r.f./i.f. 45MHz strips which, by coincidence, were mentioned by Chas E. Miller in the same issue. The coil formers used in these strips – also available separately – were in my opinion the most convenient the experimenter ever had. They were grooved to keep the turns of the winding at a constant spacing, and had two full-length fins drilled with holes to secure the ends of the winding(s). As long as we had these formers, I almost enjoyed winding v.h.f. coils.

I was told, and think it to be true, that the Pye strips were originally designed as vision r.f. strips for use with the pre-war Alexandra Palace TV transmissions, and were called up as it were for wartime service as radar i.f. strips – hence the frequency.

The EF50 was certainly a notable valve. Unlike later styles of all-glass valves the pins were stiff, and after a period of use it was common to find cracks radiating from them. I don't recall finding one that had lost its vacuum however. The original EF50s were painted red, but the VR91 services equivalent was usually unpainted. Another still remembered war-winner was the VR65, a 6·3V version of the Mazda SP41. Both the VR65 and the VR91 were used in large quantities, supplies being reinforced by manufacture in the US and Canada – if I remember correctly, the US-made VR91s were marked Sylvania. The nearest US type was the 6AC7/1852, a metal valve. But US radar equipment, unlike British, contained a lot of twin triodes – the 6SN7GT. As Chas E. Miller says, British practice was to use high-slope pentodes in as many positions as possible. This was partly in pursuance of the policy of using high gain and feedback to obtain predictable and accurate performance. The immediate successor to both of these British high-slope pentodes was the CV138, which later became known commercially as the EF91 etc. This type, and improved versions of it, remained an Inter-Service standard until the end of the valve era.

E. F. Good,
Darlington, Co. Durham.

PUSH BUTTON REPAIRS

S. Simon's article on tuning troubles in the November issue prompts me to write regarding the repair of the push buttons used on certain Rank TV sets. The point made about these buttons in the article is that the star shaped hole in the plastic wears to become a round hole, with the result that the button can no longer be used to rotate the spindle for tuning purposes. The answer to this problem is very simple, and doesn't require sticky adhesives which can leave an awful mess. Go to your nearest stockist of plastic Rawlplugs. You'll find that the ends of these are star shaped while the body diameter is tapered. So all you need to do is to cut off the required length and push it into the hole in the button, which is then as good as new. Ten plugs cost about 10p – they must be of the type that's star shaped at the end.

Roy Martin,
Belfast.

MISLEADING SYMPTOMS

A recent fault we had on an ITT colour set fitted with the CVC9 chassis and Feathertouch tuning could cause confusion. The fault itself was simple enough – the 100mA fuse F1c in the 12V stabiliser circuit (see Fig. 1) on the Feathertouch panel had gone open-circuit. But the symptoms were a dim picture with excessive sound and vision noise. Channel changing was not affected. The cause of these misleading symptoms was the fact that some voltage was still present on the 12V line – obtained from the 20V l.t. line via R1c, T1c and the base-emitter junction of T2c. So before you start chasing around the aerial, tuner and a.g.c. departments when you come across this situation, check the fuse. The set does give one clue: the channel indicator lamps don't light up.

A. Mole,
London, W4.

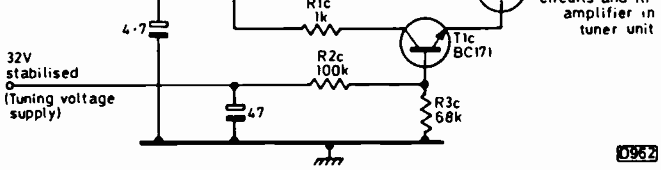

Fig. 1: The 12V stabiliser circuit on the Feathertouch tuning panel used in some versions of the ITT CVC9 chassis. When F1c goes open-circuit there's still some voltage on the 12V rail, via R1c, T1c and the base-emitter junction of the series regulator transistor T2c. This can cause misleading symptoms. There are two fuses with the reference number F1c in these sets, the other one being the mains fuse.

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		Rank BM A823 A/V	£6 89
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	5 6k 12k	17
	15k 22k	20
11 watt	1 ohm-6 8kohm	19
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AD161	42	BC262A	15	BF198	18
AD161/2	£1 15	BC262B	15	BF199	15
AD162	42	BC300	30	BF200	30
AF124	34	BC301	28	BF224	16
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AL102	£2 00	BC327	11	BF259	27
AL103	£2 00	BC328	8	BF271	24
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BC107	11	BC461	30	BF336	36
BC107A	12	BC546	7	BF337	30
BC107B	13	BC547	10	BF338	34
BC108	11	BC548	10	BF355	37
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BC108C	14	BC557	7	BF371	30
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SN76013NO	£1.15	TBA9200	£1 99
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BA154	6	OA202	11
BA155	14	IN914	3
BA156	15	IN4001	4
BAX13	4	IN4002	4
BAX16	5	IN4003	4
BB105B	30	IN4004	5
BB105G	30	IN4005	5
BY126	10	IN4006	5
BY127	11	IN4007	6
BY164	45	IN4148	2
BY176	85	IN4448	10
BY199	10	IN5401	12
BY206	14	IN5402	14
BY210/800	22	IN5403	12
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BY299/800	22	IN5405	13
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BZY88 2V7 3V, 3V3, 3V6, 3V9, 4V3, 4V7 5V1, 5V6, 6V2 6V8, 7V5, 8V2 9V1, 10V 11V 12V 13V 15V 18V 24V 27V	10

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2 5, 3, 5A	£2 16
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100ma	£2 08
160, 200ma	£1 89
315, 500, 630, 800ma	
1, 1 25, 1 6, 2A	£1 07
2 5, 3 15A	£1 43
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250, 500, 630, 800ma	
1, 1 25, 1 6 2, 2 5 3 15, 5A	37

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10	47	7	63	10	9
10	100	8	63	22	12
10	220	11	63	47	16
10	470	18	63	100	19
10	1000	20	63	220	30
10	2200	30	63	470	38
10	4700	48	63	1000	53
25	4 7	8	63	2200	85
25	10	7	100	10	12
25	22	7	100	22	14
25	47	9	100	47	19
25	100	10	100	100	29
25	220	17	100	140	32
25	470	22	100	220	35
25	1000	36	450	1	23
25	2200	46	450	4 7	28
25	4700	80	450	10	28
40	2200	52	450	22	56
63	1	7	450	33	62
63	2 2	7			

MIXED DIELECTRIC

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600	1	38	1250	1	45
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1000	047	29	1500	033	59
1000	1	32			
1000	22	48			

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Video Mixer

Malcolm Burrell

ONE of the prime ambitions of the amateur video enthusiast must be to build a control desk to enable different video sources to be selected as required. One often progresses no further than a plug and socket, or at best a row of toggle switches. The aim of the present project has been to design a very simple system which the enthusiast with limited finances can easily build. It'll give his efforts that little extra polish.

Design Considerations

The mixer was designed to complement the simple video camera featured in recent issues of the magazine. Depending on the quality of the cabinet used, the constructor who shops around might be able to build a two or three camera monochrome outfit for about the cost of a single commercially built domestic camera.

I've called it a simple system, but the word "simple" refers to the electronics. As the system grows, so do the number of interconnecting units, cables and plugs and sockets. Then there comes the need for a monitor to enable you to preview the pictures at your disposal. So we end up with a system that's less portable and not exactly for the living room, rather for the "den", spare room or garage.

Flexibility really is the keynote of the "Studio 80" series. The ideas are tried and tested and can be taken up or discarded at will.

This mixer, in conjunction with two or more video sources which must share a common source of sync pulses, enables "live" programmes, lectures etc. to be produced. Those with a video recorder will be able to make large chunks of or even complete productions, using different cameras and mixing shots as necessary without having to stop the machine – with the inevitable picture disturbances that this produces. The lone amateur on the other hand could sit before a fixed camera with one hand on the mixer to enable him to add a little "finesse" with captions, test cards or general shots.

Operation

A-B channel mixing is used, i.e. a single fader control selects the input from either of two banks of switches (see Fig. 1), depending on its position. With the fader in the A position, operating the top switch buttons will give black level, camera 1, camera 2, camera 3, camera 4 or effects if this feature (to be described in a later article) is incorporated. The bottom row of switches gives the same results with the fader in the B position. A fade-in can be accomplished with say the fader in position B and black level selected on the bottom row of switches and camera 1 selected on the top row. Moving the fader upwards will then fade in the camera 1 picture. Moving the fader down again will fade out the picture.

Mixing between two video sources is also possible. Say camera 2 is selected on the top row and camera 4 on the bottom row of switches. Moving the fader from A to B will result in the pictures first dissolving into each other, finally leaving the camera 4 picture on the screen. With the fader in this position, a cut to camera 1 is produced simply by operating the camera 1 switch on the bottom row. The next shot involving the use of the fader can then be selected at the top.

This arrangement provides enough facilities for most purposes. Crude superimposition of titles is possible if a "contrasty" background is used. The lettering should be white on a black background. By moving the fader to about half way into the dissolve mode, the title should be discernible, though the relative brightness of the overall picture will be reduced. I shall be covering this in greater detail when we get to the special effects unit.

The mixer is tolerant of deviations from the ideal 1V peak-to-peak video signal, and it's possible to mix composite (video plus syncs) and non-composite (video only) signals as well as colour and monochrome signals. In the latter case however the output obtained will always be in monochrome due to the loss of the original sync pulses, the burst and all signals below the black level (this includes part of the chrominance with dark colours such as red and blue).

The video inputs should be of 75 Ω impedance, and in addition to the input socket an extra socket is provided for looping through (see Fig. 2) to monitors etc. If the signal is not to be fed to another piece of equipment, a switch can be incorporated to introduce a terminating resistor or the cheaper solution of using a "stuffer" can be adopted. The latter is simply a suitable plug containing a 75 Ω resistor.

The sync pulse generator has been built into the unit to save on extra casing, power supplies and cables. The four outputs available are mixed syncs, mixed blanking and line and field drive. These can be taken to a five-pin DIN plug. As with the original circuit published in the May 1977 issue,

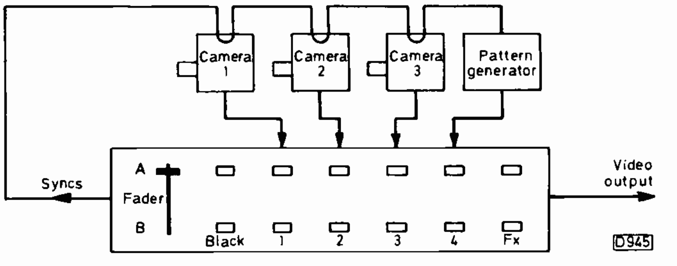


Fig. 1: Fader, switches and general arrangement of the inputs. Position 4 can be used for a pattern generator or a fourth camera.

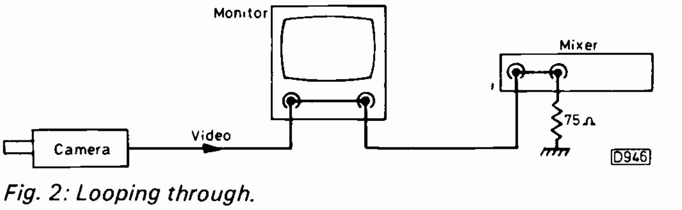


Fig. 2: Looping through.

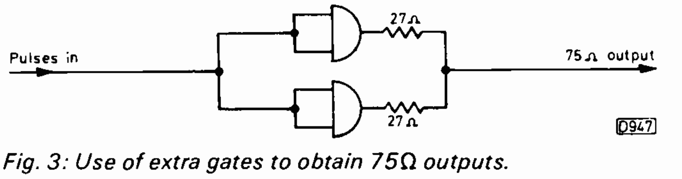


Fig. 3: Use of extra gates to obtain 75Ω outputs.

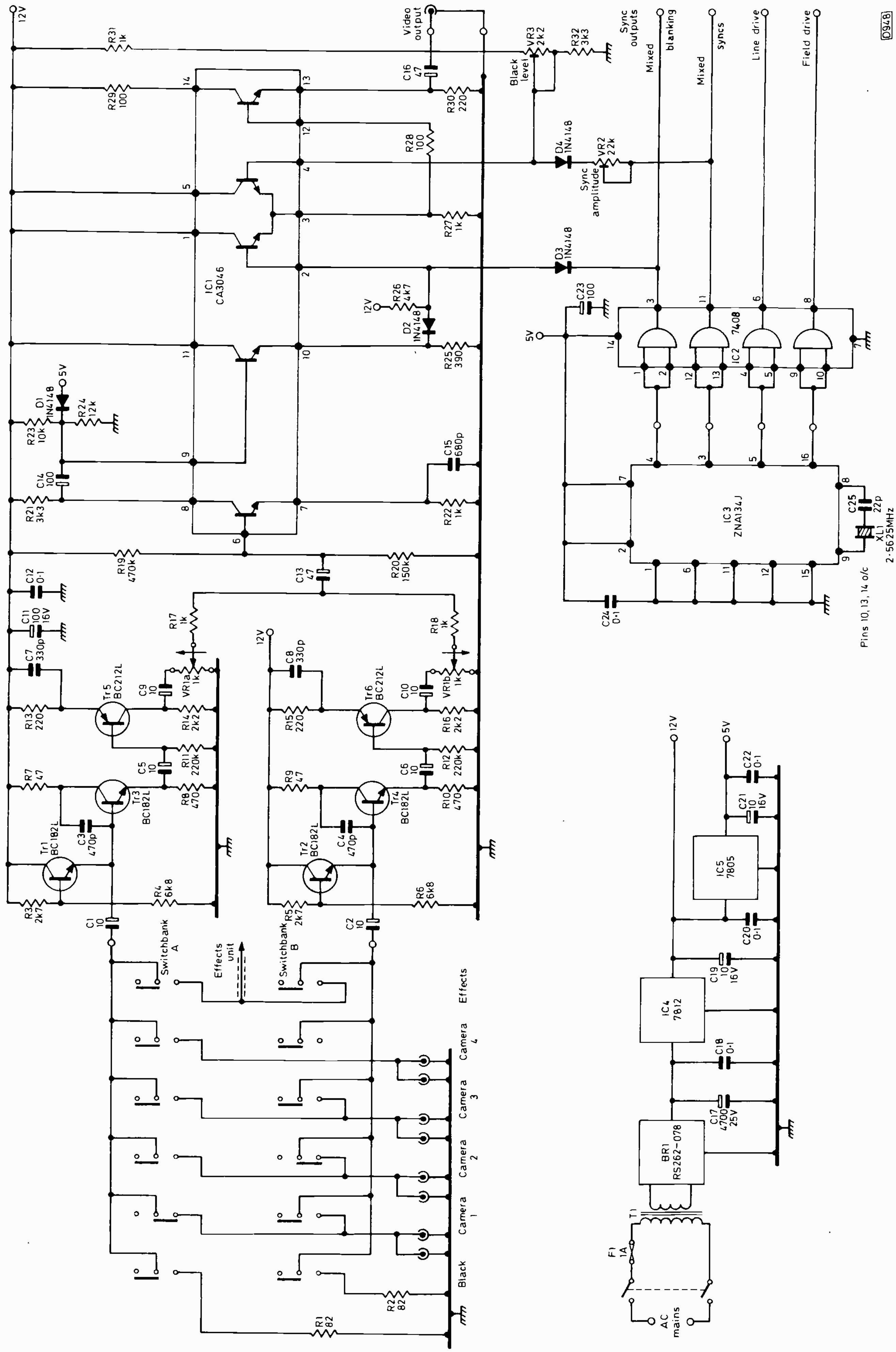


Fig. 4: Complete circuit of the video mixer unit.

these are at TTL level. The perfectionist (who won't build this unit anyway!) will probably throw up his hands in horror, though a limited number of video sources will work happily with these medium-impedance pulses. The use of extra gates will give you 75 Ω outputs (see Fig. 3).

The selector buttons used are those marketed by Maplin. They can be arranged in rows ranging from one to ten. For convenience, two banks of six are employed, but if a simpler video system is to be used and no expansion is envisaged a smaller number can be used.

Circuit Description

The channel A and B amplifiers are identical, so the A one only will be described (see Fig. 4). The input selected by the switchbank is a.c. coupled by C1 to the emitter-follower transistor Tr3. Since selecting different video signals whose mean level may vary widely can produce picture disturbances with a large-value coupling capacitor, a d.c. restorer transistor (Tr1) is used to provide a stable base bias. The alternative approach (using a lower value coupling capacitor) would result in an unacceptable l.f. response. C3 is included to prevent instability.

A.C. coupling is again used to the fader amplifier transistor Tr5. The fader control itself, VR1a/b, is a dual-slider control with each track connected in the opposite sense. Since this control tends to be noisy, at least until it's worn in, a.c. coupling (C9) is used between the control and the collector of Tr5. The use of large-value coupling capacitors preserves most of the l.f. response.

The output from the fader is a.c. coupled by C13 to the first transistor in the CA3046 transistor-array i.c. – this is

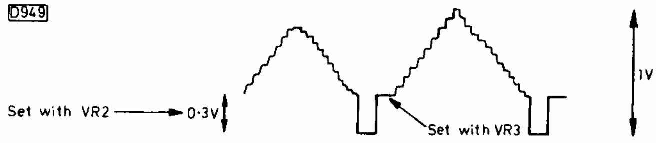


Fig. 5: Setting up the sync and black level controls.

used to reduce the transistor count in the circuit. The first stage is an inverter, which is a.c. coupled with d.c. clamping (D1) to the following emitter-follower stage. The use of a.c. coupling with d.c. restoration at this point was found to give a very significant improvement to the performance of the mixer. The addition of C15 in the emitter circuit of the inverter stage improved the vertical edges.

The blanking and sync pulses are added at the following differential-amplifier stage, with VR2 setting the sync level and VR3 the black level (see Fig. 5). The blanking removes any sync pulses in the original signal. The final stage is a further emitter-follower which provides a 1V peak-to-peak output at 75 Ω.

The well-known ZNA134J sync pulse generator i.c. has been used as the sync source, the outputs being buffered by IC2. The cheap and cheerful circuit shown in the August 1979 issue should work reasonably well as a cheaper alternative.

Setting up

To set up the mixer, feed in the output from a camera, adjusted to 1V peak-to-peak. With the output from the mixer viewed on a scope, adjust VR2 for a sync amplitude of about 0·3V, then set VR3 so that the darkest parts of the

★ Vision mixer components list

Resistors:

		R11	220k	R22	1k
R1	82	R12	220k	R23	10k
R2	82	R13	220	R24	12k
R3	2k7	R14	2k2	R25	390
R4	6k8	R15	220	R26	4k7
R5	2k7	R16	2k2	R27	1k
R6	6k8	R17	1k	R28	100
R7	47	R18	1k	R29	100
R8	470	R19	470k	R30	220
R9	47	R20	150k	R31	1k
R10	470	R21	3k3	R32	3k3

0·25W, 5% carbon film

VR1	1k+1k lin.
VR2	22k miniature horizontal skeleton preset
VR3	2k2 miniature horizontal skeleton preset

Miscellaneous:

Switchbanks	See text.
F1	1A anti-surge with holder
XL1	2·5625MHz crystal
Heatsink	RS 401-497 for IC4-5
T1	240V primary, 15V 3A secondary
Mains on-off switch	
Input/output sockets as required.	

The crystal is available from:
Senator Crystals,
36 Valleyfield Rd.,
London SW16 2HR

IC3 is available from:
Semicomps Ltd.,
Willington Rd.,
London Colney,
St. Albans, Herts.

Capacitors:

C1	10 16V radial electrolytic	C13	47 16V radial electrolytic
C2	10 16V radial electrolytic	C14	100 16V radial electrolytic
C3	470p ceramic plate	C15	680p ceramic plate
C4	470p ceramic plate	C16	47 16V radial electrolytic
C5	10 16V radial electrolytic	C17	4700 25V can electrolytic (e.g. RS 102-774)
C6	10 16V radial electrolytic	C18	0·1 ceramic disc
C7	330p ceramic plate	C19	10 16V radial electrolytic
C8	330p ceramic plate	C20	0·1 ceramic disc
C9	10 16V radial electrolytic	C21	10 16V radial electrolytic
C10	10 16V radial electrolytic	C22	0·1 ceramic disc
C11	100 16V radial electrolytic	C23	100 16V radial electrolytic
C12	0·1 ceramic disc	C24	0·1 ceramic disc
		C25	22p ceramic plate

Semiconductors:

Tr1-4	BC182L
Tr5-6	BC212L
D1-4	1N4148
IC1	CA3046
IC2	7408
IC3	ZNA134J
IC4	7812
IC5	7805
BR1	RS262-078

video waveform just touch the black level. If a scope is not available, view the picture on a monitor, setting VR2 for a steady locked picture then VR3 so that the darkest parts of the picture begin to blend with the dark grey areas. Then back VR3 off slightly to give a satisfactory contrast range.

Miscellaneous Matters

The mixer and the effects generator to be described can be housed in the same cabinet, sharing the same power supply. Whether or not the mixer is used with the camera design previously described, it should provide a cheap solution to amateur TV production problems. Surplus, even ex-broadcast, equipment can be obtained by the amateur from time to time, and although the mixer is not of broadcast quality it should work well with most video equipment.

Many cameras, such as the Crofton design, can be adapted for separate sync operation. There are many however, especially those of the surveillance variety, which can be difficult to operate in this way without extensive modification. This is mainly because they obtain their field scan by shaping the mains supply waveform. All need not be lost if you have one of these, since with some ingenuity the sync can be separated from the video and used to drive other units.

Mixing colour signals is a complex business, with the need to avoid phase errors, preserve the burst and lock the subcarrier and ident on all units in use. There's no reason however why an RGB system could not be used with a mixer circuit like the present design in triplicate, feeding a common colour encoder.

A PCB for the project is in preparation and will be shown next month.

The Complementary Transistor Switch

S. George

IT'S common to explain the action of a thyristor by drawing an analogy with a complementary pair of transistors. Fig. 1 shows the idea. As we should know by now, provided the thyristor's anode is positive with respect to its cathode, then by applying a positive-going pulse to its cathode gate to make this positive with respect to its cathode the thyristor will conduct. It will then remain conductive so long as the current flowing through it is sufficient to hold it on. In the circuit show in Fig. 1(a) the thyristor will switch on and discharge capacitor C1 – which would have charged previously from the positive rail via R1. If the value of R1 is such that the hold-on current is insufficient once C1 has discharged, the thyristor will switch off. By timing the pulses so that C1 charges periodically via R1 and is then discharged via the thyristor, a sawtooth output can be obtained at the junction of R1/C1.

Why does the thyristor remain conductive after the cessation of the switch-on pulse? The two-transistor analogy explains the action – see Fig. 1(b). By switching Tr2 on, the base of Tr1 is made negative with respect to its emitter, so that it too switches on. Tr2's collector current flows via the base-emitter junction of Tr1, while Tr1's collector current flows via the base-emitter junction of Tr2. So provided the current flowing through the transistors is sufficient, the pair remain conductive. When a thyristor or a pair of complementary transistors switch on, the voltage across them falls to a very low level, in the region of 1V. This is the base-emitter saturation voltage of one transistor plus the collector-emitter saturation voltage of the other.

A complementary pair of transistors is in fact quite widely used in TV receiver circuitry. The use of a pair of transistors may be cheaper than a thyristor, while having both bases available for biasing gives the arrangement greater versatility. There are several possible applications.

Protection circuits

One is in protective circuitry. A good example is the overload protection circuit used in the Rank Z718 chassis – see Fig. 2. 5VT1 is the line driver transistor, and the idea is to remove the drive to it in the event of an overload in the line output stage. With no drive applied to the line output stage, the set shuts down. To this end, 5VT4/5 act as a shorting switch across the line driver transistor's base circuit.

During normal operation, 5VT4/5 remain cut off, since the positive voltage tapped from the slider of the set overvoltage trip potentiometer 5RV3 is insufficient for the 8·2V zener diode 5D7 to conduct. The line output transistors' emitter current flows via 5R8, so that the voltage developed across this resistor – and the combination 5RV3/5R15 – is proportional to the load on the line output stage. An excessive load will increase the voltage at the slider of 5RV3 to the point where 5D7 and thus 5VT4/5 conduct. In order to restart the set, it must be switched off for a minute or so for the h.t. to decay. If the overload was transient, the set will then start up. An overload due to a fault in the set will reactivate the trip. 5R16 and 5C22 provide a time-constant to prevent the trip responding to switch-on surges and momentary transients. A similar circuit is used in the later T20 chassis, though the overload sensing arrangement is different.

Low-voltage Protection

In contrast, Fig. 3 shows the complementary transistor switch circuit used in the Panasonic Model TC333G 13in. battery/mains colour portable to switch the set off in the event of the battery voltage falling to a low figure. This is done in the interests of both the set and the battery. A LED

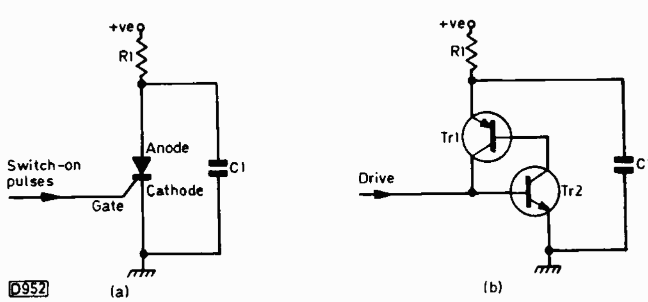


Fig. 1: Analogy between a thyristor (a) and a complementary transistor switch (b). Both operate in the same manner, the thyristor acting like a pair of pnp/npn transistors with their bases and collectors d.c. coupled. The discrete transistor circuit gives greater flexibility in application.

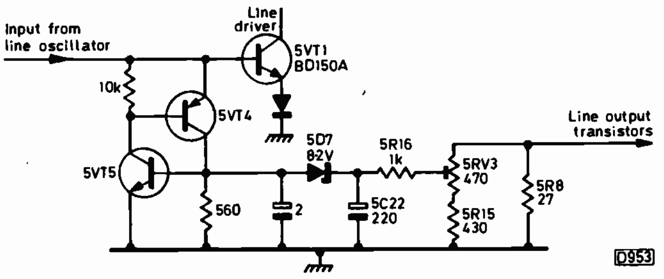


Fig. 2: Use of a complementary transistor switch circuit as an overload trip in the Rank Z718 chassis. In the event of excessive current being drawn by the line output stage, the trip operates to remove the input to the line driver stage.

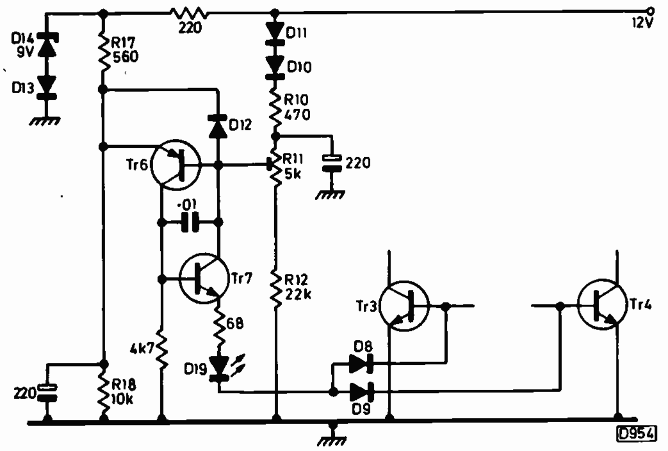


Fig. 3: The complementary transistor switch circuit Tr6/7 in the Panasonic Model TC333G 13in. battery/mains colour portable comes into operation when the voltage from the battery falls to a low level.

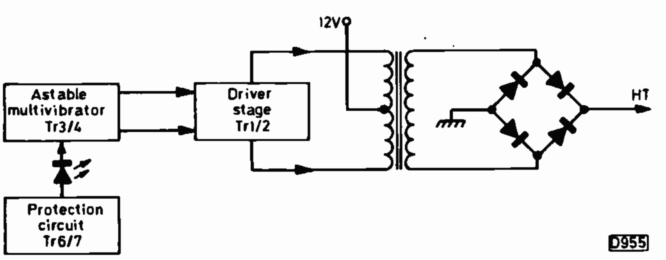


Fig. 4: Block diagram of the battery power supply arrangement used in the Panasonic Model TC333G. In the event of the 12V battery voltage falling to a low level, the protection circuit shuts down the multivibrator oscillator.

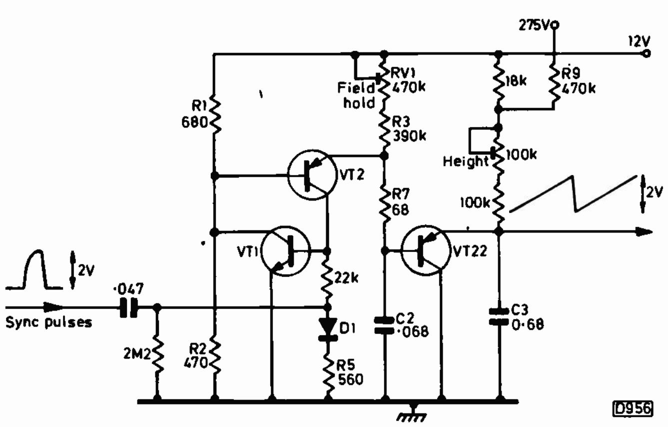


Fig. 5: Use of a complementary transistor switch (VT1/2) as the field oscillator in the Rank Z718 chassis. The circuit is timed by C2 in conjunction with RV1 and R3. The field sawtooth is generated in the following stage, as C3 charges from the 275V h.t. rail via R9 and the height control etc.

comes on at the same time to show that the battery is in need of a recharge.

Fig. 4 shows in block diagram form the arrangement used to obtain the h.t. supply on battery operation. Briefly, the outputs from an astable multivibrator circuit are fed to a driver stage which produces a 20V peak-to-peak squarewave across the primary winding of a step-up transformer. The output from the secondary winding is rectified by a bridge rectifier circuit to provide the h.t. supply.

Tr6/7 form a complementary transistor switch which is normally cut off. There's no current through the LED indicator D19 therefore, and the astable multivibrator transistors Tr3/4 oscillate at line frequency. Tr6's emitter voltage is set by the fixed potential divider R17/18 across the 9V zener diode D14, its base voltage being determined by the setting of the "battery undercut" preset R11 which is connected across the 12V supply in series with R12, R10 and diodes D10 and D11. If the voltage from the battery falls sufficiently, Tr6's base voltage will fall below its emitter voltage (which is held steady by the zener diode). In consequence Tr6/7 will switch on, current flowing via the LED, the two isolating diodes D8/9 and the base-emitter junctions of the two multivibrator transistors Tr3/4. With both Tr3 and Tr4 held conductive, there's no output to the driver stage and the power supply shuts down. Diodes D10/11/12/13 are included to provide temperature compensation.

The flexibility of the complementary transistor switch circuit is highlighted by the fact that in the first example given the switch is operated by applying a positive voltage to the base of the npn transistor whilst in this second example the switch is operated by applying a negative-going voltage to the base of the pnp transistor.

Field Oscillator Circuit

Our final example takes us back to the Rank Z718 chassis, where a complementary transistor switch is used as the field oscillator. This illustrates two other aspects of the circuit, control via the emitter of the pnp transistor, with the switch reverting to the off condition after the discharge of a capacitor.

The circuit is shown in Fig. 5 and depends for its basic operation on the timing circuit RV1/R3/R7/C2. The base of VT2 is biased at about 5·2V by the fixed potential divider R1/2, its emitter voltage rising at field rate as C2 charges via R7/R3/RV1. When VT2's emitter voltage rises above its base voltage, the two transistors switch on, discharging C2 via R7. Once C2 has been discharged, the two transistors switch off, the comparatively high-value resistors R3/RV1 being unable to provide a hold-on current. The oscillator is synchronised by applying positive-going pulses to the base of the npn transistor. D1 and R5 rectify the sync pulses, producing a negative bias to hold VT1 cut off until the next field sync pulse arrives. The stage is triggered just before the natural switch-on time set by the timing circuit is reached.

Whilst the oscillator could be used to produce the basic field scan ramp waveform, this is done by the following "field waveform generator stage" comprising VT22 and the associated components. When C2 is discharged, the base-emitter junction of VT22 is forward biased. As a result it switches on, in turn discharging C3 across which the field ramp is generated.

The complementary transistor switch is a versatile circuit then, and once you recognise it for what it is the circuit action becomes clear. ■

Teletopics

VLP now LaserVision

Philips have decided to adopt the name LaserVision in place of VLP for their video disc system. The term VLP (video long play) had been employed since the original laboratory demonstrations of the system in 1972. Two other terms are being introduced to make the system easier for consumers to understand. For marketing purposes, the CLV discs will be known as Long Play discs and the CAV ones as Active Play discs. The constant linear velocity/long play versions of the disc have a playing time of an hour per side, while the constant angular velocity/active play discs have a playing time of 36 minutes per side but in addition offer still frame, slow motion, reverse motion and frame indexing facilities. The same player can operate with both types of disc.

The LaserVision disc system is understood to be on schedule for its launch on the UK market in mid-1981. The system is now on sale in all major market areas in the USA, following various initial test market trials, with players produced by Magnavox (Philips) and Pioneer. Philips are expressing confidence in the successful launch of the system in the UK on two counts, first the technical superiority of the system and secondly the fact that it will be available ahead of its RCA and JVC rivals. Discs for the European markets will be produced at Blackburn, where the installation of the disc-pressing plant is well on target – trial production started in October 1980.

The initial disc catalogue will include over 100 titles and will be expanded to 250 by the end of the year. Rank have agreed to make films available, joining Magnetic Video/20th Century Fox, MCA/Universal and Paramount. Philips envisage sales of LaserVision players in the UK rising from tens of thousands in the first year to 150,000 in 1983 and 700,000 in 1986, and regard these estimates as "conservative". The players are expected to sell at around £500, with the discs averaging £15.

The name LaserVision is to be used world wide, all players and discs made to the Philips optical system carrying the term in addition to any other brand name.

High-voltage Line Scan Darlingtons

The use of a Darlington line driver/output transistor pair in a common encapsulation is now well established in monochrome portables. Matsushita have now announced in Tokyo the successful development of a high-voltage version for use in large-screen colour sets. As with the low-voltage devices, the pack also includes the shunt efficiency diode and a speed-up diode.

Grundig's 2×4 Plus Launched in UK

Grundig have now launched on the UK market what they call their "second generation" VCR using the joint Grundig/Philips V2000 format. It's the 2 × 4 Plus, which offers still pictures plus fast and slow motion. We first mentioned it in this column last November after it had been on show at the Cologne Photokina exhibition. Grundig comment that with the dynamic track following that's a feature of the V2000 system, the excellent picture quality achieved in normal operation is maintained in the new operating modes, providing clear, interference-free pictures. The slow motion is at a third of normal speed, with fast forward at three times the normal speed.

Another new feature of the machine is the provision of video input/output sockets. An "A" indication lights up in the LED display to show that the machine is in the AV mode. Like the standard 2 × 4, an automatic programme finder (APF) records a signal on the tape at the beginning and end of each recording. When the cassette is run in the fast forward or rewind modes with the tape threaded round the drum, the machine automatically stops at each signal. The timer can be programmed to record four programmes on separate channels over a period of ten days.

The new machine has been taken up by Visionhire, and will be available initially through their 140 branches in the south east.

ITV Changes

The main changes following the IBA's franchise review are as follows: Television South is to take over the south and south east region from Southern Television, while Television South West will take over the Devon/Cornwall area from Westward Television. ATV Midlands is to be restructured, with Lord Grade's Associated Communications Corporation holding no more than 51 per cent of the shares, and Yorkshire Television and Tyne Tees Television must be run separately. The new contracts take effect from January 1982. Breakfast TV is to start some time in 1983 and will be run by TV-AM, which is headed by Peter Jay. In addition to news reports there'll be current events programmes, analyses, features and entertainment. Transmissions will be from 6·15 a.m. to 9·15 a.m. TV4 starts in late 1982. The BBC is also considering breakfast TV, with a possible launch date in early 1982.

The Turbo Trinitron

Sony's latest release on the UK market, their 27in. Model KV2704UB colour set, incorporates some interesting features. For a start there's the 27in., 114° tube, the largest to be used in a domestic colour set. Secondly there's the use of velocity modulation, which is employed to give enhanced picture sharpness. The technique, which Sony call "Turbo modulation", alters the scan speed fractionally when there's a sudden change in picture content. Sony say that the use of this technique enables the sharp pictures obtained with small-screen tubes to be obtained on the new large-screen tube. A sharpness control is provided to enable the viewer to set the degree of picture sharpness to suit his own taste. A third technical feature of interest is the use of a quasi-parallel sound system. This appears to mean that the sound signal is tapped off at an earlier than usual point in the i.f. strip, thus obtaining better results than with the conventional intercarrier sound technique. To make full use of the improved quality sound signal, there's a 10W audio amplifier with independent bass and treble controls and a loudspeaker mounted in its own acoustic enclosure within the main cabinet.

The set's up-market specification includes electronic tuning by voltage synthesis, full-function infra-red remote control and comprehensive input/output facilities. The recommended retail price of the set, which is being produced at Sony's Bridgend factory in S. Wales, is £650.

Death of Sir Jules Thorn

One of the best known names in our industry, Sir Jules Thorn, died on December 12th last, aged 82. Sir Jules was still president of Thorn-EMI, having handed over as chairman in 1976. He was born in Vienna in 1898 and came to England in the early 20s, his first venture being into the import and supply of electric light bulbs and radio valves. When import tariffs were introduced, he started to manufacture his own bulbs. That was in 1932. His Electric Light Service Co. had been formed in 1928, and in 1936 he bought the Enfield based radio receiver manufacturer Ferguson. The combined company was named Thorn Electrical Industries Ltd.

During the war Thorn bought DER (Domestic Electrical Rentals), laying the foundation of the future TV rental business. TV manufacture started after the war, and in 1958 the British Radio Corporation was set up in conjunction with EMI, giving Thorn the rights to manufacture and sell sets under the HMV and Marconiphone brand names. Shortly after this the Ultra Electric Ltd. radio and TV interests were taken over, giving Thorn two more brand names – Ultra and Pilot. The long series of acquisitions before and after these included AEI's lighting division, Radio Rentals in 1968, and both electrical and gas appliance manufacturers. Well known Thorn brand names include Ferguson, Kenwood, Mazda, Tricity, AVO and Taylor.

Over the years the business expanded in many directions, including hire purchase finance and mechanical engineering. The largest divisions remained TV manufacture/rental and lighting however. The most recent move was Thorn's takeover of EMI in 1979.

Sir Jules was knighted in 1964. He was president of the Radio Industries Council in 1966 and of BREMA from 1964-8. Today Thorn is one of the UK's largest companies, with sales of £1·75 billion and pre-tax profits of £125 million in the last financial year. Sir Jules himself played the major role in building up this massive enterprise.

Video Round up

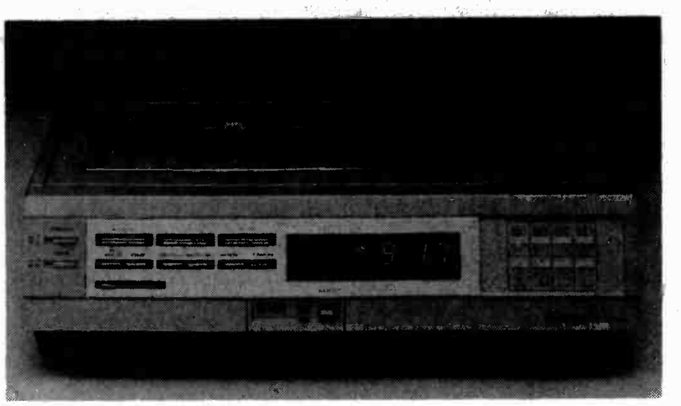
Hitachi have come up with an interesting VCR in their new Model VT8000, combining as it does the latest video technology with a suggested retail price of only £549 including VAT. Features include pause, still picture, frame-by-frame advance and forward or reverse playback at five times the normal speed to give visual search. A wired remote control unit comes as standard, and the timer can be set to record any programme up to ten days in advance. The size of the motor drive system has been reduced by using a direct drive capstan and a direct drive drum motor system. This gives a very compact, lightweight machine. To assist in setting the machine up initially, a test signal generator has been built in.

Sharp have also announced new video products – two VCRs and a colour camera. The VCRs are the VC7700H and VC7300H, both to the VHS standard, the former being a full-specification machine and the latter a down market model selling at some £200 less. Features of the VC7700H include pause, frame-by-frame advance and half and double speed, automatic programme location by searching for a signal laid down when the record button is pressed, and infra-red remote control. The XC33H camera has a ×6 f1·4 manual zoom lens, a through-the-lens viewfinder and a suggested retail price of around £500.

The new Marconi MV402 all solid-state miniature TV camera was on show at the latest Video Tradex International exhibition. This UK-made, matchbox-size battery-operated camera is primarily intended for industrial surveillance purposes.

Rediffusion have announced the opening of 22 video centres to provide customers with a comprehensive video service. Rediffusion are also launching a videocassette library, with the cassettes for sale or rental. The scheme is to be extended to several hundred of the group's 450 shops.

A somewhat different type of projection TV receiver has been announced by Sanyo – a back-projection colour set



The new Hitachi VT8000 VCR.

with 45in. screen. The two speakers deliver 10W per channel.

A gadget called the Editor has been introduced in the USA to enable VCR users to remove the advertisements from their recordings – this is something of a problem for US users since on average something like 15 minutes in every hour is devoted to adverts. The device, which is manufactured by the Shelton Video Company, works by detecting the short no-signal periods that, in accordance with FCC regulations, must precede all advertisements. The Editor then switches the recorder off for 32 seconds after which, if another black cue doesn't follow, the recorder is switched on again. Apparently only two per cent of commercials slip through – the proportion of missing bits of programme is the same. Shelton are doing further work with the hope of achieving 100 per cent effectiveness.

Prestel Developments

British Telecom's Prestel service is to become international this July, following a successful trial run throughout last year. The latter involved over 300 businesses in seven countries. The full service is expected to follow the pattern found most successful during the trial, with information for specific business sectors, including shipping movements, investment statistics and commodity prices, plus "closed user" segments giving organisations exclusive use of certain parts of the information bank for intra-company use. The database used will be quite separate from the one used for general purposes in the UK.

Prestel International will be restricted initially to the seven trial countries – Australia, Holland, Sweden, Switzerland, W. Germany, the USA and UK, plus Hong Kong – though access will be possible from anywhere in the world. The first database, a GEC 4080 computer, will be sited in London, a second one in the USA being due to come into operation towards the end of the year. Databases will be brought into service in other countries as required.

Meanwhile on the domestic user front various adaptors at under £200 have been announced (Tangerine, Radofin, Zycor), though it's not quite certain what the status of these adaptors is – whether they are still in prototype form etc. It seems that the development of specialised i.c.s for the purpose is likely to have a dramatic effect on costs.

Access to Prestel-type database systems and page selection by means of voice control has been demonstrated, for the first time, at a conference held by the National Maritime Institute at the IEE. It would form part of a radio Prestel system for marine use, enabling ships at sea to replace much of the printed documentation currently used.

Videotape Warnings

Warnings about the use of cheap, imported videocassettes have been issued by Granada TV Rentals, Hitachi and

JVC. Granada comment that a shortage of videotape in the UK last year led to a flood of cheap imports, while JVC mention "obscure brands of VHS cassettes which don't meet the company's technical standards". The tape can be abrasive and shed oxide which causes clogging and damage to the heads. One point to watch out for is tapes prefixed with the letter "T" instead of the European "E". "T"tapes are manufactured for use with the US NTSC television system, which is less critical than the PAL system for recording purposes.

Revised Panel Prices

Philips Service have announced revised prices for two of their replacement panels. The 212 27327 CDA panel for use in Pye hybrid colour receivers now costs £17·00, while the 212 27314 rear-mounted convergence panel for use in later versions of the Philips G8 chassis is available as a new unit only at £17·85. These prices do not include VAT.

Roberts-Dynatron Link

Roberts Video, the TV section of Roberts Radio, has bought the Dynatron TV interests from Philips. This will keep the brand name alive in the TV field, and will give Roberts the advantage of being able to offer dealers up-market sets in cabinet styles varying from modern to traditional.

Trade Round up

Japanese colour receiver production is expected to reach a record level of over eleven and a half million sets in 1980 – production exceeded one million for the first time in any month in November 1980. A further increase in 1981 is anticipated.

Meanwhile European problems worsen. The Italian TV/consumer electronics industry is the latest to get into difficulties, as a result of which a proposal for joint operations between Indesit, Voxon and Emerson has been put forward. Indesit is at present under "special supervision" – an Italian form of receivership. Voxon is expected to apply for this status, while Emerson appears to be anticipating bankruptcy. The three companies are hoping that government financial guarantees will enable a holding company to be set up. This would form one of the largest electronic concerns in Italy, and with pooled development, purchasing and marketing would provide considerable cost savings. Italian Grundig and Zanussi have both announced substantial lay-offs.

Colour tube production has ended in Finland with the closure of the Finnvalco plant. After three years' operations, losses exceeded £24 million. We were always rather puzzled by this venture, which was started shortly after Thorn withdrew from tube production in the UK. It seems that the problems of starting from fresh in a greenfield site in a rather remote area – selected to help deal with local unemployment – were too great at a time of excess world-wide tube making capacity.

A Bit of Fun

The new generation of more complex video games certainly seems to be doing good business in pubs and clubs across the land. One problem is that customers eventually get bored and require something new. The ingenuity of manufacturers in you know where is apparently rising to meet the challenge however. One of the games that's not so far appeared in the UK features babies being flung from the roof of a burning building. The idea is to catch them before they land on the ground. If you miss, the baby goes "splat" on the sidewalk and a tiny angel appears and moves slowly up the screen. Our more erudite readers might like to devise a steam-hammer and editor game. The idea would be to splat the editor with the steam-hammer, when a small fountain pen would appear on the screen and . . . Never mind.

Station Openings

The following relay transmitters are now in operation:

Alton (Hants) BBC-1 ch. 49, TV4 ch. 52, Southern Television ch. 59, BBC-2 ch. 62.

Baltasound (Shetlands) BBC-1 ch. 39, Grampian Television ch. 42, BBC-2 ch. 45, TV4 ch. 49.

Brighstone (Isle of Wight) Southern Television ch. 41, BBC-2 ch. 44, TV4 ch. 47, BBC-1 ch. 51.

Bristol (Barton House) BBC-1 ch. 21, HTV-West ch. 24, BBC-2 ch. 27, TV4 ch. 31. Polarisation horizontal.

Mallaig (Inverness) Scottish Television ch. 40, BBC-1 ch. 43, BBC-2 ch. 46, TV4 ch. 50.

Ravenscraig (Strathclyde) BBC-1 ch. 21, Scottish Television ch. 24, BBC-2 ch. 27, TV4 ch. 31.

Polarisation is vertical unless otherwise stated.

VCR Clinic

Steve Beeching, T.Eng.(C.E.I.)

November was fun time. Amidst the rubble and wiring, work progressed at a slow pace whilst I tried to sort out my little shop. A few interesting faults have come along, sent by various dealers who had problems and saw no reason why I shouldn't be burdened with them.

Replay Wobble

First came a JVC HR4100 portable VCR. It replayed known good recordings with no problem at all. When it made its own recordings and replayed them however the verticals wobbled at the top and bottom of the screen – the centre vertical line was stable. The effect was similar to that produced by displaced video heads, so we changed them. This was a waste of time. Well I thought, the problem can't be mechanical, since replay of a known good recording is fine. So I tried a recording made by the machine on another one. The fault then showed up, indicating that the wobble was due to something being recorded by the machine on the tape.

Experience led me to deduce (think up) that the problem was being caused by the head drum changing speed, which in turn suggested a drum servo fault. But the drum employs the same components for both record and replay – or does it?

Inspecting the motor drive voltage in both the record and replay modes revealed a lump on the d.c. voltage in the record mode – a parabolic lump. So further investigation was called for, tracing back along the servo system from the motor. The voltage from the error detector circuit was level and steady (pin 12 of IC3), but on the other side of the non-linear circuit (see Fig. 1) there was this parabola. The problem was thus due to X9 or its associated circuitry.

Now X9 is part of the still circuit. The aim is to hold the drum servo voltage at a fixed value, near the true working level, during a pause. During normal play, pulses from the tracking control monostable in IC3 are fed to the base of X8, turning it on and off sequentially. As a result, C52 is kept discharged via D15 and X8. In the pause mode however X7 switches on to remove the pulses from the base of X8, which is thus kept cut off. The result is that C52 charges via R60, X9 turning on to clamp the servo motor voltage at the level set by R62.

So what was happening in the record mode and not on playback? Answer, X8's collector voltage was not falling to zero, since it was not being turned on fully by the pulses from the monostable. Now the pulse duration on record is shorter than on playback, and these short pulses were not turning X8 fully on. In consequence C52 was not being fully discharged and X9 was turning on, producing the offending parabola.

During playback the monostable which produces the pulses to switch X8 on is timed by the tracking control, the timing period being fairly long. In record the timing is done by the crossover point adjuster R28, the timing period being short. The record crossover point was in fact a bit high, occurring some eight lines before field blanking instead of three and a half lines. Adjusting R28 to the correct point cured the wobble. A good one, isn't it?!

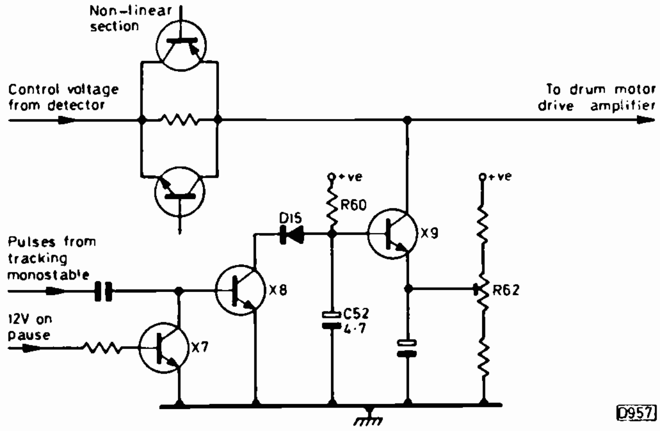


Fig. 1: Part of the pause circuit in the JVC portable Model HR4100. During a pause transistor X9 switches on, clamping the drum servo voltage at the level set by R62.

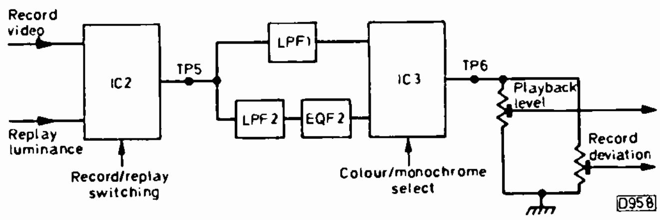


Fig. 2: Luminance signal path in the JVC Models HR3330 and HR3660.

No Drum Servo Lock

Another of these portables came along a little while later, this time a Ferguson version. The fault reported was no drum servo lock – the dealer's engineer had tried various possibilities without success. All the circuitry up to the non-linear bit worked, but after this there were lumps on the drum motor drive voltage. Now as you know Beeching is not one to be caught twice, so R28 was adjusted. The effect was astounding. The servo still didn't lock. Check with scope and find the lumps present at both the collector and base of X9. Hello, hello, hello – on the base which is decoupled by a nice electrolytic? A nice blue tant – in fact a nice blue open-circuit tantalum capacitor! Stick in a new $4{\cdot}7\mu$ F capacitor and the servo works.

Picture Fault

The next machine was yet another one sent in by a bald dealer (due to tearing his hair out). The accompanying note said that the machine replayed known good tapes but would neither record nor play its own. So I checked it out, and found that the replay of its own recordings was diabolical – very low level and fuzzy, with lots of ringing on the edges. I then tried a known good tape. The replay was better, but there was still some ringing.

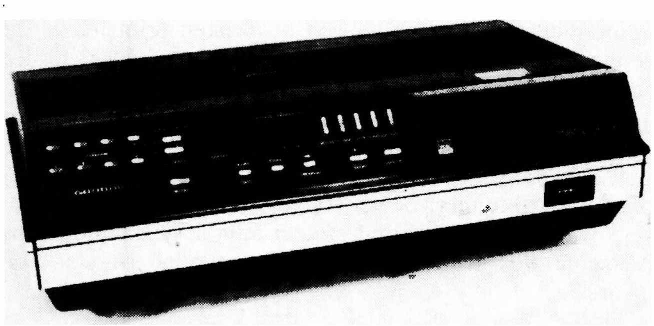
The next step was to check the record carrier f.m. deviation and level. These were a bit odd, but could be set up all right. The level was a bit out, but this was put down to previous twiddlings. The results were still bad.

I next tried playing a recording from the machine on another one. The results were reasonable. Not good: reasonable. This led me to conclude that whatever was causing the problem was obviously in both the record and replay paths. The ringing on the edges of transients was tolerable when a known good recording was being replayed, and when the defective machine's tapes were replayed on another machine, but when the machine was used to replay its own recordings the results were terrible.

I put on a test tape and started to check around, somewhat puzzled. It was around IC3 (see Fig. 2) that I came across some slight discrepancy. The signal level at TP5 was about 2V peak-to-peak on replay, but at TP6 there was only about 250mV instead of 1·2V peak-to-peak. So being a bit dim I changed IC3, which made no difference.

Switching the rear selector switch to monochrome gave a black-and-white picture with increased video levels. So it must be IC3 – there's not much else except filters. Just for interest, I did a recording and replay and discovered that the signal level in the monochrome mode was considerably greater. Hmmm. Since there was ringing, I replaced low-pass filter 2. No difference. Change equalisation filter 2 and the fault is cleared. So this was the cause of the trouble – a partial internal short to chassis in the filter.

In writing the above I've deliberately missed out the other components that were removed and checked before the filter was proved to be the cause of the fault. Naturally a replacement filter had to be ordered from Japan – because they don't go wrong, do they?



The latest VCR from Grundig, the 2×4 plus, uses the V2000 format. For further details see page 188.

Service Notes on the Siemens Model FC365

Mike Dutton

THE Siemens Model FC365, a 90° colour set, is one of the few foreign receivers imported during the colour boom I'd not come across until recently. Over the past three months however some fifty of these sets, bought ex-rental, have passed through the workshop.

The most common problem we've had has been failure of the tuning selector unit. It's of the push button type, with phosphor bronze spring contacts. These snap off or go weak, causing non-operation of the particular button or poor tuning reset accuracy. The units can be returned to the Siemens Service Agent for repair – new units are not available.

The set is typically German in design, with a large horizontal main panel and four plug-in panels for the power supply control circuitry, RGB output, decoder and field timebase. The main panel contains the luminance, line oscillator, thyristor line output stage and the rest of the power supply circuitry. The panel can be taken out of its slides and parked vertically on the hook provided: this gives excellent access to both sides. The plug-in panels can also be plugged into the back of the main panel, giving access to both sides. A separate side panel contains the sound circuitry, a plug-in i.f. panel and plug-in tuner.

The controls are mounted in a block which can be easily removed after releasing four fastenings. The convergence panel is mounted along the top of the chassis and hinges upwards to enable adjustments to be made from the front of the set. Excellent convergence can be obtained, with extra controls provided for corner convergence correction.

The power supply is slightly unusual. Fig. 1 shows the main essentials. Thyristor D601 provides a regulated h.t. supply and, with D536, C536 and C539, is incorporated in what's basically a voltage doubler circuit. An overload trip is incorporated in the power supply – it operates when the return current flow via R612 exceeds a certain limit or the beam current is excessive, disabling the trigger pulse circuit. To reset the trip, the set must be switched off then on again.

The set's reliability is good, and with a new tube the picture quality is excellent. Much the same chassis is used in the following models: FC366, FC370, FC371, FC373, FC375, FC376, FC379, FC385 and FC388.

The most common fault is a dead set, and the 4A anti-surge mains fuse S1201 (at the left back of the main panel) will usually be found blown. The usual cause of this is that D536 is short-circuit. The original type had a metal body – a BY133 is a suitable replacement. Lift out the power supply control panel – D536 will be found mounted on the main panel, under where the power supply control panel sits. In only one case have we found the thyristor D601 to be faulty.

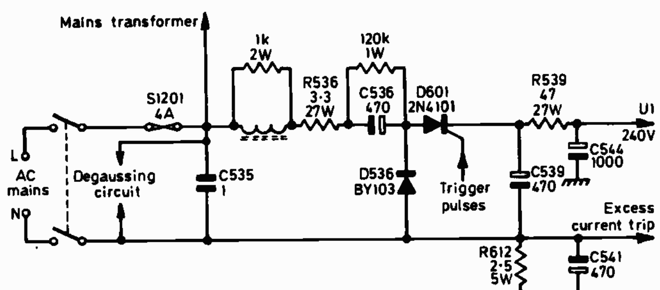


Fig. 1: Simplified circuit showing the mains input and h.t. rectifier circuits.

Lack of width with bottom foldover is due to low h.t. (the U1 line). The cause may be a faulty preset (R614 on the power supply control panel) or loss of capacitance in C536 (470μF) – when this electrolytic goes completely open-circuit the effect is a dead set. It's always advisable to check the power supply adjustments when servicing one of these sets. Set R607 to minimum, then adjust the U1 supply (R614) for 238V (at pin 1 of plug II). Finally adjust R607 to bring the U1 supply up to 240V. In the l.t. department, adjust R651 for a reading of 24V on the U9 rail (emitter of the series regulator transistor V555).

If the set's dead but the h.t. supply is present, suspect failure of the line oscillator (V590 – BC238B – and associated components), the emitter-follower driver transistor V596 (BC337-25), or the line drive coupling capacitor C598 (0·22μF).

The thyristor line output stage seems to suffer few faults. The only dry-joints I've met have been under R1157 (220 Ω, 17W). This resistor carries the line scan current, and is associated with the line frequency windings on the EW correction transductor T1155. A case of power supply tripping was traced to one of the line output stage tuning capacitors, C1151 (0·22μF) – it had split open. A faulty tripler (type TVK52S) will also cause the power supply to trip.

Field timebase faults have been confined to dirty preset controls and field collapse due to failure of the emitter-follower transistor V1035 (BC237A).

A bright screen with flyback lines was caused by C702 (5μF) on the RGB panel. The customer had complained of a gradual increase in brightness until eventually the picture disappeared, leaving a blank screen. The capacitor had a heavy leak.

A case of no sound was also traced to a capacitor. This time C199 (10μF) had gone dead short, removing the bias from the base of the audio preamplifier transistor. Loss of sound can also be due to failure (base-emitter open-circuit) of the driver transistor V210 (BC328-25).

I've had two cases of no colour. The first was due to R326 (1k Ω), which sets the reference oscillator frequency, being faulty. The second was due to C320 (0·1μF), which decouples the slider of R326, being leaky. The result of this was that R326 didn't have enough control range to pull in the reference oscillator.

Convergence adjustment is all electronic, with no mechanical static convergence adjustments. Gross misconvergence can be caused by broken print inside the convergence assembly on the tube neck. Coil L843 on the convergence panel burns up, causing various effects.

The first anode presets are mounted together on the main chassis and can be responsible for grey scale drifting.

R270 (33kΩ, 2W – it's R547 on some sets), which feeds the TAA550 tuning voltage stabiliser from the U1 rail, runs very warm. I've found that greater reliability is obtained by replacing this with a component mounted on stand-off pillars.

Finally, the on/off switch control knob breaks off. With care however the control can be stripped down and the knob glued. In general I've found that these sets are capable of producing a good quality picture and sound, and are well worth renovating.■

Practical TV Servicing: Capacitor Defects

S. Simon

THERE'S no doubt that defective capacitors are responsible for a large percentage of the breakdowns that occur in domestic electronic equipment. Whilst we're primarily interested in TV servicing here, the fact is that at some time or another we probably all get called upon to attend to radio receivers, stereo units, cassette recorders and the like, so a few words here and there about such items may perhaps save the reader some time and heartache – particularly if he's not normally involved in servicing audio equipment.

Let's start at the shallow end, as usual, by considering what should by now be well known, in order to go on to what may not be so well known. When a hybrid TV set is encountered with an open-circuit mains fuse and the fuse is not blackened to suggest a direct short, due say to a short-circuit h.t. rectifier or filter capacitor, we've often advised readers to check with an ohmmeter the reading from the top cap of the PY500 boost rectifier in the line output stage to chassis. If the boost supply is in order, a reading of something over 200kΩ can be expected. Anything much less should give us food for thought before proceeding further.

A reading of 100kΩ for example may well suggest that the boost feed to the tube's first anode circuit is at fault, and investigation may prove that a decoupling capacitor in this area is short-circuit. Such a reading will be obtained only when the 100kΩ (say) feed resistor which the capacitor decouples has maintained its value despite the heavy current flow due to the short-circuit capacitor. It's rather doubtful whether the resistor would have retained its value however, since the usual rating is only about 1W. In fact the overheated resistor would probably have already indicated its distress by sending up smoke signals.

Let's suppose that the reading obtained is say 3kΩ, which you may say is a rather funny figure. Not so really, because it could mean that the 100kΩ feed resistor has fallen in value as a result of the overload and is now only 3kΩ . It could. But in fact this doesn't often happen because when the 100kΩ filter resistor we're considering changes value it usually does so in no uncertain manner, ending up with a very low resistance. So much then for the boost supply filter in the feed to the c.r.t.'s first anode circuit, and as regular readers will have recognised we were thinking in particular of the Pye hybrid colour chassis in the foregoing comments.

Let's get back to our discovery of a lower reading than 200kΩ between the top cap of the PY500 (or whatever) and chassis. What do you do next? You get a nice bright light and examine the high-voltage capacitors associated with the line output stage. The ones you'll usually find are round disc types with a value of some 200pF and a voltage rating of 8kV or 12kV. If one of these is responsible for the low resistance reading, it will usually have a blackened area on it – if it's not in fact more severely damaged.

One might have thought that with such a deterioration there'd be a direct short, and you could be right about this. More often however you'll find a resistance reading of several thousand ohms when checking cold, and this is what you should generally expect under the circumstances. The purpose of these capacitors is to contribute to the shaping of the line flyback pulse, and the original type and capacitance value must be maintained. The tubular type of pulse capacitor is not so reliable, and discs are to be preferred. A few sets do use the tubular type however – in the ITT VC200 hybrid monochrome chassis for example there are three in a row, and it's extremely common to find one of them burnt up, presenting a short-circuit across the boost line.

So here are two types of capacitor that often cause trouble in TV sets – the ceramic (disc or tubular) types used for tuning in the line output stage, and the paper/polyester types used to decouple the c.r.t.'s first anode supply. These are all high-voltage types of capacitor.

Leaky Couplers

Ceramic capacitors will also be found in most low-voltage circuits, and these are of a different construction. They are normally (considering the vast quantities used) very reliable, as also are the equally widespread polyester ones of the gaily coloured variety. They are not above suspicion however.

Let's revert to the Thorn 1500 hybrid monochrome chassis which we mentioned so often in the previous Beginners' Guide series. The audio department here consists of a PCL82 valve and associated components, with the triode used as a voltage amplifier and the pentode as the power output stage to drive the loudspeaker. The output developed across the triode's anode load resistor is coupled to the pentode's control grid by a capacitor, so that the a.f. signal appears at the pentode's control grid but not the high d.c. voltage at the anode of the triode. If a positive d.c. voltage does reach the pentode's control grid, it will pass excessive current and the sound will be badly distorted. There are two ways in which the pentode's control grid can become positive – either leakage in the coupling capacitor, or a defect in the valve itself. If the positive voltage is still present at pin 3 (pentode control grid) when the valve has been removed, the coupling capacitor is leaky and should be replaced. This is a common enough fault, and serves to illustrate that leaky capacitors are not found only in the high-voltage sections of the receiver.

Open-circuit Capacitors

Leaky capacitors are usually pretty obvious, since they disturb the d.c. conditions and can therefore be detected using a meter. Open-circuit capacitors on the other hand just sit there and do nothing except cause trouble. If the open-circuit capacitor is a large electrolytic one, the effect is usually quite dramatic and fairly easy to trace.

Say the main h.t. reservoir capacitor becomes open-circuit – something one must expect to encounter quite often. There will be a drop in the h.t. voltage, which should be revealed without much ado by checking with the meter. Provided one knows what the h.t. voltage should be of course.

In a recent case we were asked to repair a solid-state GEC colour set (C2110 series). The customer's complaint was that the sides of the picture had come in and that the colour had failed, leaving a blue picture (not movie). This could have been a confusing set of symptoms, but a meter check at the top right-hand side power resistors revealed that the h.t. was only about 130V instead of 186V. So we removed the bottom centre power unit and unsoldered the connections to the h.t. reservoir/smoothing electrolytics (they are separate on this chassis, instead of being the more common multiple unit). The left-hand reservoir capacitor moved the meter's pointer to a certain reading (actually 300kΩ) where it remained steady – instead of the pointer swinging over to give a low reading, then recovering to a fairly high reading as the capacitor charged. Replacing the reservoir capacitor restored the h.t., the width and the colour signals, though it didn't do much for the predominantly blue cast since this was due to a worn tube. Resetting the grey scale made an immense improvement however, producing quite an acceptable picture.

All pretty obvious you may say, but the essential point is that once the effect of low h.t. due to an open-circuit h.t. reservoir capacitor is appreciated the repair can be carried out with a minimum of checks and disconnections. The effect of an open-circuit h.t. smoothing capacitor is also well known, the symptoms varying from curved verticals and impaired sync to complete loss of any recognisable picture – depending upon the amount of extra smoothing and decoupling used in the set (more capacitance further along the supply lines). Some sets employ quite an elaborate h.t. supply network, with separate supply lines, each separately decoupled by a fair sized electrolytic, going to various parts of the set. With such a set the failure of the main h.t. smoothing electrolytic will not have such drastic results as in a set which relies on one single large electrolytic to provide the majority of the smoothing. In the latter type of set, loss of the one electrolytic section will produce many varied and confusing symptoms.

To check whether an h.t. smoothing/reservoir electrolytic is open-circuit, simply shunt the suspect with another one of similar value. Note however the charging effect of the test capacitor if the circuit is working, i.e. fit it before switching on, so that it charges normally. This check will nearly always prove the point. Remember to discharge the test capacitor if the test is not conclusive, preferably via a resistor to avoid the heavy spark which occurs when the tags of a charged electrolytic are shorted across.

Low-voltage Electrolytics

Electrolytics are not confined to power supply smoothing applications of course. For a.g.c. purposes we require a d.c. control voltage, i.e. the signal variations present at the source of the a.g.c. voltage must be smoothed out before the

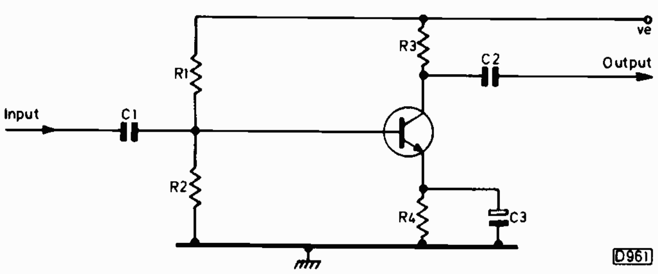


Fig. 1: Simple transistor audio amplifier stage.

a.g.c. potential is applied to the controlled stage. This again may be fairly obvious, but the fact is that an open-circuit a.g.c. line smoothing capacitor can be responsible for apparently baffling symptoms, and that much time can be saved by remembering to check this at an early stage in the fault finding procedure.

Let's consider next the effect produced by an open-circuit decoupling capacitor in an ordinary transistor audio amplifier stage – we rarely mention this sort of thing in these pages. Many preamplifier stages used in audio equipment employ small electrolytics to prevent negative feedback, and it's instructive to consider the simple circuit shown in Fig. 1.

The transistor is an npn type of the BC109 variety (low noise, high gain). The input signal is applied to its base, while the output signal is taken from its collector, being developed across its collector load resistor R3 as a result of the variation in the current flowing through the transistor. If a resistor (by itself) is connected in the transistor's emitter lead, this will also develop a signal voltage – since the transistor's emitter current is also its collector current. The signal voltage at the emitter will cancel the input signal voltage at the base (negative feedback), which defeats the whole purpose of the exercise. So in designing such a stage we can do either of two things – we can omit the resistor in the emitter circuit, or we can decouple it with a capacitor (C3 in our circuit) which smooths out the signal voltage variations in the emitter circuit so that the transistor is left with a d.c. voltage at its emitter.

If you are faced with an amplifier that fails to amplify despite the voltages around it being apparently correct, spare a thought for the fact that negative feedback might be cancelling the input signal, i.e. check the capacitor which decouples the emitter resistor. You will almost certainly find that it's open-circuit, which will be proved by shunting a suitable replacement across it.

You may say that one rarely comes across this type of audio preamplifier circuit in a TV set. All the more reason to draw attention to it, since it's the "one off" jobs with unfamiliar circuitry that are the most time consuming. Just to emphasize the main facts here, a hum test or a signal injector should produce a certain level of output when applied to the collector of the transistor, a much greater response when applied to the base, and no response when applied to the emitter. If the test produces approximately the same response at the collector, base and emitter, it can be assumed that the emitter decoupling capacitor is open-circuit.

Polystyrene

Polystyrene is a word that strikes terror in the heart of the busy engineer. Capacitors using polystyrene as the insulating material are normally high-stability types employed in parts of the TV set where frequency stability is essential – for example in the colour decoder reference oscillator circuit or in the line oscillator circuit. Such capacitors all too often become open-circuit, with the result that the oscillator runs at the wrong frequency (it usually continues to oscillate due to the natural capacitance of the coil and the presence of stray capacitance). The situation is aggravated when the defect is intermittent. The only sure remedy is to replace any suspects, using exact replacements or silver mica types of the same capacitance value (these are also high-stability components). Typical values found in line oscillator circuits are 390pF and 820pF. We don't want to give the impression that line hold problems should direct attention first to the small capacitors in the line oscillator circuit however: the well known trouble spots should be checked first.

For example, say you have a Pye hybrid colour set which is giving trouble with unobtainable or varying line hold. If you immediately changed the polystyrene capacitors in the line oscillator circuit, you'd almost certainly be disappointed – because the trouble is likely to lie elsewhere. Our oft repeated advice on dealing with this problem on this chassis should be followed.

In short, you'd first check the 47kΩ resistor which feeds line pulses back to the flywheel sync discriminator circuit – simply by looking at it. If it's still smart and colourful, there's little cause for concern. If it's in an obviously distressed state, change it and check the nearby discriminator diodes – these often go short-circuit when the resistor has allowed too much current to pass. Next, if necessary, look at the 100kΩ resistor in series with the line hold control – disconnect one end and check its value. If everything's in order here, move over to the left-hand side i.f. panel where you may find that the sync separator's 4·7MΩ base bias resistor is high in value. Ah, you may say: in this case the field locking would also be weak. Ah, we reply, weaker than usual, though it may not be too obvious, so watch it! If these points check out o.k., turn attention to the 16μF capacitor which decouples the oscillator's h.t. supply, and the PCF802 valve itself. When all this has been done – and the routine takes only a few minutes – one may fairly view the polystyrene capacitors in the line oscillator circuit with suspicion.

Leaks and leaks . . .

What exactly does one mean by a leaky capacitor? Leaky like a dripping tap? Possibly, in a way that might surprise you. Otherwise what we mean is that the capacitor has lost its d.c. insulation. We've already mentioned the audio circuit in the Thorn 1500 chassis, where the coupling capacitor can become leaky with the result that the operating conditions in the output side of the circuit are upset. Many other such examples could be quoted, but we don't wish to labour this rather obvious condition. It's the other aspect of the leaky condition that requires a little explanation.

It applies only to electrolytics, but can spell havoc on a crowded circuit board. Once upon a time one could shake an electrolytic capacitor and actually hear the electrolyte sloshing about inside. Since those days the electrolyte has thickened up a bit, so you can't slosh it about. It can still leak out however, and does. The trouble is that the capacitor can go on functioning, since it retains its capacitance even though it's leaking.

"What's this on the carpet under the TV set dear?"

"It must be the cat."

The cat might be quite continent, but the picture on the TV set may be doing funny things – like getting progressively darker as the conductive fluid spreads into the beam limiter circuit say, causing transistors to conduct when they shouldn't.

When your TV set or audio unit is doing funny things, shine a light on to the end of the electrolytics to see if they are moist. If they are, look to see where the fluid has spread (or dripped). Many items may have to be removed in order to clear the effects of the leakage, or perhaps a whole panel may have to be replaced if your patience doesn't run to removing the multipin sockets etc. in addition to the more run of the mill resistors, capacitors and transistors in order to clean out every trace of the conductive chemicals, wet or dry . . .

Video Report: The Sony HVS2000P Effects Generator

David K. Matthewson, B.Sc., Ph.D.

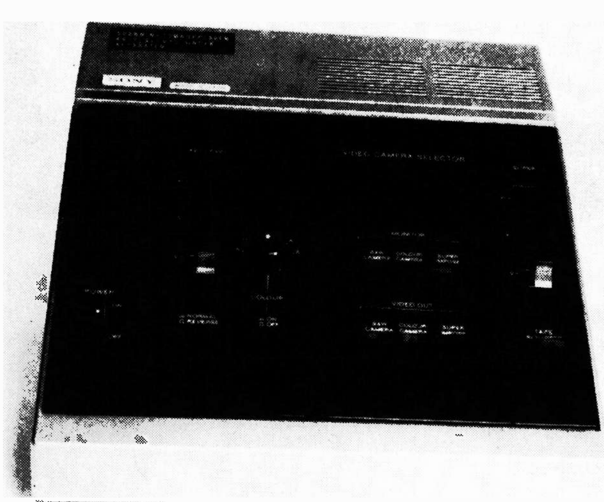
THE Sony HVS2000P camera power unit, switcher and colouriser is a remarkable release on the domestic video market. This small box – only some 4 × 10 × 10in. – acts as a 12V d.c. power supply unit for one monochrome and one colour camera (the Sony HVM100CE monochrome and HVC2000P colour cameras say) and allows the user to cut synchronously between the two cameras. The latter means that the cutting is done during the field blanking period, so that no interference appears on the screen. A monochrome picture can also be faded in and superimposed on top of the colour one, and even artificially colourised at the touch of a button. These features should make the switcher interesting enough to the domestic or low-budget industrial/educational video user, but a further feature should clinch the deal – the suggested retail price, including VAT, is only £72!

At this price, which is little more than the SRP of the power unit alone for the HVC2000P colour camera, Sony admit that they are not making a profit out of the unit. The hope is that it will encourage the sales of cameras and the wider use of video equipment. Sony also comment that most of the development costs have already been recovered, as many of the i.c.s employed in the unit were originally designed for use in various pieces of more expensive professional equipment.

Features

Before we take a look at how it works, let's consider in a bit more detail what it does.

The unit is housed in a sloping fronted case and weighs around seven pounds. At the rear are the various connectors, including two of the new K type 14 pin sockets for power out/video in, and two BNC video output sockets. One of these sockets is for feeding a VCR and the other for feeding a monitor. Although both outputs may appear to be identical, only the VCR output is controlled by the blanking switcher: the monitor output gives asynchronous cuts, and should not therefore be used to feed a VCR.



The Sony HVS2000P effects unit, showing the layout of the controls on the sloping front panel.

Other sockets provide an audio output (this supplies the signal from the colour camera's built-in microphone to the VCR), a remote control jack to allow the colour camera's trigger to stop and start the VCR, and a tally jack which enables the "tape run/stop" button on the HVS2000P's front panel to do the same thing.

The front panel has two banks of vision selector switches, one for monitor output – a sort of preview, which allows you to examine an effect before selecting it for recording – and one to select the video output fed to the VCR for recording. These two banks of switches enable either the colour camera signal or the monochrome camera signal to be selected for recording or, when the superimpose button is operated, a number of special effects can be carried out. In the simplest mode this enables you to mix (fade) monochrome pictures with colour ones, or to key them into colour ones – keying is a form of non-additive mixing. This effect for example enables you to superimpose in monochrome the name of a man shown talking in the colour picture – this sort of thing is often done by broadcasters during news programmes. With the artificial colouriser switched on, the keyed in item can be superimposed in colour – in either yellow, cyan, green, magenta, red or blue. By operating the normal/reverse button the opposite effect is obtained – in other words a coloured field with the caption keyed into it, through which the colour camera's picture is visible.

Use

All in all then it's a very versatile piece of equipment. Colour cameras other than the HVC2000P can be used, connected via suitable adaptor leads. Off-air TV signals or off-tape video can also be fed in (see Fig. 1), so that titles can be added to a prerecorded tape for example. A word of warning here. Much of the signal processing within the switcher is timed by the incoming colour video signal, and it's essential that this is of the highest possible quality and quite stable – nth generation rolling video tapes will produce very unsatisfactory results.

The monochrome camera recommended by Sony for use with the unit is their HVM100CE, which can be switched to operate with its own internal sync pulses or locked to an external sync source. It must be used in the latter mode with the HVS2000P, its syncs being derived from the incoming colour video signal. Hence the need for stability. Rather awkwardly, Sony have chosen to supply the monochrome camera with a mixed sync signal with the horizontal drive positive-going and the vertical drive negative-going, the whole waveform being about 2·8V peak-to-peak, instead of a standard 2V or 4V mixed syncs signal or separate line and field drives on two wires. This makes the use of other monochrome cameras difficult, since it's essential that both video sources are synchronised.

Difficult certainly, impossible no. The sample mixer I had for review came along with an HVC2000P colour camera but no monochrome one, so I devised a method of

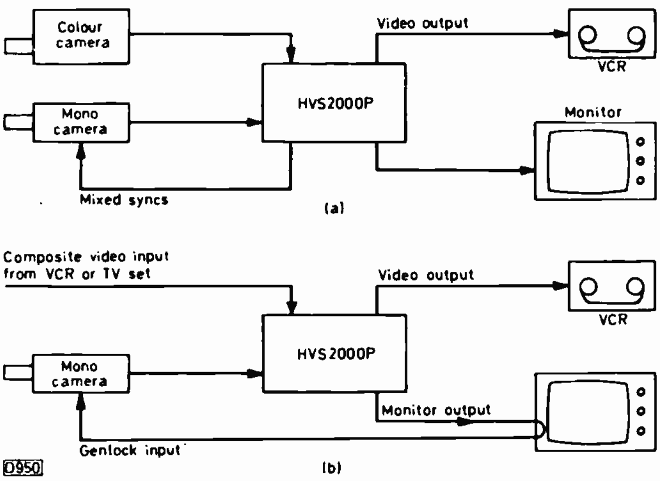
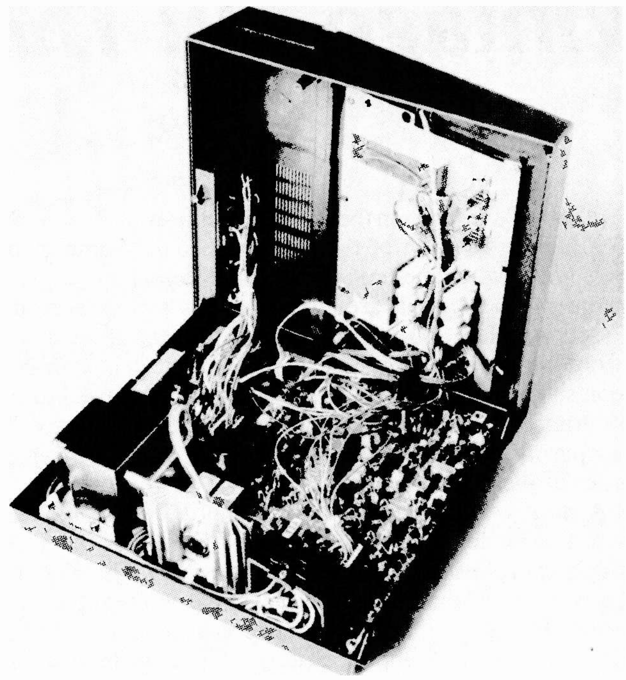


Fig. 1: Using the Sony HVS2000P effects unit. (a) Normal use. (b) Alternative ways of using the unit.


Innards of the HVS2000P effects generator unit.

testing it out that may be of interest to others. I had a National monochrome camera that could be genlocked to an external video signal (for those not familiar with video techniques, genlocking is a way of synchronising a camera's or a vision mixer's sync pulse generator to an external video signal so that the two operate synchronously: they can thus be mixed etc.). By selecting the colour camera's output on the monitor switch bank and feeding this to the National camera's genlock input socket, I was able to feed synchronous signals from the National camera to the HVS2000P switcher and thus do mixes etc.

Results

Even when compared with units costing several thousand pounds the Sony HVS2000P switcher was found to perform very well indeed. The only slight complaint I have is that the synthesized colour field does not completely overlap the colour camera one. On some TV sets this may appear as a small margin of colour picture at the top and right-hand side of the synthesized picture. The effect is not present when captions are superimposed on a colour signal. Quite why this problem arises I'm not sure, but it's obviously supposed to happen since it's mentioned in the users' handbook.

The synthesized colours were well saturated and impressive, judged subjectively. The keying and mixing facilities worked well, and lighting the captions to be keyed in, something that's always a problem, was not too difficult. For anyone who wants the facilities this unit offers, I can quite unhesitatingly recommend it.

One has learnt not to expect much for £70 in the video world. It came as a considerable surprise therefore when I lifted the top off the switcher and counted some thirteen i.c.s and over 90 transistors, all arranged on a neat pcb. The presets are clearly labelled, and there are plenty of test points.

The operating principles are quite straightforward, as the block diagram (Fig. 2) shows. The basic waveforms required, including the U and V subcarriers and the PAL alternate line phase shift for colourising, are all derived from the incoming colour video signal. The incoming signal from the monochrome camera is sliced, i.e. the signal level above a preset level is considered to be white, that below the preset level black (no greys), the white portion then being used to gate the monochrome signal into the colour one at the mixer.

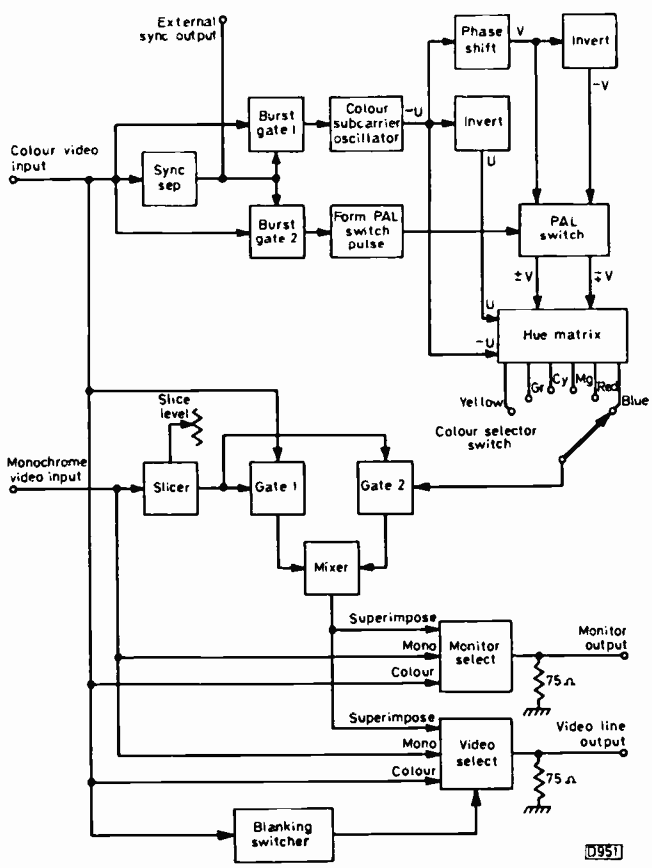


Fig. 2: Simplified block diagram of the Sony HVS2000P effects unit, which also provides regulated power supplies for the two cameras.

Though the unit is intended for the home video market, I'm sure it will find wider applications in education and industry. It doesn't conform to broadcast standards, but nevertheless works very well. With these features at this price, it's a must for everyone seriously interested in video programme production.

Finally (oops) a correction to my review of the Hitachi GP4/VKC750 colour camera last month. The Sony colour camera referred to was the HVC2000P of course.■

Vintage TV: The Baird Everyman

Vivian Capel

THE cost of a receiver in the early days of television amounted to a high proportion of the average income. Some models were not greatly different in price from present day ones, but incomes then were only around a tenth of what they are today. So sets were few and far between, and only the affluent could afford to gaze at the wonders on the 9in. screen in their living rooms. Thus it was that several manufacturers tried to beat the price barrier and bring TV to a much wider audience. For this purpose, sets cut down to the barest essentials were the order of the day.

A noteworthy example was the Baird Everyman. There were two basic models. The first to appear was the T29A, which was for use on a.c. mains supplies only. The reason for this was that a small transformer was used to feed the c.r.t.'s heater. The rest of the heaters were connected in series across the mains, with a dropper resistor, in the usual manner. The arrangement rather belied the name Everyman, since a number of areas then had a d.c. mains supply. So the second version, the T29U, appeared. This was fitted with a GEC 6505A c.r.t. instead of a Mazda CRM92, and as this tube had an 0·3A heater it could be connected in the series heater chain, dispensing with the transformer.

To call it a series heater chain is not entirely accurate since two of the valve heaters were connected in parallel. The valves concerned were the 20P1 line timebase valve and the 10P14 field output valve. The former had an 0·2A heater and the latter an 0·1A heater, so they could be connected in parallel in the heater chain. It was a bit risky however, since if one of these heaters went open-circuit the other would be considerably overrun. The rest of the valves would still be working, with the sound present, so there was the possibility that the owner would leave the set on to hear the rest of the programme.

The most interesting feature of the set however was the fact that it used only eleven valves, plus the c.r.t. This was before the days when multiple valves became commonplace, and in fact the only multiple valve was the 6D6 double diode (vision and sound detectors). The sets were of the t.r.f. variety, with three r.f. stages. One provided both sound and vision r.f. amplification, the other two providing sound and vision r.f. amplification respectively. Further saving was achieved by using the sound r.f. amplifier in the reflex manner – as an audio amplifier as well. All this meant that there was not a great deal of gain, but the sets were quite adequate for areas where the signal strength was reasonably good. The 6F12 pentode used in the r.f. amplifier stages was also used in the video output, sync separator and even the audio output positions, so the engineer needed to carry only a few valves to have a complete range for the set.

There were two versions of both models, one for the London region (channel 1) and the other for the Birmingham area (channel 4). The alignment of the latter version was rather critical, sound rejection in particular needing very careful adjustment.

Focusing

The standard method of focus adjustment, which eventually came to be used in almost all monochrome receivers, consisted of two magnetic rings on the neck of the tube. One was fixed while the other could be moved by means of a lever. It was quite common in very early sets to use a form of electrical focusing however, sometimes adjustable by varying the current through a focusing coil.

Two methods of varying the focusing were used in the Everyman. The main focusing was provided by means of a permanent magnet. There was also a fine focusing control however which varied the e.h.t. around the nominal value of 7kV. This was done by including a 200Ω potentiometer in the h.t. feed to the one-valve line timebase. Reducing the h.t. supply decreased the e.h.t. and also the line scan power. Since the deflection sensitivity of the tube is dependent on the e.h.t. however, the sensitivity increasing as the e.h.t. falls, the focus control had little effect on the width. To ensure that the height was not affected, the focus control also varied the h.t. supply to the field timebase.

Line Timebase

The line output stage circuits used in sets of the time were always comparatively simple. The single-valve line timebase used in the Everyman really did reduce things to a minimum however (see Fig. 1). There were three windings on the transformer (plus the e.h.t. rectifier's heater winding of course). The secondary provided feedback to the 20P1's control grid, and also drove the scan coils. A single *RC* time-constant network set the frequency (one or two extra components were added to this part of the circuit in some sets). The valve's screen grid feed resistor was also the sync separator's anode load resistor – the screen grid voltage was thus modulated by the line sync pulses. The usual overwinding fed an EY51 rectifier to provide the e.h.t.

Field Timebase

A rather more complex field timebase circuit was used (see Fig. 2), though there were circuit economies here as well. The two valves employed were a 6F12 in the blocking oscillator circuit and a 10P14 for the output. The charging circuit

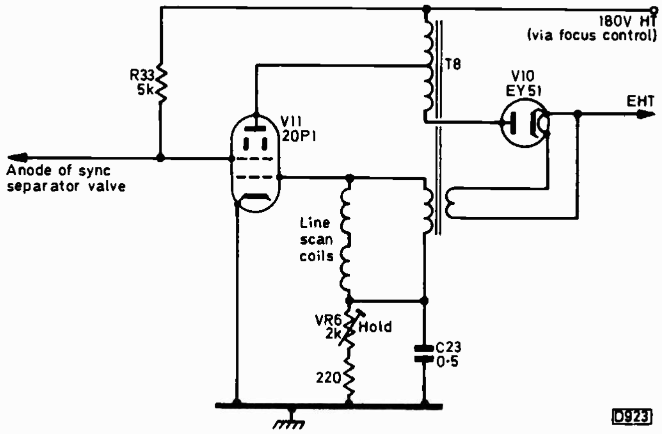


Fig. 1: The single valve line timebase used in the Baird Everyman. In addition to driving the scan coils, the secondary winding on the line output transformer T8 provides feedback to the 20P1's control grid. The self-oscillating circuit was synchronised by applying the line sync pulses to the valve's screen grid. There was no efficiency diode in this early form of line timebase, the output valve conducting throughout the scan while the flyback energy was dissipated as heat.

R27/C26 generated the basic field scan waveform, C26 being periodically discharged by the oscillator valve. The field hold control circuit consisted of just three resistors and a wire link to short out sections as required. The manual rather optimistically stated that "the frame hold is fixed before leaving the makers and will not normally require resetting". As engineers who were active in the trade in those days will recall, the field hold control was in most models the most likely one to need adjustment. In fact with some sets good interlace could be obtained only at certain critical hold control settings. Other sets would start rolling as soon as they warmed up, so that the control had to be set near the opposite limit of its hold range, the idea being that the set would drift into rather than out of lock! The danger of course was that the field would be out of lock when the set was switched on.

The field output stage also had some unusual features. Instead of an output transformer, the load consisted of a choke, the scan coils being connected between the valve's anode and cathode via the 100μF electrolytic C24. The height was controlled by means of a variable resistor in the cathode circuit. This didn't control the bias, since doing that would have affected the linearity as well. With the control grid returned to the top end of the control, the h.t. applied to the stage was being varied instead. Linearity was controlled by means of the 5kΩ variable resistor VR7 in series with the anode choke. This was not a user accessible control, being mounted underneath the chassis. The comparatively low value (150Ω) screen grid resistor R29 was returned to the valve's anode, so the valve was being operated as a triode.

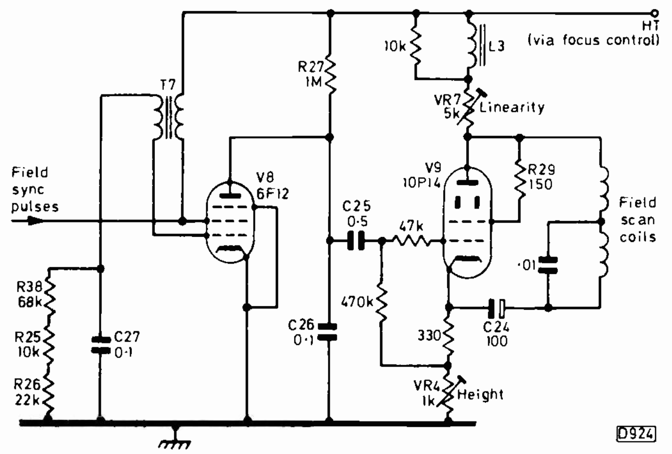


Fig. 2: The Baird Everyman's field timebase circuit. The network R38/25/26 forms a fixed field hold control, resistors being shorted out as required. The output valve is operated as a triode, with the scan coils a.c. coupled via C24.

All in all then the set was an interesting exercise in circuit economy. Given more modern valves, the count could have been further reduced. With a single field timebase valve, a combined video/sync valve, a stick e.h.t. rectifier and germanium diodes for signal detection, the count would have been little more than that of a contemporary radio receiver!

Service Notebook

George Wilding

HUM PROBLEM

The problem with an ITT hybrid colour receiver (CVC8 chassis) was a broad hum bar plus a pronounced hum from the speaker. This suggested either impaired smoothing or an open-circuit diode in the l.t. supply bridge rectifier. The 1N4001 bridge rectifier diodes all proved to be in order, so the next move, after taking the usual precautions, was to stab a 25μF electrolytic with long wire leads across each of the h.t. smoothing electrolytics. These range in value from 25μF to 200μF in this chassis, but if shunting a 200μF electrolytic with a 25μF one results in any diminution of the fault you can be reasonably sure you've located the culprit.

Before shunting the various electrolytics I checked with a meter to see which tags carried h.t. – discharging the test capacitor to an earthed point would produce a big and possibly damaging spark. While doing this I found a reading of about 11V on one of the tags under a multiple electrolytic can. This tag turned out to be the common earth one for the unit. The print path across the panel was followed and found to be terminated by a large soldering tag, and just touching this with the positive test prod produced some sparking. Anyway a touch with the soldering iron cured all signs of hum.

EHT FAILURE

The raster had suddenly disappeared on a Philips Model G20T300, leaving the sound unaffected. Failure of the e.h.t. of course, and the likely suspects were the line timebase valves, the boost capacitor C2064 and the line output transformer. On removing the back, we noticed a small solder blob near the top leadout wire of the boost capacitor, which is vertically mounted on the panel. This suggested that the line output transformer had almost certainly been changed recently and could be eliminated from the list of suspects. This proved to be the case, a new PL504 line output valve restoring the e.h.t. Now why did that solder blob give us a clue?

Well, if you can obtain only a very small spark at the anode of the PL504, the next step should be to remove the boost diode's top cap and see whether h.t. is still present at the anode of the PL504. If so, and in the event you'll probably get a hearty arc, then either the boost capacitor is short-circuit or, as happens quite often in these sets, there's a short between the secondary windings L5022/3 on the line output transformer and the primary winding. The easiest and quickest way of deciding which is at fault is to eliminate the capacitor – it's soldered at both ends to connection points on the i.f./line timebase panel, so you can simply cut the top leadout wire. If h.t. is still present at the PL504's anode, the transformer's insulation has broken down. It was clear then that someone had investigated a no e.h.t. fault recently and, having found that the boost capacitor was o.k., had resoldered its lead and replaced the transformer.

PICTURE DEFECTS

The picture on a Pye hybrid colour set was said to "go into lines" after about twenty minutes, while at other times it would tend to fade and become "fuzzy". On switching on, quite a good picture was obtained, but after some minutes the picture was suddenly blotted out by a black-and-white check pattern. The pattern looked as though a signal generator had been applied, but vanished within seconds. Ten minutes later the picture started to fade away, with at the same time a steadily increasing type of noise being superimposed on it – not the usual grainyness you get with inadequate aerial input, but more like minute horizontal streaks.

The nature of the noise suggested that it was subject to high amplification, implying a fault in the tuner or the first i.f. stage. The picture then improved, and within some minutes was tolerable. Well, the i.f. panel in these sets is extremely reliable, so it had to be the tuner. It's mounted on a small, easily removable panel at the side of the cabinet, so even I could change it reasonably quickly.

Changing varicap tuners with their five leadout wires and four lugs can be irritating and time consuming in some sets, so I usually get young Ian (the chip off the old block!) to do it for me. He can do it with incredible speed, and the secret of fitting the replacement is apparently first to repeatedly drive a stiff piece of wire through all the PCB holes. Then check that all the leadout wires are straight and parallel, and make sure that they are vertical, or if anything very, very slightly inclined towards the opposite edge of the tuner. You must now position the board so that you can see beneath the tuner. First fit one lug on the side nearest the leadout wires, insert the nearest wire in its hole, and continue along the board. If any wire is slightly nearer to the opposite edge than it should be, it can easily be pushed back and into its hole using a long, thin screwdriver. Don't waste your time, and risk repeatedly bending the leadout wires, by attempting to position the wires and lugs precisely and then drive the tuner home.

Anyway, the new tuner in the Pye set cured the symptoms and produced a fine, grain-free picture.

CURIOUS SYMPTOMS

The picture and sound on an ITT hybrid colour set (CVC8 chassis) would intermittently vanish, leaving a very strange visual display and only an unusual type of "vision buzz" from the speaker. The raster would become green, with no modulation or noise except for about six two-inch multicoloured bars near the left- and right-hand edges of the screen. The set might revert to normal operation within a few seconds, or remain in the fault condition for an hour or so.

Simultaneous loss of the sound and vision suggested a fault in the i.f. or a.g.c. circuitry. There are one or two fairly well known faults that occur on the signal side. The TAA550 voltage stabiliser i.c. for example can go short-circuit or develop less than the normal voltage, giving complete loss of signals (though sometimes sound from a foreign radio station can be heard). Then a faulty a.g.c. transistor (T41) or diode (D45) can result in an overloaded picture with weak or no sync. The clue in this case is incorrect voltage across the a.g.c. smoothing capacitor C114 (50μF). Neither of these faults would produce the bizarre symptoms present this time however.

A start had to be made somewhere, so we checked the voltage across C114. This should be 1V with no signal and about $-1 \cdot 1$V with an average strength signal. We measured several volts however, so clearly the a.g.c. circuit wasn't operating normally. Both the transistor and the diode were o.k., while replacing the gating pulse coupling capacitor C235 made no difference. This pulse comes from tag 4 on the line output transformer, so it seemed logical to remove the line output stage cover and take a look at the connections to the pulse winding. There are five tags in a row near the bottom of the transformer subassembly board – and all were almost bereft of solder! Resoldering all five tags restored normal results.

When discussing the matter with ITT, we were told that the most common cause of troubles in this area is when tag 3, the chassis connection to the pulse winding, is dry-jointed or open-circuit. The earthing wire from the transformer's subassembly board to a tag on the transformer's core fixing clamp can also be dry-jointed. In addition it's advisable to check the transformer assembly clamp fixing nuts which hold the transformer to the cage assembly.

TV Tussles

Nick Lyons

THERE are times when I seriously wonder whether TV sets have some inbuilt evil intelligence. You may think this a strange statement, but it's made after careful consideration of the evidence. Haven't you noticed for example how sets can smell a public holiday a mile off, then start dying en masse? Then a mere word of praise as to a set's reliability will immediately provoke clouds of smoke and pungent odours from within.

With all this in mind, it came as little surprise when after my last attack on Thorn sets the species launched an all out assault on me. I won't go into the full details, merely mention a couple of examples.

"The picture's dwindling away" the customer mournfully told me on the phone. On arrival the picture had dwindled to oblivion, and had clearly been en route there for some weeks. The set in question was a transportable fitted with the 1400 chassis. Off came the back and a PL504 with its top a most singularly pure white was revealed. In with another, switch on, and wait. Eventually a narrow picture with rather poor horizontal linearity presented itself, then dragged itself out to full width over the following two-three minutes. Changing the PY801 boost diode improved matters, but the line oscillator's frequency moved around quite a bit once the set had warmed up, so in went a new 30FL2 as well.

Problem with a Plastic Case

I'll digress at this point to tell you that when a set's at a convenient level with the back off I frequently lift it by putting my hand under the back edge of the top. It's very easy to lift a set an inch or two off the bench in this way, and to swivel it around to look at the back or the front.

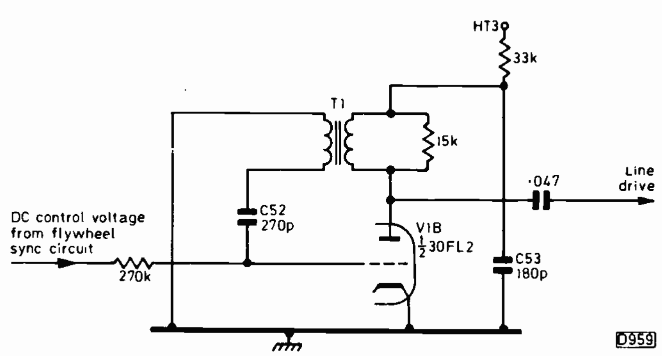


Fig. 1: The line blocking oscillator circuit used in the Thorn 1500 chassis. The weak spot here is the charging capacitor C53, which can cause intermittent line tearing when leaky.

With some sets, such as the Thorn 1400 under consideration, there's a handle on top to make this easier still. So I was rather astounded when, after fitting the new 30FL2, I picked up the set to swivel it around and look at the picture and, with the set half way round, there was this distinct crash. The set had fallen the two or three inches to the table top. Butterfingers you're thinking. Well, not quite, because I was still holding the top part of the set. The rest of it had now assumed a more stable, though fractured, pose on the table – the case looking like a half peeled banana. And all this in front of the customer!

What else to do but dive into the tool box in search of Araldite? No luck of course. But the customer, when he'd recovered from shell shock, managed to produce a tube of Bostik, with which I hastily glued the thing back together. Mercifully it had come apart at the joints only – the so-called dovetails that hold the top on – and when the repair was completed you couldn't see the join.

Explosions

I supplied another customer, a noted bad payer, with a reconditioned 1500 on the cheap. So I was a little wary when she called to say that it had blown up. I replaced the offending mains filter capacitor, but was told it couldn't possibly be that as the set had gone off with such a loud bang. I switched the set on, and it produced a picture. Then, just as I was about to leave, the line oscillator dived off lock and next ceased to oscillate at all.

"I told you" she moaned, then repeated the description of the Hiroshima like explosion the set had apparently produced. The PL504 was now overheating of course, and an Avo connected to its control grid confirmed the lack of line drive. The anode of the line oscillator mustered just 2V, due to the 180pF charging capacitor C53 being virtually short-circuit (see Fig. 1).

The Rediffusion Mk. I Chassis

So much for Thorns then. The Rediffusion Mk. I chassis is not something you very often find in private ownership, and those not connected with Rediffusion might find it a little strange. I've only recently inherited a pair of them, and hope that my follies when trying to recondition one of them may serve as instruction for others. The basic problem was that the set had more than one fault, and that I kept making dubious assumptions.

For those not familiar with the chassis I should perhaps first outline the basic features. It's a hybrid design, with just two valves (PY500A and PL509). Most of the rest of the circuitry uses discrete transistor stages, there being only one chip (TBA750 for intercarrier sound). There's a mains transformer for the l.t. supply and the valve and tube heaters.

So now to the reconditioning exercise. Switch on and get sound (lovely tone – two speakers and a tone control) but not much by way of a raster, though the e.h.t. rustled up. Find internal preset brightness control, on timebase board, but adjusting this produced no more than a mid-grey, totally unmodulated raster (it sets the bias applied to the c.r.t. grids). Next, my first mistake. The RGB output transistors are all of the BF337 variety, fed from the 200V h.t. rail via 6·8kΩ load resistors. I measured the collector voltage of each using, second mistake, an Avo. There was 200V or so at each collector. First misleading and time-consuming assumption: there must be something wrong with the drives. Much fruitless stabbing around was undertaken before I did what I should have done in the first place – get out the scope. On looking at the output stages, all was revealed. There was no h.t. at the collectors at all! So what was the 200V the Avo stubbornly displayed? The scope revealed this also – a great line rate pulse of about 600V amplitude. If I'd looked at the circuit more carefully I would have foreseen this. There's feedback clamping in the RGB driver/output stages you see, and the Avo was simply giving average value readings of the clamp pulse voltages. The moral I suppose is to spy out the territory first, and to treat meter readings with suspicion where pulses abound. In the event, all that was wrong was that the 1·2kΩ power resistor R602 was open-circuit, removing the 200V h.t. line.

Having replaced the power resistor (R600 + R602) we were rewarded with rather a nice picture – but in monochrome. After my initial dismal efforts however I felt that tea was in order, and decided to take advantage of the monochrome picture to set up the convergence. Anything to avoid getting into a tussle with the decoder. The convergence set up very well, and as the tea ran out I'd no more delaying tactics.

I must have convinced myself that something complex was wrong, because instead of simply going through the chroma circuits with a scope I resumed picture diagnosis. Weak colour could in fact be obtained by careful tuning and turning the colour control to maximum. So a considerable time was spent setting up the decoder. Almost adequate saturation was obtained, but with the colour control still flat out.

Bring out the scope again. Pin 6 of module 4 on the i.f. strip (chroma take-off point) showed a healthy chroma envelope, as did TP12 (collector of the second chroma amplifier) on the decoder board. The same could not be said when the check was made at the collector of the third chroma amplifier transistor TR205. In fact the transistor had failed. It's a BF194, but I never have any of these. So a BF597 went in instead and proved to be an excellent replacement – vast levels of chroma were now available, and my problems were at last at an end.

The picture quality that can be obtained on these sets is good – the equal I'd say of my favourite of the era, the ITT CVC5 chassis. "In house" components are not generally used, good quality, well known semiconductor devices being the order of the day. BF337s, BF194s, 1N4148s etc, making replacements simple. The chassis doesn't seem to rely desperately on the parameters of particular devices however, and seems to be very tolerant of any substitutions that are made. This is not true of some chassis, and is important I think with sets of this age, since the fewer the components that have to be kept in stock the cheaper the sets are to repair and the less likely you are to end up with unwanted bits and pieces when the sets are eventually scrapped.

The construction of the set is reasonably good, though there are many panels dotted about at various levels and angles to one another. This is not as bad as it sounds, since the boards are for the most part easy to get at, and unclip and unplug for easy swapping about. The hardest bit to find is the power supply. It's behind the main chassis, which must be removed for easy access. There's a cut out in series with the mains fuse: it carries the line output valve's cathode current, operating when the line output stage is overloaded. There were various versions, some standard aerial ones, others video monitors and CATV ones for carrier distribution systems.

Editorial note: Some fault notes on this chassis were published in a letter in our December 1978 issue (page 72). ■

Long-distance Television

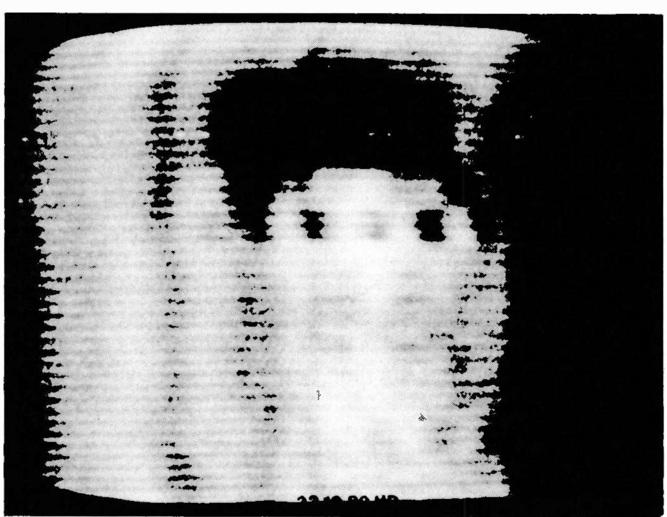
Roger Bunney

THE events since the last column was written have certainly been dramatic! Australian ch. A0 signals have been received in the UK on several occasions, and there's a suggestion that New Zealand ch. 1 may have been received just above the noise.

The day after the last column was posted to the magazine Hugh Cocks rang to report that weak line syncs were visible on ch. A0 (this was at 0825GMT on October 28th). Here at Romsey unfortunately considerable Russian interference meant that only the basic sync information was visible. There was sufficient however to confirm the presence of a video signal. The programme content subsequently noted at Hugh's E. Sussex location consisted of a newsreader. Information that Anthony Mann has sent suggests that the signal was from ABMNO (Wagga Wagga, NSW). Channel A0 was received by Hugh on the 1st, 3rd and 21st of November during the morning period, and a definite identification of the new Australian ethnic service was achieved – a light entertainment programme in French.

My own pièce de résistance during the period occurred on October 29th, when a weak vision buzz, i.e. the vision carrier, was logged at an aerial heading of NEN at 0855GMT on 42·25MHz – the New Zealand ch. 1 allocation. The signal was audible only on a narrow-band radio receiver, attempts to display the video using a narrow-band TV receiver proving fruitless – all efforts were nullified by very strong adjacent frequency Russian communications signals. The 42·25MHz signal was steady but just above the noise level. It was present for some fifteen minutes, then faded – it hasn't been logged since!

Though Hugh Cocks is only some 100 miles to the east of my Hampshire location, we often find when comparing logs that particular signals varied considerably in quality (and even presence). Russian ch. R1 F2 signals for example generally rise above the noise earlier at my location, which is farther from the transmitter site, while the fade out times at the end of an opening also vary.



Reception of Chinese TV in Holland? This Asiatic newsreader was received by Henny Demming on ch. R1.

Russian F2 signals were less active during November than during the same month last year. During some periods, particularly after the middle of the month, nothing was present on ch. R1. Generally the openings have started later than in 1979, with earlier closing down. On October 29th there was F2 reception up to ch. R2 vision, and for the first few days during November reception from Russia was good. Farther into the month reception became erratic.

On the 15th there were strong Russian ch. R1 and Dubai ch. E2 signals. F2 reception improved again on the 21st, with ch. R1 and ch. A0. The long awaited ch. A2 System M signals from N. America first appeared on the 25th – at Hugh Cock's location for two minutes at 1555GMT. They were preceded by an odd audio signal, CBC (Canada) at 50·7MHz. This is 4·5MHz *below* the ch. A2 vision carrier – the sound should be at 59·75MHz! Unfortunately 50·7MHz is saturated with interference here at Romsey. The 26th however was better for me, with two audible 55·25MHz carriers just above the noise level producing a difference beat of about 4kHz. The video couldn't be locked however due to the marginal signal level. What was very evident was a blockbusting Canadian amateur, V1ABX, calling CQ on the American 50MHz amateur band during the afternoon period.

F2 reception has been widely reported by readers, Cyril Willis (Ely) getting his first sight of Gwelo ch. E2 (Zimbabwe) on October 28th.

Sporadic E propagation also had its moments during the period, specifically on the 3rd, 16th, 18th and 20th – with sustained signals from RAI (Italy) on the 16th. There were also two small tropospheric openings. Signals were received from Switzerland and Germany (both East and West) on November 1st, in Band III and at u.h.f. Activity was noted around midday in the south and south east of the UK. The second opening was on the 20th, with a greater number of Swiss and German signals, DFF (E. Germany) being particularly prominent. The opening was widely reported throughout southern and eastern England.

The Leonids meteor shower produced signals during mid-November, with sustained Band I signals on the night of the 14th. Andrew Tett (Surbiton) received signals from as far as DFF, ch. E34. He's troubled with very strong Crystal Palace signals, requiring considerable filtering to minimise cross modulation from adjacent channels.

Conditions overseas have been excellent. Sustained F2 and TE (transequatorial skip) signals have been received in S. Africa, with openings lasting for many hours on many days, the signals at times being as high as chs. E4 and R2. David Maden (Vereeniging) received RTVE (Spain) chs. E2 and 3, RTP (Portugal) chs. E2 and 3, and RTVE Izana (Canary Isles) ch. E3, plus heavy interfering signals on chs. R1, 2 and E4. The openings sometimes commenced in the afternoon (around 1530) and continued until well after the local sunset (2200).

Anthony Mann (Perth) and Robert Copeman (Sydney) in Australia have been logging Chinese ch. R1 signals, while on the 6th and 8th of November, during the period 0900-1030GMT, Anthony received ch. B1 sound and vision. He notes that when the BBC ch. B1 audio or the TDF (France) ch. F2 audio is received after 1100GMT it has a characteristic TE flutter.

Solar activity was particularly high during the first week of November, with a count of over 300 on the 6th.

News Items

USSR: A ch. R33 transmitter for the fifth programme, which is due to start in 1983, is being installed at the

Ostankino Tower in Moscow. The first programme is also to be transmitted at u.h.f.

W. Germany: Alexander Wiese comments that with the opening of BFBS-TV in W. Berlin there are now transmissions on five different standards in the city – systems B/G PAL, I PAL, L Secam, G Secam and M NTSC. The Canadian forces are likely to have their own TV service later this year.

Belgium: Dieter Scheiba reports irregular pirate TV transmissions on ch. E22. The video quality in the Brussels area is good.

Australia: As reported last month, the new ethnic/multicultural TV service has started in the Sydney and Melbourne areas, on chs. A0 and 28. Robert Copeman points out that the Sydney ch. A0 vision carrier frequency is offset at 46·26MHz. F2 DXers note!

USA: The Satellite Corporation of America is proposing a multi-channel direct transmission system to home viewers, operated on a subscription basis. Two channels would be used for nationwide coverage, with a further two channels serving selected areas via spot beams. Subscribers would rent/buy a decoder to unscramble the coded video. Receiving units with 1m dish aerials are suggested. Thanks to Brian Fitch for this information.

Satellite News

The Anglo-Swiss Telsat group hopes to start a satellite TV service on January 1st 1984, two launchings for the craft having been reserved. The venture is a joint British (45%) and Swiss (55%) one. Initially services in German, French and Italian are planned. "Excellent" reception should be possible in Switzerland, France, the Netherlands, Austria, most of Germany and North Italy, while considerable interest has been expressed in Holland/Belgium where there are extensive cable systems. Three of the Swiss channel allocations in the 12GHz band would be used. The RTL (Luxembourg) satellite, about which there's been considerable speculation in recent months, is likely to be delayed until the late 80s.

From our Correspondents . . .

Mike Allmark (Leeds) has received many signals of all types during the past few months – signals from most of Europe, and recently from Russia and the UAE via F2. The fine test grid he's seen during afternoons to the south on ch. E2 comes from Ghana! During the excellent October tropospherics he received ORF (Austria) at u.h.f. – possibly a record distance. On June 30th on ch. E3 he observed a cartoon film and a second programme – the presentation of diplomas – on ch. E3. These signals were also received by Ryn Muntjewerff (amongst others) in Holland. The diploma presentation was by King Hussein via Jordan Television, Amman, while the cartoon film came from the Dhahran Aramco transmitter in Saudi Arabia. The latter station, often known at HZ22, recently changed from system M (525 lines) to system B (625 lines).

Gareth Price (Isleworth, Middlesex) has constructed an impressive wideband log-periodic array covering Band I through to Band III. We hope to see an article on it in the magazine in due course. For u.h.f. he uses a Vorta VPX22 wideband array. He visited the far east during October and reports that Malaysia uses the PM5544 test pattern on both networks, with no identification. The letters "RTM" are shown between programmes and during the news. When programmes are networked however two clocks are shown side by side, since part of the country is half an hour ahead of the rest (GMT $+7\frac{1}{2}$ and +8 hours). The Singapore card (the PM5544 of course) has "SBC COLOUR" across the bottom – transmissions are in Band III only. Thailand uses System M and System B PAL, with no duplication of services on the two standards. In Bangkok an extra sound channel is available in Band II – this is often used to transmit the original sound track of a film that's been dubbed into Siamese. Dual-standard receivers with 14-channel turrets are available in the System M areas. On November 2nd, Gareth received G4CRJ using an ELC2060 tuner and his Vorta aerial.

T. S. Nanda Kumar (Madras, India) has had great success with Band I DXing. Various Indian and Pakistani stations have been received, plus Dubai and suspected Thailand.

Petri Pöppönen (Finland) received a ch. E2 signal via F2 on November 7th at 0935, possibly Malaysia. The blank PM5544 pattern, with no VITS, was followed by a programme at 1000GMT. Considerable F2 backscatter has been noted on ch. B1 – severe multiple images etc. Nicholas Brown's July 14th reception (see November column) has been confirmed as coming from Finland – "Hetkinen" means "just a minute please". J. Abbott (S. Africa) has received the Russian Stat T satellite (714MHz) using a 5ft diameter dish aerial with a head amplifier featuring 38dB gain and a noise figure of only 1·8dB. I'm hoping to devote some space next month to S. African reception of the satellite's 714MHz signals. Finally, Henny Demming (Holland) has sent in a large quantity of photos of F2 reception. Included are several of Asiatic newsreaders. These were received on ch. R1, at 0900-0912GMT on October 22nd, and are suspected Chinese signals.

Amateur TV

Our mention of amateur TV activities in the 430MHz band produced quite a response. ATV transmissions lie within the spectrum 434-440MHz, with the vision carriers at 435 or 436MHz, and are often to the full PAL specification. Activity is rather sparse unfortunately, with pockets of active amateurs in London and the South East, East Anglia and the Birmingham areas. When conditions are good, signals from French, Belgian, Dutch and German amateurs may be picked up, with the call signs starting F, ON, PA and D respectively. The ELC2060 tuner will tune directly to 430MHz, as will receivers in the Bush TV161 series. The ELC1043 and ELC1043/05 tuners can easily be modified to cover the band.

A new ATV handbook is in preparation, and I hope to review this shortly. Specialised aerials for the 430MHz (70cm) band can be purchased, but some domestic aerials, such as the Wolsey Colour King, give reasonable results at these frequencies. Activity is irregular however and is most likely to be noted at weekends (if you know that a pocket of ATVers is not too far off) or during a tropospheric opening.

Our thanks to the editor of the British Amateur Television Club journal for the above information. Enquiries about membership of the BATC should be sent to Mr. B. Summers, 13 Church Street, Gainsborough, Lincs. – with an SAE please.

The JVC Model 3040UKC

In the August issue last year I reviewed the Panasonic Model TR5030G, a small-screen dual-standard receiver offering scope for DX use. I propose to review two other sets offering similar facilities, the JVC Model 3040 this month and the Plustron Model TVR50 at a later date. Our main interest in reviewing these sets is to report on their suitability for TV-DXing in simple installations.

The JVC 3040 is a 5in. v.h.f./u.h.f. receiver with switching between System B/G sound (5·5MHz) and System I sound (6MHz). Coverage of the v.h.f. Bands I and III is provided by a varicap tuner, a mechanically tuned three-gang tuner covering u.h.f.

The JVC set is more attractive and convenient to operate than the Panasonic one, with the variable tuning controls for both tuners accessible on the front control panel. The band-switching and volume controls are also forward facing, likewise the loudspeaker. The v.h.f. tuning scale is circular and clearly visible, the ch. E2-4 spectrum covering 150° of the scale and chs. E5-12 a further 180°. The u.h.f. tuning calibration is visible through a small window, with channel number indications every two channels.

Attractive though the JVC set is, its suitabilty for TV-DXing is questionable. The gain at u.h.f. is good, the tuner's i.f. output passing via the v.h.f. tuner to the two-stage i.f. strip. At v.h.f. however the two i.f. stages do not provide sufficient gain to make the set suitable for DX use (something it wasn't designed for of course), particularly since the small number of tuned circuits make for a relatively unselective bandpass characteristic. As a result, there's considerable adjacent channel interaction – when for example ch. E2 and R1 vision carriers are both present. The lack of gain at v.h.f. could well lead to the unwary using a preamplifier, which would cause a further deterioration of the adjacent channel performance. The system switching introduces an 11·5MHz oscillator for 5·5MHz operation – its output is fed to a 6MHz tuned circuit, creating a 5·5MHz difference frequency.

Strangely, there's no brightness control, the screen illumination being adjusted by means of the high-level contrast control, which of course affects the video gain.

The aerial input to each tuner is via external screw terminals. The input impedance at v.h.f. seems to be 75Ω unbalanced (though no indication of the chassis connection is given), but at u.h.f. is 300Ω balanced, i.e. intended for use with ribbon feeder. So for optimum performance at u.h.f. the correct (300/75Ω balanced/unbalanced) transformer must be used (it can be obtained in the UK), while for v.h.f. use the correct chassis connection for the screen of the coaxial cable must be determined.

Field and line synchronisation on weak signals is good. The set can be operated off dry cells (nine 1·5V HP2 etc.) which fit in a compartment beneath. A whip aerial is fitted on the upper side of the case, with a spade terminal connection emerging adjacent to the rear aerial connection terminals.

The basic version of the set has little to recommend it for DX use at v.h.f., though it does have potential at u.h.f. (assuming that an aerial input matching transformer is used). The lack of a separate brightness control is a decided handicap.

In conclusion then, the 3040UKC receiver we tested is suitable for normal domestic use and, with reservation, for u.h.f. DX work. With modification, say an additional i.f. amplifier (this would certainly make it a "hot" u.h.f. receiver) and the addition of a rear mounted brightness control, the receiver could be a useful feature in a DX-TV installation, particularly as the tuning controls are well placed for easy operation. The use of a wideband i.f. system for DX reception presents problems however, as I've pointed out in the past (see the August 1980 column for example, page 556). Anyone buying one of these sets with a view to DX use should bear these shortcomings in mind.

My thanks to JVC for supplying a set for test and evaluation.

Test Report: Thandar PFM200 Digital Frequency Meter

Eugene Trundle

ONLY a few years ago a frequency counter would have been considered to be an expensive and fussy laboratory instrument with no business on the service workbench. The situation has been changed by the all-conquering silicon chip, which has now come up with inexpensive and accurate digital counters. Of those currently available, we selected a Thandar (Sinclair Electronics Ltd.) PFM200 for evaluation.

Frequency Meter Applications

Some of you may still regard a counter or frequency meter as an expensive luxury in the radio and TV workshop. With the exotic équipment we are called upon to service nowadays however such test gear finds many applications. Here are some of them:

Setting up the tape speed in audio tape recorders and decks, in conjunction with a standard test tape.

Checking local oscillator frequencies in a.m. and f.m. superhet receivers.

Setting transmitter frequencies for amateur radio, model control, etc.

Adjusting infra-red and ultrasonic remote control transmitter and receiver units. These are very widely used in TV sets nowadays, and the idea of remote control is beginning to spread to certain makes of audio equipment.

Setting up timebases and subcarrier oscillators in TV receivers.

The applications for a frequency counter with VCRs include setting the f.m. deviation for video record f.m. modulators, the carrier frequencies in the colour signal processing circuitry, and the capstan speed. With VHS machines, the final check on the capstan speed consists of verifying a 3kHz tone on the VHS video test tape.

Calibrating and checking test equipment and signal sources.

Identifying quartz crystals.

Checking the clock frequencies in computer and other digital circuitry.

The PFM200

In appearance the Thandar PFM200 looks rather like a large pocket calculator. In place of the keypad there's a single four-position slider switch which sets the gate time or sampling rate and a single slider switch for function setting. The readout consists of an eight-digit LED display which indicates the applied frequency in kHz, with automatic digital point placement.

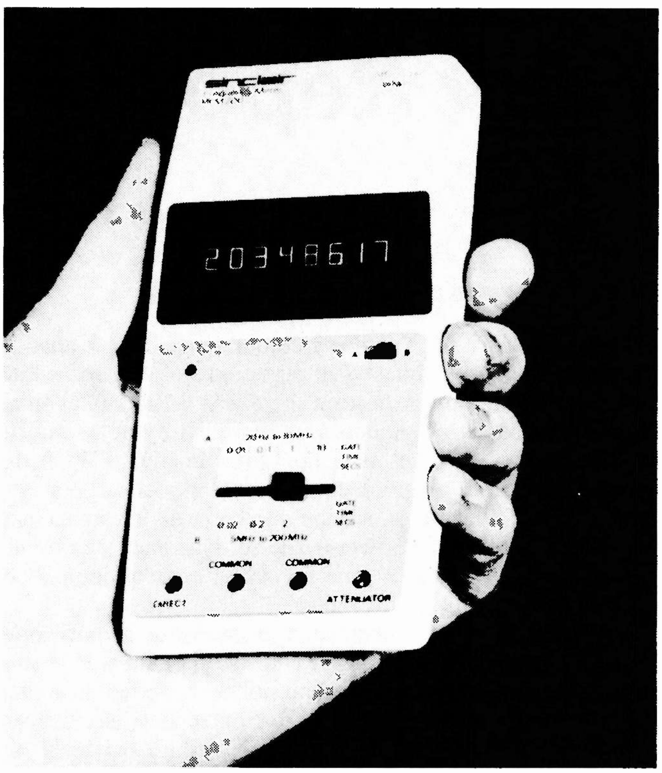
A very wide frequency range (20Hz to 200MHz) is covered without range switching apart from the two-position function switch. The sensitivity is typically 10mV, with a safe input level approaching 1kV at frequencies below 1kHz. Accuracy, the most important factor in a frequency counter, is typically $\pm$ 2 p.p.m./$\pm$ 1 count, a very acceptable figure. The instrument is portable indeed, weighing less than $\frac{1}{2}$lb (200gm) and being powered by a PP3 type battery (operation from an a.c. adaptor is possible). Test leads are provided, along with an operator's manual and a protective wallet.

Inside the PFM200 there are four i.c.s and nine transistors. The circuitry is based on a 10MHz crystal clock oscillator, a 28-pin jumbo chip containing all the counters, timebases, decoders and drivers for the LED display. With the low signal levels and "quiet life" that this sort of instrument enjoys, electrical failure is unlikely and a long trouble-free life can be expected, provided that care is taken in handling it and that expired batteries are removed.

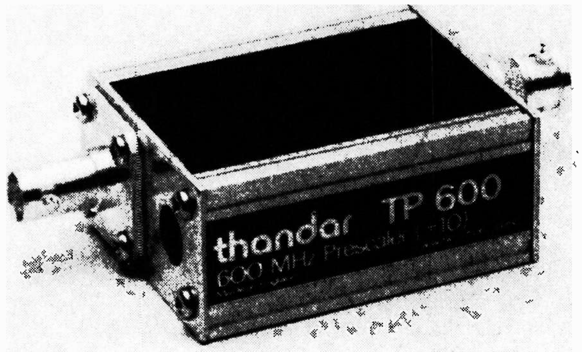
We were sufficiently convinced of the virtues of the PFM200 to purchase one for the workshop. This has enabled us to evaluate the instrument at leisure, with no deadline for its return.

In the general mêlée of television field servicing a counter is seldom required. In other electronic fields it could be an important tool – for the mobile man concerned with transmitters, data links and industrial electronics for example. It could also we imagine be a boon to the friendly Post Office engineers who minister to radio amateurs and trace interference for radio and television users.

Many applications were found for the PFM200 in the workshop – in the audio, video and TV departments. On receipt, our first action after fitting a battery was to connect the meter to the best frequency standard we know – the locked reference oscillator of a working colour TV set. Up came the display at 4433·617 – not bad at all! A slight tweak of the calibration trimmer brought up 4433·619, and this calibration has held steady over a period of six weeks to date. Tongue in cheek we then used the instrument to check



The Sinclair/Thandar PFM200 digital frequency meter.



The Thandar TP600 frequency prescaler can be used to extend the upper frequency limit of most frequency meters, including the PFM200, to 600MHz. The sensitivity is better than 10mV r.m.s. and the suggested price £37·50 plus VAT.

the parameters and calibration of some of our workshop test equipment – and discovered some surprising and embarrassing inaccuracies (in the equipment, not the PFM200!).

The instrument works basically by counting the zero crossings of the test waveform, and it's important to bear this in mind when checking sources containing beat frequencies or heavy harmonic distortion. It would be a bit naïve for example to connect the counter to the i.f. input of the working envelope vision detector of a TV receiver and expect to see a readout of the i.f. at 39·5MHz without further filtering. We found generally that it helped to know in advance roughly what frequency was to be expected.

Many of the applications we found for the counter didn't call for anything like the full accuracy of the instrument. For these a shorter gate time can be selected, giving the advantage of a quick settle-down time. Many short cuts were discovered in applications where equipment manufacturers' setting up procedures were based on the assumption that a counter was not available. This has resulted in much time saving. When looking at low-level signals from a high source impedance we found that an oscilloscope type 10:1 probe was useful in reducing circuit loading and avoiding misleading readings, though this type of probe will not work up to the counter's full 200MHz capability. Since its arrival in the workshop the counter has been much in demand, spending its time shuttling between the TV, audio and video sections.

We found our instrument better than its sensitivity specification at 1kHz, and at the other end of the scale we were quite happy to plug the test prods straight into the mains socket. Donning our executioner's hat, we next subjected the poor little counter to a source of 800V line flyback pulses, using the attenuated input. We were rewarded by a rock-steady reading of 15·625kHz with no signs of distress.

If the instrument is in fairly constant use in the workshop a suitable a.c. adaptor would probably pay for itself – PP3 batteries must be about the most expensive form of energy going in terms of pence per milliampere-hour, and the current consumption of the PFM200 (20-60mA) is rather hard on these little batteries if used for prolonged periods. Most of this energy is spent lighting the LED display, which is perfectly readable even within a foot of a 100W bulb and reflector. The visibility is aided by a tilted display and purple filter, the viewing angle being wider than that of a pocket-calculator readout.

Conclusion

Nobody could say that a 200MHz counter at under £60 is not good value for money! The Thandar PFM200 seems to be a very good counter, though we must admit that our previous experience of digital frequency meters is rather limited. An LCD display would have reduced the battery consumption considerably, but no doubt there were good reasons for adopting the LED system. The frustration and time we've saved since investing in the PFM200 is considerable, and we regard it as money well spent. The PFM200 is available from Thandar stockists at £57·27 including VAT.■

Fault Report

Derek Snelling

TANDBERG TROUBLES

The problem with a Tandberg colour set (CTV2-2 chassis) started a few weeks back. The report was of reduced width, and sure enough on inspection there was a 1in. gap at either side of the screen. This could be removed by adjusting the width control, which sets the bias in the EW raster correction circuit. A quick check on the associated resistors revealed nothing amiss, so the control was left at its new setting. A week later however the set was back again with the same fault, and this time the width control couldn't be adjusted for a full width picture.

Nothing amiss could be found in the width circuit, so we thought maybe the line output transistor's gain was low. A new line output transistor had no noticeable effect however, so the transistors in the EW raster correction circuit were checked. This got us nowhere, so rather belatedly we checked the e.h.t. – the height was normal, but the field scan tracks the e.h.t. since the supply for the height circuit is obtained by rectifying pulses obtained from the line output transformer. On switching on again, the e.h.t. went off the scale (over 30kV). I switched off hastily and wondered what X-ray dosage I might have received. What could be wrong? The h.t. was correct, so the next thought was that maybe the flyback tuning capacitor C754 was doing something funny – I remembered from a lecture I'd attended that it was a special component. Anyway, a replacement cured the problem, and it's worth noting that only the correct type, obtained from Tandberg, should be used. In fact it's several capacitors in one, hence the width reducing in stages.

A week later another of these sets came in. This time the card said "set dead". Switching the set on produced loud arcing noises from the back however. Not exactly my idea of "dead", so we hastily switched off. Next we switched it on and off briefly whilst looking in the back, and noticed flashes from the power supply can. A ha! I thought, a dry-joint in the power supply (it's happened to me a couple of times). Now in this chassis the power supply is enclosed in a metal can, which is fixed with awkward non-standard screws with vaguely hexagonal heads. They usually call for the use of a pair of pliers. A five minute struggle revealed the power supply – but no sign of arcing.

Another brief switch on revealed the awful truth. What I'd taken for arcing in the power supply had in fact been a reflection in the metalwork of arcing higher in the set – coming from the scanning yoke in fact. Very unusual.

Removal of the blue convergence segment revealed a small burnt patch and, worse still, a corresponding hole in the neck of the tube. Luckily the customer had a four year tube guarantee, with six months left, so all we had to do was to persuade the manufacturer that the broken tube neck was not the result of a blow with a blunt instrument.

The replacement tube arrived four weeks later, and in it went together with a new convergence segment. Switching on produced a few loud bangs followed by a high-pitched buzz/whistle. This sound meant either a heavy load on one of the outputs from the power supply (it's of the blocking oscillator chopper type, as in the Rank T20 chassis), or a fault in the power supply itself. The latter proved to be the case, so two new transistors and a new trigger thyristor were fitted.

I decided this time to power the set from a variac, slowly increasing the mains voltage whilst monitoring the line output stage h.t. and e.h.t. supplies. By the time the h.t. had reached 100V (the normal line output stage h.t. voltage is 160V), the e.h.t. had already risen to 25kV. The cause of the original tube failure was now clear – excessive e.h.t. – and remembering the previous set a new flyback tuning capacitor was fitted.

This cured the basic problem, but a glance at the screen revealed a bright raster with flyback lines. Obviously the arcing had damaged other components. So we checked the RGB output stages, where we found the red output transistor short-circuit. We also found the TBA530 matrixing i.c. faulty. These were replaced, but on switching on the only noticeable difference was a slight picture in the background. In an effort to reduce the excessive brightness, the beam limiter and c.r.t. first anode controls were turned to minimum, producing a viewable if slightly bright picture.

At this point the height began to decrease, and a wiff of smoke came from R816. This is the surge limiting resistor (47 Ω) in series with the rectifier (D806) which produces the negative supply for the height circuit. D806 was short-circuit. Replace D806 and R816. Switch on once more and closely inspect the picture. Lack of width, pincushion distortion, and severe convergence errors. Adjustment made no difference, and in the end we cleared the first two problems by replacing the EW modulator driver transistor Q853 (2N5298) and the latter one by replacing all four transistors in the R/G vertical convergence circuit (the set has a 110° delta gun tube).

This left me with the "minor" problem of excessive brightness. The first anode voltages were correct, and the matrix i.c. had been changed earlier. This suggested something amiss in the luminance/beam limiter circuits. Unfortunately the circuit gives few voltages in this area, so that fault-finding is not easy. I decided that the TBA500 luminance i.c. was the most likely suspect, since i.c.s are rather susceptible to high-voltage spikes. Not this time however: all the voltages were substantially correct. So out came the scope, which revealed that the signal was being lost somewhere around the i.c. Perhaps the beam limiter, which acts on pin 6 of the i.c., was responsible? A closer look in this area revealed that R248 (15k Ω) was open-circuit (see Fig. 1). This would result in the c.r.t.'s grids being at a much higher than normal voltage. There's a moral here of course: when dealing with excessive or inadequate brightness, don't forget the tube's grids.

So there it was. After replacing R248 we had the set working correctly. But why the failure of C754 had on this occasion produced such dramatic results compared to the earlier occasion remains open to speculation.

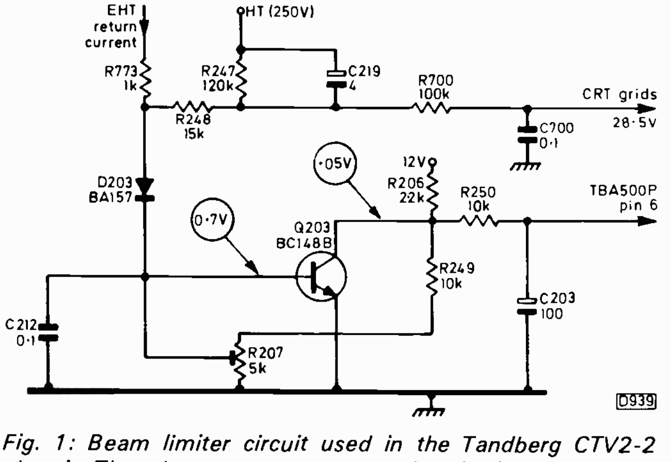


Fig. 1: Beam limiter circuit used in the Tandberg CTV2-2 chassis. The e.h.t. current returns to chassis via R773, D203 and R207, D203 being forward biased via R247 and R248. There are two modes of beam limiting. Transistor Q203 senses the voltage at the slider of R207. If this swings negatively, Q203 will begin to turn off, applying beam limiting to pin 6 of the TBA500P luminance i.c. This reduces the contrast, then the brightness. Should the beam current exceed the bias current flowing via R207, D203, R248 and R247, D203 will cut off. The beam current will then flow via R773, R248 and R247 to h.t., and the voltage at the junction of R248/7 will swing negatively. This negative voltage is applied to the c.r.t. grids via R700, thus reducing the beam current. R207 should be set for 1·1V across R773. This is equivalent to an average beam current of 1·1mA.

EW FAULTS ON THE G11

Just recently I've been plagued by Philips/Pye G11 chassis with EW raster correction faults. They fall into two categories: the easy ones, where the fault is due to a dry-joint on the modulator transformer L3137 (usually pin 3) or failure of the EW driver transistor T2150 (BD238) on the timebase panel, and the ones you get on the twelfth floor of a block of flats (that's where I encountered the next one anyway). A quick check showed that T2150 was short-circuit, and thinking that this would be all that was required I replaced it and switched on. The new transistor lasted a few seconds, then failed, accompanied by the smell of burning. Oh dear.

The burning smell seemed to come from the line output stage panel, and a quick check here revealed that L3134, which is in series with T2150, had melted, while the modulator transformer L3137 looked a bit charred. I didn't have either with me of course, so back I came next day. Replace T2150, L3134 and L3137 and switch on. Lack of width and another dead T2150. Check the diodes in the modulator circuit, and discover that D3132 is short-circuit. I didn't have one, but I did have a replacement line output panel – twelve floors below in the car. In due course the replacement panel was installed and yet another BD238 was fitted, and the fault had been cleared. Back to the workshop with the faulty line output panel.

D3132 was replaced and with the panel on the bench a dry-joint was spotted on pin 14 of the line output transformer. After repairing this the panel worked satisfactorily. I've had the problem three times since and, whilst L3137 usually survives and D3132 doesn't always go short-circuit, L3134 always melts, T2150 always fails – and there's always a dry-joint around pin 14 of the line output transformer (usually on the wire link connecting the transformer to C3128). So it pays to resolder these joints when working on the line output panel.

Finally the other diode (D3133) in the modulator circuit often goes short-circuit, blowing the 1A h.t. fuse (FS4037). Unfortunately it usually blows T2150 as well.

Two-channel TV Sound

Harold Peters

COMING close on the heels of a superlative "Last Night of the Proms", which was "simulcast" to give stereo sound, Pat Hawker's November 1980 article on "Developments in TV Sound" has stimulated enough interest for some readers to want to know more about two-channel TV sound. Let's first recap on the basic requirements that have been laid down, and on the four techniques that have been developed to date.

The requirements are first that the quality of the sound should be to high fidelity standards – of the order expected from LP discs and v.h.f./f.m. radio, i.e. a flat frequency response to 15kHz. Secondly that in addition to stereo sound it should be possible to use the two sound channels for totally different signals, for example transmissions in two languages, with minimum crosstalk between the two channels. Thirdly there should be no reduction in the service areas of the transmitters. And finally there should be complete compatibility with the existing transmission system so that viewers with single-channel sound TV equipment are not aware of any change.

The first two-channel system, the pilot-tone technique used for stereo f.m. radio broadcasting, is a non-starter for TV since it's suitable only for stereo, the channel separation being inadequate for use with a two-language programme.

The second system is the f.m.-f.m. one currently used in Japan. In this system the second sound signal frequency modulates a subcarrier at twice the line frequency, i.e. 31·25kHz with a 625-line system. The two signals are then added, the resultant multiplex signal frequency modulating the r.f. sound carrier.

A totally different approach is to use digital techniques, with the sound signals interposed in unused sections of the line or field flyback blanking periods. The broadcasting authorities have been using a "sound in sync" system to distribute the present single sound channel TV signals for many years now. The sound signal is first compressed then converted from an analogue to a digital one. The resultant digital signal is inserted in the line sync pulse interval. At the receiving end, the signal is converted back to an analogue one, then expanded. All this presents compatibility problems, so that any system of this sort is only likely to come into use along with a new broadcasting system, for satellite TV for example.

The fourth system is the two-carrier one, with a second sound carrier spaced 242kHz from the present one. This system is currently on trial in W. Germany, which now insists that all future broadcasting equipment is capable of handling it, and seems the most likely one to be adopted elsewhere in W. Europe.

Another desirable feature is that the system should tell the receiver whether the sound being transmitted is monophonic, stereophonic or bilingual. The f.m.-f.m. and two-carrier systems both provide this feature by including in addition a pilot tone at 3·5 times the line frequency. The codes used differ however. The Japanese amplitude modulate the pilot tone at 922·5Hz to indicate a bilingual and at 982·5Hz to indicate a stereo transmission. The W. Germans frequency modulate the tone at 274·1Hz to indicate a bilingual and at 117·5Hz to indicate a stereo transmission. In both cases mono is indicated by the absence of the pilot tone control signal.

Dual-channel Receivers

It's the receiver side of things that's the main interest to readers of this magazine however, so without further ado we'll move on to this aspect of the subject. The following comments relate to experience to date with the two-carrier system.

Simple adaptors can be designed – and may well form the basis of future constructional articles. Trials to date however show that sets specifically designed for the job provide a worthwhile improvement in the results obtained.

The major snags experienced with trial receivers have been vision buzz and poor separation of the two sound channels – especially in the case of bilingual broadcasts, where the presence of a second commentary in the background is annoying. These problems occurred with sets using intercarrier sound however – the current convention. Changing to a "split-carrier" system was found to provide a cure to these problems – i.e. taking a separate sound i.f. signal direct from the tuner, as in many of the old 405-line only designs. With intercarrier sound, the separation of the two sound signals was 44dB at best. Using split carriers improves the separation to 56dB. A separation of 40dB is considered to be adequate (i.e. a little crosstalk can be heard if you listen closely), so intercarrier systems may yet turn out to be feasible, and could easily be improved using careful alignment and modern techniques. The same modern techniques however have made the split-carrier system less of a bogey than it has been.

Intercarrier sound has ruled the roost for so long because it's cheap to produce and because it's free from the effects of detuning caused by local oscillator drift – since you detect the *difference* between the sound and vision signals (6MHz), and because this difference is crystal controlled at the transmitter, the sound is always on tune provided the picture is locked in. Tuner drift is of the order of 1-2MHz, and the use of a separate 33·5MHz sound i.f. could have lost the sound signal during the first hour of viewing. The coming of colour made the problem worse, since the tuning of the colour subcarrier is as critical as that of the sound signal. Most sets now use a.f.c. therefore – while a.f.c. is mandatory for good teletext data capture.

The a.f.c. signal is normally taken from a detector tuned to the vision carrier: it produces a d.c. output proportional to the difference between the carrier fed to it and 39·5MHz. This is then applied to the tuner in the right phase to pull the oscillator back on to tune. The 6MHz intercarrier signal cannot be used for this purpose, despite what some textbooks suggest, because no matter how much the oscillator drifts the difference between the sound and vision signals remains the same – 6MHz. With a split-carrier i.f. system however it's possible to produce a very steep-sided a.f.c. action in the sound channel. This can be merged with the vision-signal derived a.f.c. to provide a stable tuning action.

The sound i.f. bandwidth requires careful tailoring. At present a sound i.f. bandwidth of ±200kHz is acceptable and can be achieved by using single tuned circuits of high Q or ceramic filters. For two-channel work however the bandwidth needs to be 200+242+200kHz, i.e. 642kHz, which can be easily achieved by simple tuning with a 33·5MHz split-carrier system but would require very careful bandpassing with an intercarrier system.

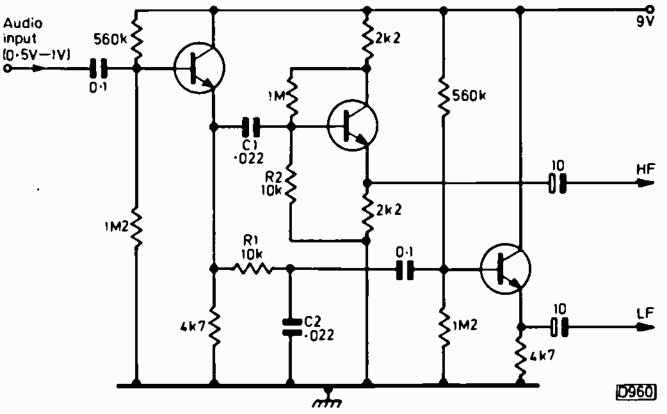


Fig. 1: Pseudo-stereo sound filter circuit – C1/R2 and R1/C2 filter out the h.f. and l.f. components of the sound.

Conventional detector circuits can be used, though the de-emphasis components need to be moved over to the other side of the decoding circuit. What's this? Well, for stereo operation L+R is transmitted on the main sound channel and L–R on the subsidiary channel. So to recover the L and R signals we have to do the same sorts of things we do in a colour decoder with the colour-difference signals, i.e. adding L+R and L–R gives us 2L etc. Once a system has been agreed upon, purpose designed i.c.s will take care of all this.

Having gone to all this trouble, if the set is specially designed for dual-channel sound it's worth arranging the audio circuits more along the lines of a high fidelity unit. Why not have tape input and output jacks, with a function switch to select mono/stereo/channel 1/channel 2 and a full tone control system?

Experience with the Philips K12 chassis shows that a compact bass reflex enclosure with twin speakers is practical without running into purity and degaussing problems. One snag however is the typical size of the TV cabinet, which would separate the stereo loudspeaker system by only the width of the c.r.t. This is no problem with monophonic or bilingual programmes, but for stereo a greater sound spread is preferable. One way round this problem is to feed the h.f. component of one channel, suitably phase shifted, into the other channel. This gives the same effect as putting a phase switch in one speaker lead and appears to spread the sound. Not all programmes would need this treatment, so a switch marked "stereo extra" or something similar can be incorporated. All these arrangements can be d.c. controlled using i.c.s, which means that they can all come under the control of the remote armchair handset.

Moving the de-emphasis farther downstream permits the ingress of clicks and bangs from appliances, so transient suppression is required somewhere along the line.

Andrew Flockton adds: A synthetic form of stereo has been offered with some US TV receivers. They have loudspeakers at either side of the screen, driven by separate audio output stages, the TV sound signal being artificially processed to give a pseudo-stereo effect – rather like those records marked "mono recording electronically reprocessed to give a stereo effect".

The technique used is to split the signal at a certain frequency, sending all the signal above this frequency to one side and all the signal below to the other side. Apparently consumer response has been mixed – some find it worthwhile while others find it annoying. Interesting, but no substitute for true stereo. If anyone wants to try this out, Fig. 1 shows a suitable circuit.■

Active Sound Filter

Keith Cummins

THE circuit described in this article was adopted following problems with recording the sound from a television set (the famed *Television 625-line Receiver*) using an elderly Revox G36 audio tape recorder. Now the performance of this recorder is excellent – it can produce tapes that are virtually beyond reproach. It's input circuits do not include low-pass filters however, making things difficult when you want to record from a stereo tuner or a TV set.

In the former case the stereo difference signal, centred on 38kHz, can produce beat signals by mixing with the bias oscillator signal. The second harmonic of the stereo signal, at 76kHz, can do the same thing. Similar problems arise with the harmonics of the line timebase in a TV receiver, since they fall at approximately 31, 46, 62 and 78kHz. A TV set produces a lot of energy at line frequency, and when attempting to record the sound I found that a permanent whistle was present in the background. This was due to the difference frequency between the line harmonics and the recorder's bias oscillator falling within the audio passband. Only a small amount of line frequency signal mixed with the receiver's audio output is sufficient to produce a whistle.

Filtering Arrangements

My first effort at dealing with the problem consisted of adding a simple *RC* filter. This was effective in reducing the whistle, but also reduced the audio response very noticeably at the top end. It was obvious therefore that a basic single-pole filter was not the answer: something more sophisticated was required. So the use of a two-pole active filter was investigated, and proved to be the solution. It was built around the popular, cheap and cheerful (about 25p) 741 operational amplifier i.c.

Fig. 1 shows the basic low-pass active filter using an operational amplifier. It will be seen that the output is fed back directly to the amplifier's inverting input. This means

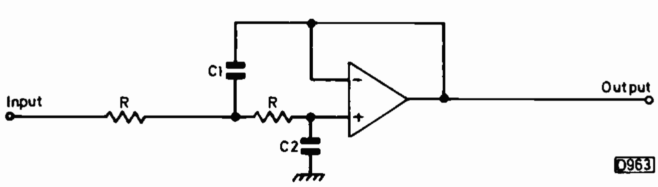


Fig. 1: Two-pole active low-pass filter, using an operational amplifier i.c.

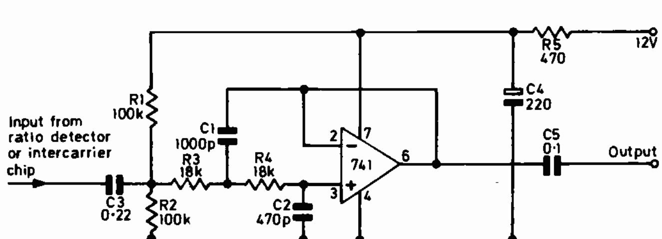


Fig. 2: Practical circuit, using a 741 i.c. The filter components R3/C1/R4/C2 give a corner frequency of 12·6kHz. If the impedance being fed is less than 50kΩ, the value of C5 should be increased to 4·7μ F.

that there's 100 per cent negative feedback, the basic stage gain being one. The first step that has to be taken is to select the "corner frequency", i.e. the frequency at wich the roll-off attains −3dB. For this type of filter a smooth roll-off at 12dB/octave is obtained by applying the formula $f = 1/(2\pi RC)$. R is the value of the two resistors used in the circuit, while C1 equals $C\sqrt{2}$ and C2 equals $C/\sqrt{2}$. It follows that the value of C2 is twice that of C1. The corner frequency decided upon was about 12kHz – sufficiently high to cause minimal audio degradation while being significantly lower than the line frequency (15·625kHz). Making the value of R 18kΩ, C1 0·1μF and C2 470pF gives us a corner frequency of 12·6kHz.

The addition of the filter will ensure that line frequency harmonics likely to beat with the bias oscillator will be attenuated by about 30dB. Assuming that they are down 20dB to start off with, this gives a total of −50dB. Even a level of −40dB would probably be acceptable.

Practical Circuit

The circuit shown in Fig. 2 was built up, with the operational amplifier biased at half-rail voltage by R1/2 since there's only one supply line. The output from the i.c. is of low impedance, which assists in preventing line-frequency pick up on the audio output cable following the i.c. The result of taking the signal via the filter was an instant success, the whistle completely disappearing. As a test, C1 was disconnected. The whistle then returned, though at a lower level than previously. So the effectiveness of the filter was proved.

The circuit can be built on a small piece of Veroboard, and positioned near the rear of the set, close to the take-off point. Note that the arrangement is safe only when the TV set has an isolated chassis (as the 625-line Receiver has). There's no reason however why the filter should not be used to drive a small audio isolating transformer directly, with the transformer suitably screened to avoid line pick up! In this case the circuit acts as a filter and buffer.

The filter is also worth consideration when the TV set is used to feed a high-fidelity sound system. Intercarrier sound systems often contain very high-order harmonics of both the line and field pulse frequencies. These can be responsible for a rattling kind of sound when passed through a wideband audio system. In reducing these harmonics the filter also reduces the bandwidth for out-of-band noise, thus improving the overall signal-to-noise ratio without drastically reducing the audio bandwidth itself. It can be argued that the de-emphasis network reduces such signals. This is undoubtedly true, but the filter described makes a much better job of it.

The supply voltage is shown as 12V. This is not critical, and the circuit would probably work quite satisfactorily if operated at 9V. There's no need to exceed 12V however – if necessary, increase the value of R5 to reduce the voltage applied to the i.c.

For those interested, a pair of these circuits can be used to filter the output from a stereo decoder should the 38kHz signal cause problems with a tape recorder.■

Service Bureau

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RANK Z718 CHASSIS

The problem with this set is that we can't balance the line output transistors. The initial fault was that the overload protection circuit would shut down intermittently. This situation continued after replacing the two line output transistors, so the output transformer was replaced. We then had the set going again, but when we tried to balance the transistors the voltage obtained across 5R6 was 20-15V a.c. instead of 1V or less.

Inability to balance the two halves of the line output stage is often due to failure of one of the flyback tuning capacitors 5C9/10, which should be replaced with Rank approved types. If necessary, check the condition of 5R6 (68Ω) as well and the components in the base circuits of the output transistors.

SONY KV1800UB

The problem we have with this set is that the "horizontal converter" transistor Q802 (2SC1316) and the two transistors Q851/2 (2SA678 and 2SD291) in the e.h.t. regulator circuit have all gone short-circuit. Since the converter stage drives the tripler, with the regulator in the converter transistor's emitter circuit, we're wondering whether the fault is due to a tube flashover. Also, are there any equivalents?

These transistors seem to fail for their own reasons, and we doubt whether tube flashover is responsible – assuming that the h.t. has been set at the correct level (110V at the emitter of Q902). There are no equivalents for the 2SC1316, and the equivalents for the others are as obscure as the originals. The correct types should be readily available from Sony or their agents.

THORN 9000 CHASSIS

The picture collapses to a single vertical white line, only momentarily and intermittently. The problem is worse when the brightness is turned up, but disappears at maximum or very low brightness settings.

The trouble is most likely to be due to one or more dry-joints on the line output transformer pins – some batches of these sets suffered from this problem. Also check the connections to the line scan coils, the Syclops transistor's emitter resistor R710 and the scan-correction capacitor C724.

PYE HYBRID COLOUR CHASSIS

This dual-standard set has given good service for many years. For a long time however it has suffered from an irritating fault which varies in intensity from day to day for no obvious reason. It consists of a pattern superimposed on the picture. If the a.f.c. control is muted and the tuning adjusted manually, the pattern can be tuned out, while still retaining colour, but as soon as the a.f.c. is restored the pattern returns.

First ensure that the various (braid) earthing leads are properly connected to the tuner and i.f. panel, and that the a.g.c. preset RV3 is not over advanced. If this does not solve the problem, the a.f.c. circuit will probably have to be realigned following the instructions in the manual. It's possible, though unlikely, that one or more of the small i.f. transistor emitter decoupling capacitors C10/20/27 etc. is open-circuit.

HITACHI CNP190

The picture is perfect apart from about half an inch of foldover at the bottom of the raster.

We suggest you adjust the field output transistor's base bias. This is done by connecting a milliammeter between the 120V h.t. line, say at pin K5 of the deflection board socket or the positive side of C713, and the negative side of C607 in the field output transistor's collector circuit, then adjusting R617 for a reading of 64mA. If the fault persists, check the field output transistor TR37 (2SC936), its base input coupling capacitor C606 (100μF) and the driver transistor TR36 (2SA15V).

THORN 9000 CHASSIS

Two faults have appeared simultaneously on this set. First, when the set has been on for about half an hour field flyback lines appear on the picture. Secondly the picture takes on a green cast – this comes and goes. No incorrect voltages can be found.

Field flyback blanking is carried out in the SN76227N colour demodulator/matrixing i.c., the blanking pulses being applied to pin 6. The first problem seems to be due either to loss of these pulses or the i.c. developing a fault when its operating temperature rises. Check for loss of pulses when the fault occurs – the problem could be a loose pin in socket 22 (pin 1) or socket 4 (pin 6). If this doesn't help, replace the i.c., which could also be responsible for the green cast fault since there's d.c. coupling from its outputs up to the c.r.t. cathodes. If the intermittent green cast fault persists, the set green bias potentiometer R194 could have a noisy track. This would affect the d.c. conditions in the green output stage. Other things to check if necessary are the green output stage transistors VT106/9 and the green gain potentiometer R190.

GEC HYBRID COLOUR CHASSIS

The original fault we had with this set was that the picture would revert to black-and-white, no amount of adjustment of the fine tuning restoring the colour. On checking the a.c.c. circuit we found that the cause was the preset P401 having increased in value from 100kΩ to some 200kΩ. We next found that R704 on the pincushion correction panel had burnt out. This was replaced, using a higher wattage component, but then R705 cooked and burnt out. These components are on the line scan side of the correction transductor. What's causing this excess current flow? – there's no short across the transductor, the line output stage does not appear to be drawing excessive current, and voltage checks have shown no great discrepancies.

Your problem should be resolved by replacing the transductor. These components do develop shorted turns, which will not show up as a direct short-circuit. Thank you for the information on the colour drop-out fault.

ITT CVC20 CHASSIS

The problem is intermittent foldover at the bottom of the screen – covering the bottom inch or so. Is there a common cause of this?

The main suspects are the field output transistors T9 and T10. First however check the output stage biasing network R62/R63/D7/R65, and for dry-joints in the field timebase – particularly around the NS phase control L7A.

SHARP 12P17H

There's sound but no raster on this portable, so I suspect the 2SB468 line output transistor. There's 12V across it and an efficiency diode which reads o.k. on an ohms check. Is there an equivalent for the 2SB468?

The direct equivalent for the 2SB468 is the AU106, though the more generally available AU113 should do just as well. Since there's apparently been no fuse blowing or signs of distress however the output transistor would not be our first suspect. We suggest you check the supply to the line driver transistor – there are two $\frac{1}{2}$W resistors here, R717/8, both 56Ω, and one will probably be found open-circuit. They are deliberately under-rated as a protective measure.

THORN 8500 CHASSIS

The trouble was intermittent loss of colour, so a disturbance check was carried out on the chroma section of the signals panel. When C160 was moved, the colour reappeared and has remained. What action should I take if it goes off again?

The best procedure would be to override the colour-killer by shorting the base and emitter of VT113. This will give you an idea as to exactly where the fault is. You will probably get coloured bars on the screen, indicating that the reference oscillator is running out of lock. C160 tunes the oscillator output circuit and is often the cause of this problem. It can also be caused by the transistor (VT111) and the 4·43MHz crystal – the crystals used in this chassis tend to go off frequency. Complete absence of colour could mean that the burst gating pulses are not reaching the decoder due to the feed resistor R404 on the timebase panel having cooked up and gone open-circuit. There could on the other hand be chroma amplifier trouble. Check the transistors (VT115 and VT117), see whether the delay amplitude control R198 is open-circuit, and check C171 and C180 as these capacitors tend to go open-circuit intermittently. The MC1327P demodulator chip could be responsible for complete loss of colour, but this is rare indeed – the chip usually causes loss of one colour when defective. Another possibility is a defective d.c. amplifier transistor in the reference oscillator control loop – the f.e.t. VT110 – since this will upset the oscillator.

SONY KV1810UB

The picture horizontals are correct, but there's quite severe vertical pincushion distortion – the verticals are being pulled into the corners as if the deflection magnets are all out of position. These are o.k. however.

The EW modulator transistor Q586 (2SC1124) is almost certainly faulty. It would also be worth checking D592 in Q586's base circuit.

INDESIT T24EGB

The problem is lack of brightness – the picture is only slightly visible with the brightness control at maximum. The voltage at the c.r.t. grid is around 47V and varies little with rotation of the brightness control. The neon in the tube's grid circuit remains on all the time, while the voltages in the video output stage are correct. Shorting the tube's grid and cathode produces a bright raster, so the tube is not suspect.

The neon is included to provide switch-off spot suppression, and should remain alight – it's in series with the feed between the c.r.t.'s grid and the brightness control circuit. The most likely cause of the trouble is simply that R230, which is in series with the brightness control, has changed value, though C215 could be leaky. Make sure that the spark gap associated with the c.r.t. grid is clean.

THORN 3500 CHASSIS

I'm reconditioning one of these sets and, in the interests of reliability, would like your suggestions on what components to replace as a matter of course.

As with any chassis, the line timebase and the power supply give rise to the majority of faults. There are also some items on the video panel worth renewing. We suggest you replace the following:

Power supply: The h.t. electrolytics C602/3/6, the 30V supply electrolytics C607/9, and the chopper output electrolytic C619.

Line timebase: R528 in the h.t. feed, and the electrolytics C506/8/11 in the line generator circuit. It would be worth replacing the sensing resistor R907 on the beam limiter board.

Video panel: The clamp circuit electrolytics C215/27/31, C221 in the clamp bias circuit and the h.t. decoupler C222.

Clean the tracks of all the preset controls, and set up the receiver throughout, following the procedure laid down in the manual.

SONY KV1810UB

This set has given good service, but recently the chopper and line output gate-controlled switches Q603/Q510 both went short-circuit, blowing the mains fuse F602. I can't find any fault that could have contributed to the demise of these rather expensive components. Any suggestions?

The only reasonably sure way we've found of avoiding a recurrence of this unfortunate fault is to replace all the following items: the mains on/off switch; the CX104A line/field oscillator chip; the electrolytics C624 (47μF) and C620 (4·7μF) on the power regulator board; the line drive coupling electrolytic C538 (0·47μF) and the flyback tuning capacitor C542 (1,800pF, 1·5kV) on the timebase board; and the two gate-controlled switches of course, making sure that you replace the mica washer on the chopper Q603. Check the condition of R608 and R642 on the power regulator board.

DECCA 30 CHASSIS

There's an excellent picture on this set, but with some captions you get horizontal pulling – this happens mainly with film titles etc. I assumed it to be a sync fault, but replacing the valve and checking the bias components have made no difference.

There are two sync separator stages on this chassis, the first consisting of transistor TR202 on the decoder panel. Check its input coupling electrolytic C207 (1μF), and try adding a 6·8pF capacitor between its collector and base. Also check the video coupling electrolytic C200 (33μF). The beam limiting action takes place in the video circuit, the sensing point being the cathode of the line output valve. Its cathode decoupler C434 (100μF) is worth checking therefore. In this respect, you should get a reading of 2·2V at R37 on the i.f. panel. The problem could be in the line oscillator stage, and the PCF802 valve and its associated electrolytics C419/23/25 should be in good condition.

GEC C2110 SERIES

When the set's first switched on there's a bright, non-linear picture about an inch high. The raster opens up to normal size after about ten-fifteen minutes.

The 40V line could be developing slowly. If so check the reservoir capacitor C601. Various components in the field timebase are suspect: the charging capacitors C457/8, the bootstrap capacitor C462, the bias stabilising thermistor TH451, R471 (220 Ω) in the bias network and the output transistors. Make sure that the mid-point voltage is set for 23V at the junction of R466/7.

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TELEVISION FEB. 1981

SABA CHASSIS F

There's lack of brightness on this set, even though the brightness and preset brightness controls are at maximum. There's plenty of contrast and colour, but the picture is dark.

The main suspect is the PL802 luminance output pentode. Another possibility in the luminance output stage is the flyback blanking transistor T313 (BC238) – it tends to go open-circuit, with the result that the PL802's cathode voltage rises. If the PL509 line output pentode is conducting heavily, the voltage across the beam limiter control P632 in its cathode circuit will be excessive. This turns the beam limiter transistor T631 on, pulling down the PC92 luminance preamplifier triode's grid voltage. Check the setting of P632 therefore and ensure that the line output stage is operating normally. The other main possibility is that the c.r.t.'s first anode voltages are low. There should be about 800V at the top ends of the first anode preset controls P581-3. If this voltage is low, check the decoupling capacitor C724 (0·01 μ F) on the line output transformer panel. It sometimes goes leaky, pulling the voltage down.

TEST CASE

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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.

Many tales about fault-finding in the Pye Hybrid colour chassis can be told. Ours this month concerns a 693 chassis with the no colour fault symptom. The decoders used in these chassis are very reliable, so it was confidently expected that either the tuning had drifted off or that slight adjustment was required to the reference oscillator frequency control RV10. When we came face to face with the set however the tuning was found to be spot on while no amount of adjustment to RV10 would bring any colour to the picture.

RV10 was carefully returned to its original position therefore, and a check was made with the meter to ensure that the –20V and 15V supplies were reaching the decoder panel, also that a voltage from the colour control potentiometer was arriving at SK11. All seemed well, so a source of 2·5V was found and applied to TP21 to override the colour-killer. This made not a scrap of difference to the monochrome picture.

Out came the oscilloscope! With some difficulty, as we'd almost forgotten our way around this decoder, we established that the chroma signal was present at SK6, that the reference oscillator was running, that a good 10V peak-to-peak ident signal was present at the collector of the ident amplifier VT18 – and that U and V chroma signals were emerging from the delay line! All the connections to the decoder panel were again checked, but no fault could be discovered on the decoder panel. So where lay the cause of this puzzling symptom? Answer next month, along with another item in the series.

SOLUTION TO TEST CASE 217
–page 156 last month –

Last month we described a battle with a recalcitrant Tandberg CTV2-2 which would produce virtually no signals after having been fitted with a new u.h.f. tuner. Not once – two new tuners were tried.

The solution to this obscure problem lay in the band-switching arrangements. In this chassis a pair of BA182 switching diodes, D1 and D2, are inserted in the i.f. output feeds from the v.h.f. and u.h.f. tuners on the tuner/i.f. panel. The band switching applies a d.c. bias to the appropriate diode, thus turning it on so that the i.f. output from the selected tuner is passed to the i.f. strip, the other output being isolated. For u.h.f. reception, the relevant diode is D2, which is switched on by a d.c. voltage from the band switch via R5.

Now in the Mullard ELC1043/05 u.h.f. tuner unit originally fitted – the one that was replaced due to the drift problem – there's an internal blocking capacitor in series with the i.f. output pin. In the replacement Elpro tuner however the i.f. output is developed across a small choke which provides continuity to chassis at the tuner's i.f. output. This was shunting away the switching diode's bias, which thus remained off, robbing the i.f. circuits of their input signal.

This is the first and only instance we've had where this new type of tuner has proved to be incompatible: in all other models designed for use with the Mullard type of tuner it's worked well.

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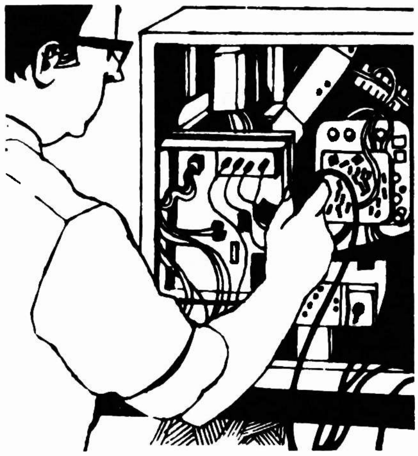

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A63/120X	£36·00	£5·40	£41·40
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TAA550	20p
TAA570	£1.00
TAA700	£2.00
TBA120A	40p
TBA120AS	40p
TBA120B	40p
TBA120C	40p
TBA120SA	40p
TBA120SB	40p
TBA120U	40p
TBA1441	£1.00
TBA396	£1.00
TBA480Q	£1.00
TBA510	£1.00
TBA520Q	£1.00
TBA530	£1.00
TBA540	£1.00
TBA550Q	£1.00
TBA560CQ	£1.00
TBA560Q	£1.00
TBA570	£1.00
TBA625	£1.00
TBA641BXI	£1.50
TBA651	80p
TBA673	£1.00
TBA720A	£1.00
TBA750Q	£1.00
TBA800	40p
TBA810S	£1.00
TBA820	£1 each
TBA890	£1.00
TBA920	£1.00
TBA920Q	£1.00
TBA950	£1.00
TBA950Q	£1.00
TBA990Q	£1.00
TCA270	£1.00
TCA270Q	£1.00
TCA270SQ	£1.00
TCA4500A	£1.00
TCA640	£1.00
TCA650	£1.00
TCA660	£1.00
TCA740	£1.00
TCA800	£1.00
TCA830S	£1.00
TCE82	30p
TCE120CQ	£1.00
TCE157	20p
TCE527	20p
TCEP100	£1.20
TDA1170	£1.20
TDA1190	£1.20
TDA1327	£1.00
TDA1412	50p
TDA2540	£1.00
TDA2640	£1.00
TDA2680	£1.00
TDA2690	£1.00
TDA3950B	£2.00
SN16862AN	£1.00
SN16964AN	50p
SN29764	£1.00
SN29848	50p
SN75108AN	£1.00
SN76001	£1.00
SN76003	£1.00
SN76003*	£1.50
SN76008KE	£1.00
SN76013*	£1.50
SN76018KE	£1.00
SN76023*	£1.50
SN76033	£1.00
SN76033*	£1.50
SN76115	50p
SN76131	50p
SN76226	£1.00

Tuner Units Varicap and Mechanical repaired. Please ask for estimate.

I.C.'s—cont.

SN76227	50p
SN7630P	50p
SN7650N	£1.00
SN76532	50p
SN76533	£1.00
SN76544N	£1.00
SN76546	£1.00
SN76550	15p
SN76570	50p
SN76650N	50p
SN76660N	50p
SN76666N	50p
SN76707N	50p

*Denotes with heatsink.

Semiconductors

AC128	25p
AC153K	25p
AC176K	25p
AC187/8K pair	50p
AF139	25p
AU113	£1.25
BA159	7p
BA182	7p
BA248	7p
BAV10	7p
BB103VHF	7p
BB105UHF	7p
BC107	7p
BC108	7p
BC109	7p
BC116	7p
BC139	7p
BC147C	7p
BC148B	7p
BC149C	7p
BC154	7p
BC157	7p
BC158	7p
BC171	7p
BC171B	7p
BC173	7p
BC173C	7p
BC174	7p
BC182L	7p
BC183	7p
BC183LB	7p
BC207	7p
BC212LT	7p
BC213LA	7p
BC237B	7p
BC238	7p
BC238A	7p
BC238C	7p
BC245	7p
BC250	7p
BC251A	7p
BC252C	7p
BC257	30p
BC300	30p
BC303	30p
BC307	7p
BC308B	7p
BC327	7p
BC336	20p
BC337	7p
BC350	20p
BC365	10p
BC413C	7p
BC454	7p
BC455	7p
BC460	20p
BC462	7p
BC463	7p
BC546	7p
BC559	7p
BD124	£1.50
BD131	30p
BD132	30p
BD136	10p
BD207	30p
BD221	20p
BD228	25p
BD238	20p
BD239	12p
BD253B	35p
BD416	25p
BD561/2 pair	30p
BD595	35p
BD596	35p
BD681	25p
BD807 10/a/70V	
NPN 9 watt	25p
BF127	20p
BF137	20p
BF157	20p
BF180	20p

Semiconductors—cont.

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BF182	20p
BF185	20p
BF195	7p
BF198	7p
BF200	20p
BF237B	7p
BF240	7p
BF245A	7p
BF263P	25p
BF264	20p
BF273	7p
BF274	7p
BF337	24p
BF355	30p
BF423 PNP	7p
BF458 NPN	12p
BF458T	12p
BF594	7p
BFT43	20p
BFY50	15p
BFY90	15p
BR100	30p
BSS68	20p
BSX20	5p
BSY79	7p
BT100	30p
BT106	£1.00
BT106 special	50p
BT109	£1.00
BT116	£1.00
BT119	£1.00
BT138/10A	70p
BT146	25p
BT151/800R	70p
BTT822	£1.00
BTT8124	£1.00
BTT8224	£1.00
BTY80	20p
BU105	50p
BU105/04	£1.00
BU108	£1.00
BU124	50p
BU126	£1.00
BU137	60p
BU204	40p
BU205	£1.00
BU208	50p
BU208A	£1.00
BU208/02	£1.00
BU326	60p
BU407	50p
BU500	£1.00
CA270	50p
CA270EW	50p
E1222	20p
R2008B	£1.00
R2010B	£1.00
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OA90	7p
OT112	£1.00
MJE51T NPN 300V 4A	25p
MJE2955/15A	50p
MJE1661	25p
BY127	10p
BY133	10p
BY176 type	25p
BY176	50p
BY179	35p
BY184	25p
BY187/01	10p
BY190	40p
BY204/4	7p
BY206	10p
BY210/400	7p
BY210/800	10p
BY223 5A/1500V	25p
BY226	10p
BY296	10p
BY298	12p
BY299	10p
BYF3123 wire end	50p
BYF3126 wire end	50p
BYF3214 20Kv	50p
BYX36/600	10p
BYX38/600	50p
BYX55/350	10p
2N390	7p
2N2222	7p
2N3055	35p
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2N4355	7p
2N4442	60p
2N4444	£1.00
2N6099	25p
2N6348	50p
2N6399A	30p
2SK30A	7p

TIP29C	20p
TIP29A	20p
TIP30A	20p
TIP31A/B	20p
TIP32	20p
TIP33B 10A/80V	25p
TIP41A-42 pair	50p
NPN TIP130 60V/8A	25p
IN3899	50p
IN4003	5p
IN4004	5p
IN4005	5p
IN4006	5p
IN4007	5p
Y716	20p
Y827	30p
1 amp/400V	20p
1 amp/1600V	7p
3 amp/100V	7p
3 amp/300V	10p
3 amp/1200V	7p
W04 bridge	15p
W005 bridge	25p
ITT bridge 1½A C73	20p
3 amp bridge	25p
B30C 600A6	12p
B30C 500	12p
1 amp/100V	20p
NKT279, AC128	12p
MC7724CP	40p

Condensers

4700/25	25p
470/40	10p
220/40	5p
1500/40	10p
1250/50	10p
220/63	10p
1000/63	15p
700/250	35p
800/250	30p
4/350	5p
8/350	8p
22/350	8p
33/350	8p
400/350	50p
33/450	10p
220/450	50p
10/500	10p
33/500	10p
.1/800	10p
.047/1000	10p
.01/1000	10p
.47/1000	30p
.0047/1500	10p
1N8/1500	10p
2N2/1500	10p
.1/2000	15p

Various Mixed Packs

10 Thermistor	50p
20 Slider Pots	£1.00
30 Presets	50p
40 Pots	£1.50
300 Condenser	£1.50
300 Resistor	£1.50
150 Electrolytic	£2.00
15 bulbs	45p
100 diodes	£1.00
100 20mm fuses	£2.00
100 W/W resistors	£1.50
100 ceramic and plate condensers	£1.00
300 Carbon film ¼W 1R to 2M ITT	£1.50

1800/4KV	5p
4.7NF/5KV	10p
180PF/6KV	10p
210PF/8KV	10p
270PF/8KV	10p
330PF/8KV	10p
1000PF/10KV	10p
1200PF/12KV	10p
1000PF/12KV	10p
6200PF/2000V	10p
BYW56 1000V 2A	
BDX32	£1.20
TIC126N Thyristors 800V 12A	65p

Sale Condensers

220/10	4.7/63
330/10	33/63
4700/10	47/63
100/16	330/63
220/16	.01/100
160/25	33/100
330/25	.47/160
470/25	2.2/160
680/25	22/160
33/35	.47/250
10/40	1/250
22/40	3.3/250
47/40	10/250
8/300	
680/40	.1/400
1/63	.005/1500

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