Servicing the Rank A823 Colour Chassis

Part 1

R. W. Thomson

THE Rank A823 chassis was one of the first all solid-state colour chassis to appear, being introduced in 1969. It remained in production for many years, though substantial modifications were made to it. The second version, the A823A, incorporated a completely different scan panel and a decoder with two instead of a single i.c. The next version, the A823AV, used a varicap tuner. The final version, the A823B, incorporated changes in order to meet BEAB requirements. There were several minor modifications, particularly in the power supply section, at various times. Many of the bugs found in the initial A823 occur with monotonous regularity in the later versions however. To start with in this series we'll keep to the A823, taking in subsequent versions later.

Features

When it first appeared the A823 chassis was of very advanced design, with a thyristor stabilised power supply circuit, an i.c. in the decoder and another for intercarrier sound amplification, almost completely modular construction (very compact too, as our cover photograph shows), and last but not least all-transistor reliability. For those of you more used to later solid-state chassis a couple of points can be made immediately. First, the l.t. rails are mainly provided by the power supply board rather than the line output stage, though the latter does provide the 40V line which powers the field timebase. The c.r.t. heater is supplied from the mains transformer, so you can get the c.r.t. heater lighting up but nothing else happening. There is an over-voltage trip on the scan panel: this stops the line oscillator and thus the line output stage, with the result sound but no raster. An unusual thing is that the line driver stage, which can be troublesome, is powered from one of the l.t. rails.

Physical Arrangements

The chassis is virtually wrapped around the c.r.t. neck. Looking from the rear, the left-hand upright supports the power and the i.f. panels, with the decoder panel mounted on the reverse side. The field timebase circuit, plus the line oscillator, driver and excess voltage protection circuit, are to be found on one panel to the extreme right of the receiver, with the line output and e.h.t. unit, plus the scan controls, assembled to the left of this, nearest the c.r.t. neck. The convergence panel is very conveniently mounted between the uprights, and swings up for easy observation of the c.r.t. screen whilst making adjustments.

Tuner

Up to the sync separator, the receiver is fairly conventional. Like its contemporaries in the very early seventies it used a mechanical tuner. Designated type A770, this tuner soon established itself as highly reliable, with high-gain performance right through Bands IV and V. Station selection is effected by four push-buttons. Like almost all the major components of the set the tuner is easily removed for servicing, plugs and sockets being used for all connections.

Two silicon transistors are used as r.f. amplifier and oscillator/mixer respectively. Both are npn types used in the grounded-base mode. Tuning is effected in the normal manner by means of a ganged variable capacitor in conjunction with four quarter-wave resonant lines. In the interests of high signal-to-noise ratios the r.f. stage does not come under control by the a.g.c. system until fairly high input signals are received. The point at which a.g.c. is applied to the r.f. amplifier in the tuner is set by adjusting a preset control on the i.f. panel. Other than occasional cleaning there are normally no servicing problems with the A770 tuner, though the occasional need for transistor replacement has to be carried out with care and precision. Once it's been proved that a tuner is defective, diagnosis follows the well-known formula: clean raster, no output signal at all, change the mixer transistor; noisy reception, snowy vision and fading, hissing sound, change the r.f. transistor. Care should always be taken before condemning the r.f. transistor however in case the symptoms are due to an aerial fault – including the socket and the connections to the tuner itself.

The tuning of these sets suffers from an old Bush failure which manifested itself for years on many models. For some reason, Bush have a penchant for using knobs made of material that doesn't stand up to a great deal of use. The

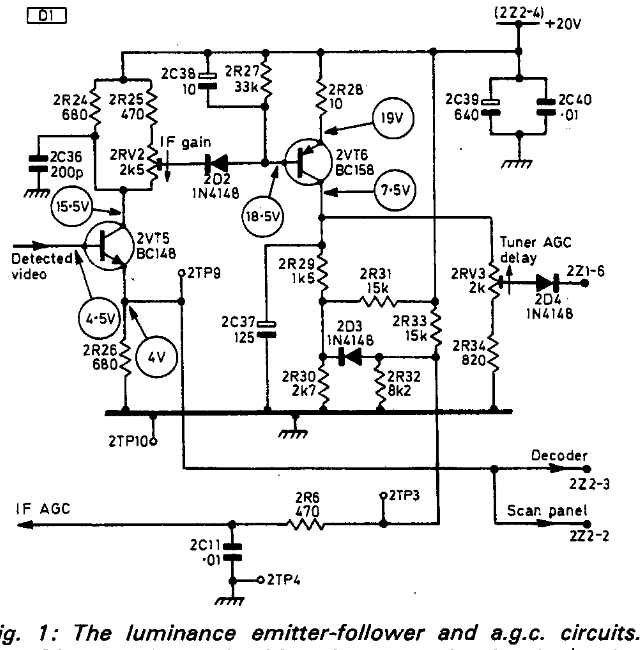


Fig. 1: The luminance emitter-follower and a.g.c. circuits. The 20V supply to the i.f. strip comes in via plug/socket 2Z2-4. 2Z1-6 feeds an a.g.c. bias to the tuner unit. The collector voltage of 2VT5 depends on the setting of 2RV2 while the collector voltage of 2VT6 depends on the setting of 2RV3. Later 2R30 1kΩ, 2R31 6·8kΩ, 2R34 1·5kΩ.

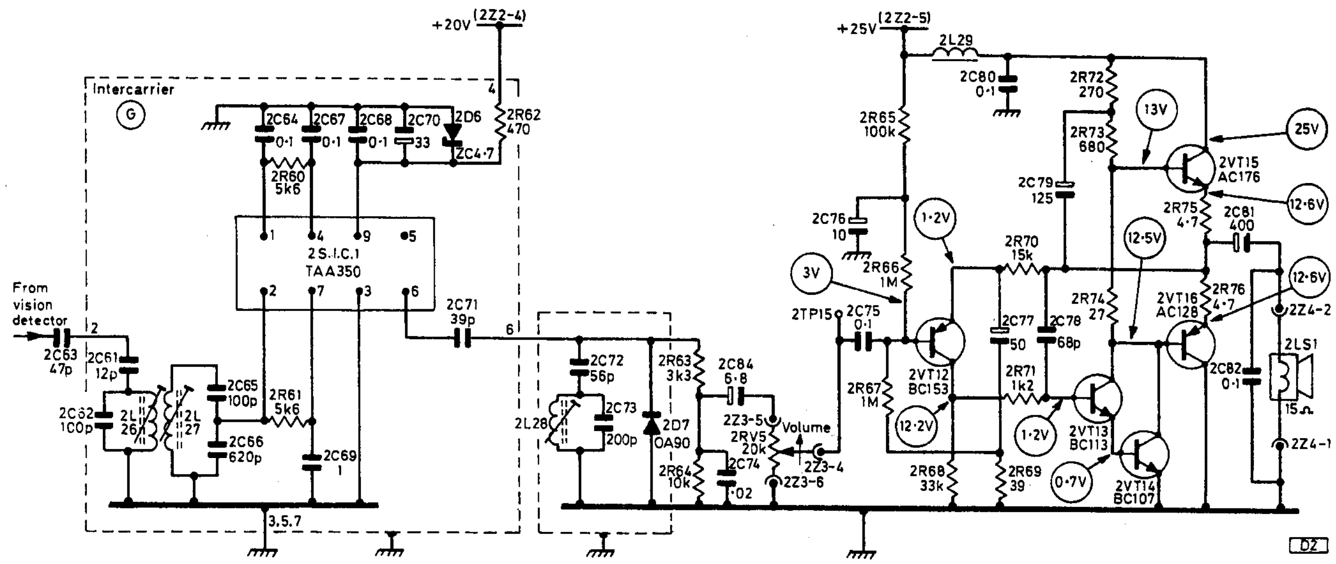


Fig. 2: The sound circuits. In later versions 2D6 was omitted and 2R62 increased to 680Ω. 2C65 changed to 120pF.

consequent wear on the inside of the knobs shows up as a refusal to engage the tuner spindle when fine tuning. The only cure is replacement, though a temporary repair can be effected by cutting an eighth of an inch off the clutch end of the offending knobs, thus allowing the small protrusions on the spindles to engage on fresh material inside the knob.

IF Stages

The i.f. circuitry is conventional too, using the familiar three-stage circuit with a cascode pair in the middle. In common with its black-and-white contemporaries, the A823's i.f. strip is built in the form of a series of small modules containing the various stages. This type of assembly was standard Bush/Murphy practice for years, and results in a clean, tidy receiver section which remains clean and tidy no matter how much gooey dust accumulates on the printed board. It doesn't lend itself to voltage tests on the various sections and transistors however. Test points are provided for checking gain, but as most readers won't have the equipment necessary for such tests it becomes necessary to check out the stages with an ohmmeter rather than a voltmeter when faults arise. As faults are very uncommon here, this is no great cause for tears.

AGC System

The a.g.c. and the intercarrier sound sections, complete with the audio stages, are also on this panel, which is known in the A823 chassis as the A809 panel. The a.g.c. is of the now common forward-bias type.

Looking at the circuit (Fig. 1), it will be seen that bias for the a.g.c. amplifier 2VT6 is obtained from diode 2D2. Negative bias is provided by rectifying the negative-going sync pulses appearing in the collector load of the luminance amplifier 2VT5. Under low or no-signal conditions, the peak rectifier circuit consisting of 2D2, its load resistor 2R27 and reservoir capacitor 2C38 produces insufficient voltage to turn 2VT6 on, so this transistor is inoperative. Diode 2D3 is permanently biased on under these conditions, the voltage at its anode from the potential divider 2R32/2R33 being greater than that at its cathode from the potential divider 2R30/2R31. The voltage on the a.g.c. line at the test point provided, TP3, is then approximately 3·5V.

When the signal at the collector of 2VT5 increases, diode 2D2 rectifies the sync pulse tips and produces an increasingly negative voltage across the base/emitter junction of 2VT6, turning this transistor harder on as the signal strength increases. The current through 2VT6 increases, causing an increase in voltage at the cathode of 2D3. This increases the impedance of the diode and, because there is less current through it, the voltage at its anode rises. This voltage is applied to the base of the first i.f. amplifier, so the current through it increases, lowering the gain of the stage. At this point the voltage across TP3 to deck will be approximately 4·5V positive, and no further increase is possible. The delayed tuner control system takes over if the signal strength is so high that it needs further attenuation.

This function is carried out by diode 2D4. The cathode side of this diode is connected to the r.f. amplifier's bias network in the tuner itself, the positive voltage available at that point providing the delay action. By suitably adjusting 2RV3 on the i.f. panel, the anode voltage of 2D4 can be selected so that the tuner a.g.c. action comes into effect only after full control has been exerted on the gain of the i.f. stages. In this way the tuner runs at full gain, reducing the mixer noise to an acceptable level, until the input signal is so great that cross-modulation would be a problem.

Correct adjustment of the two presets 2RV2 and 2RV3 is quite simple. With a signal properly tuned and the contrast turned fully up, rotate 2RV2 until the set locks "out", giving no signal conditions. Turn the control back again until the receiver again operates properly, with no picture judder, then continue to turn it back a fraction more. Adjust 2RV3 for minimum noise and no cross-modulation.

Sound Channel

A common detector, 2D1, in the final i.f. can (can K) is used for the luminance and the intercarrier sound signal. The latter passes via a bandpass tuned circuit (see Fig. 2) to the TAA350 intercarrier sound amplifier/limiter i.c. The output from this is demodulated by a slope detector circuit (2C72/2C73/2L28/2D7) and is then a.c. coupled to the volume control which in turn is a.c. coupled to the audio preamplifier 2VT12. The following stages are d.c. coupled – the Darlington pair driver stage 2VT13/14 and, in the output stage, our old friends the AC176/AC128. These

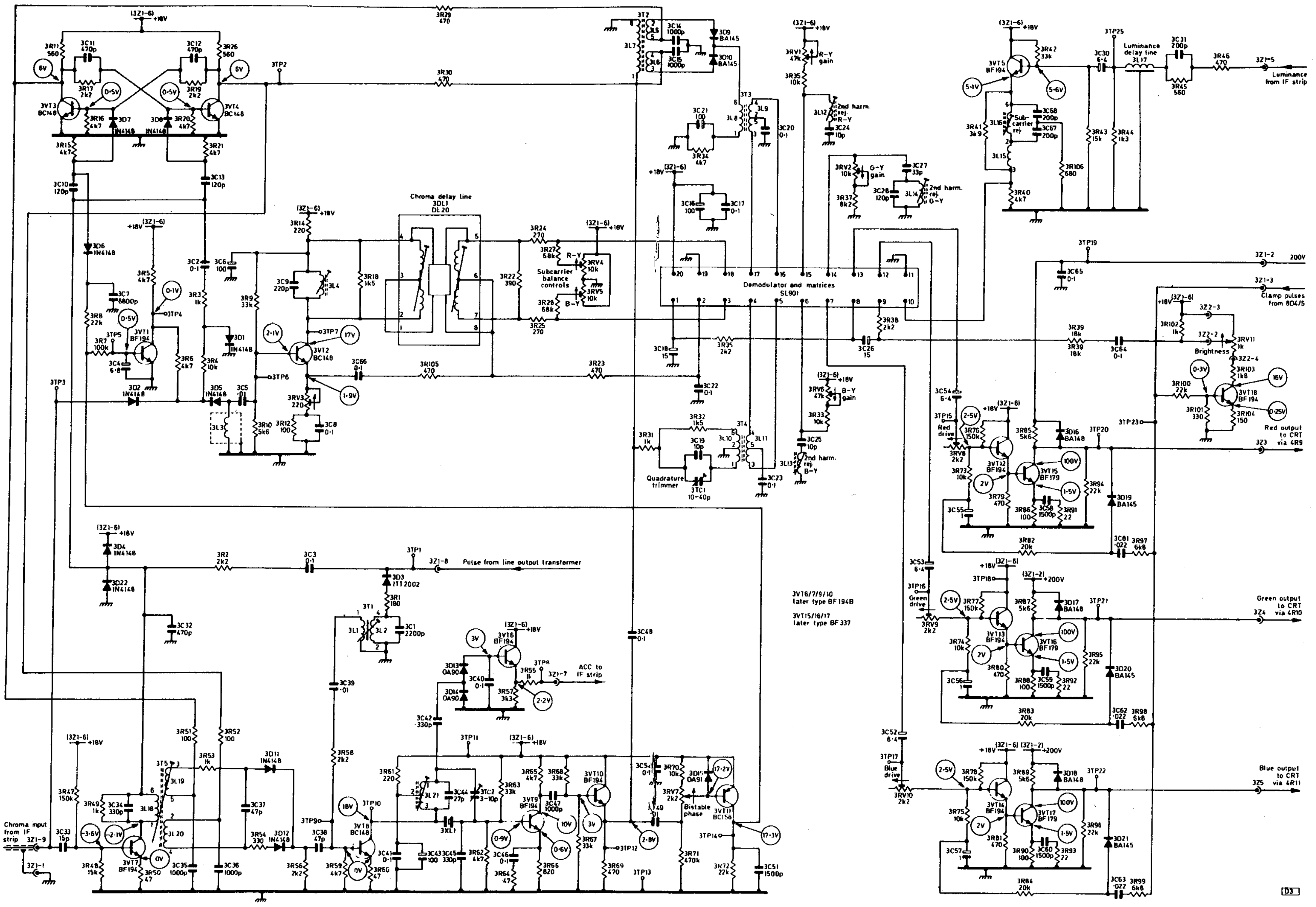


Fig. 3: Circuit diagram of the A807 decoder/RGB output panel. Voltages measured with a 20kΩ/V meter. 3VT2 voltages depend on the setting of 3RV3. 3VT3, 3VT4, 3VT9 and 3VT11 voltages measured with colour: with colour off, 3VT3 Vc is 12V, Vb 0V; 3VT4 Vc is 0·5V, Vb 0·8V; 3VT9 Vc is 10V, Vb 2·1V, Ve 1·5V; 3VT11 Vc is 0·6V, Vb 17·4V. 3VT12-17 voltages apply at maximum brightness. At minimum brightness the driver emitter voltages are 1·4V and the base voltages 2V, the output transistor collector voltages are 125V, base voltages 1·7V and emitter voltages 0·8V.

drive a 15Ω speaker and, thanks largely to the fact that 2VT12 is also used to provide good d.c. stabilisation (very important in d.c. connected transistor circuits), and the fact that the sound output is limited to 1·5W, the output gives few causes for complaint. 1·5W may seem laughable in these days of 50 × 50W stereo outfits, but there is more than enough volume for the average room and with a large speaker the sound quality on these sets is good.

IF Panel Faults

Faults are not common on the A809 i.f. panel. There are some regulars however. Poor field sync for example is commonly due to a dud 2C37 in the a.g.c. circuit. The same capacitor can be responsible for a.g.c. flutter, this time due to excessive capacitance: reduce its value from 125μF to 25μF. Low gain but with clean pictures and good sound and 2·2V a.g.c. bias at 2TP3 is due to 2C13 being defective: this 0·01μF decoupling capacitor is in the collector circuit of the first i.f. stage, in can J. The a.g.c. reservoir capacitor 2C38 can dry up to cause overloading (negative picture). The latter fault can also be caused by 2VT6 of course.

Sound Faults

No sound with loud hum is usually either the audio output transistors 2VT15/16 (which can also be responsible for low, distorted sound) or a dud TAA350 i.c. Less common causes of no sound are the driver transistors 2VT13/14, the slope detector diode 2D7 or the electrolytic coupler 2C84. The TAA350 can also be responsible for buzz and distorted sound.

If the TAA350 i.c. is suspect, check the following voltages:

(1) Supply voltage to pin 9. This should be between 5 and 8V. If not within these limits, check the supply circuitry.

(2) The following voltages should be obtained with a 20kΩ/V meter: pin 1 4·9V; pin 2 4·9V; pin 3 chassis earth line; pin 4 4·9V; pin 5 5·0V; pin 6 5·0V; pin 7 4·9V.

(3) If any of these voltages are wrong, check the values of 2R60/61.

(4) Check the current taken by the i.c. by inserting an Avo between pin 9 and the supply. It should be within the limits of 15-30mA for 6V supply at pin 9. The current is proportional to the supply voltage at this pin.

(5) If errors are found during the above checks, replace the i.c. – bearing in mind that when new the i.c. has ten leads, only nine of which are used in the A823. Cut off the lead opposite the spigot before fitting.

If instability occurs after replacement, fit a 1μF electrolytic in place of the existing 2C69. This should have a minimum working rating of 30V. On later receivers, 2C64/67/68 were all changed to 0·05μF.

Severe crackling on sound is nearly always due to 2C64/67/68/69 on the A809 panel, but it should be borne in mind that as the type of capacitor used in these positions is of the semiconductor (barrier-layer) type, resistance tests are not conclusive, replacement being the only reliable method of testing.

Chrominance IF Stages

In addition to the main i.f. circuit, the luminance emitter-follower 2VT5, the a.g.c. circuit and the sound circuit, two of the cans on the A809 i.f. board are concerned with the chrominance signal – so no colour or intermittent colour can be due to a fault on this board.

The chrominance i.f. signal is taken off between the cascode i.f. stage and the final vision/sound i.f. stage and fed to can L. This contains an i.f amplifier transistor 2VT8 (BF196) and a second transistor 2VT7 (BC148) which is used to apply a.c.c. to the base of 2VT8. The colour control acts on the base of 2VT7, the a.c.c. potential from the decoder board being applied to its emitter. The second module, can M, contains the final chrominance i.f. transistor 2VT9 (BF197), the chrominance detector diode 2D5 and the two-stage chrominance amplifier 2VT10/11 (both type BC148). Problems here are few and far between, but the transistors can be responsible for no colour or intermittent colour while the electrolytics 2C41 and 2C42 (both 10μF) which decouple the base and emitter of the a.c.c. transistor 2VT7 can be responsible for faulty colour control operation or fluctuation of the colour content.

Filter Fault

The only remaining source of trouble that comes to mind on the A809 i.f. panel is the input selective can H. Slight misalignment of the large core at the bottom of this module can give noisy chrominance and a sharply tuned buzz on sound. Very slight tweaking of this core usually cures this annoying fault, which is sometimes complained of as being intermittent buzz, the customer being unaware that very slight tuner retuning gets rid of it!

The Decoder

So we come to the decoder, which is probably one of the most reliable produced by a UK setmaker. This panel (A807) is easily distinguishable from the one used in later versions of the chassis since it has just one large i.c. instead of two. The RGB channels are also mounted on this board. Decoding errors are nearly always attributable to a faulty electrolytic, transistor or i.c., in that order, though most non-decoding faults (i.e. colours missing or predominant) are usually the result of defective RGB output transistors.

Before we go farther we had better mention that the decoder employs some rather unusual techniques. These all revolve around the use of a passive circuit instead of the usual feedback oscillator with a.f.c. loop to generate the reference signal. The bursts are applied direct to the passive crystal oscillator circuit, which thus rings and continues to do so throughout the active line until the next burst appears. For this to work effectively, the alternating PAL bursts have to be converted to a constant phase signal. This is achieved by a switching circuit which is driven by the same bistable that drives the PAL switch. It's worth taking a detailed look at the decoder circuit therefore (see Fig. 3).

The signal from the chrominance section of the i.f. strip arrives at pin 9 of plug 3Z1, where it takes two separate paths, one concerned with chroma processing – to the delay line driver 3VT2 and then to the i.c. – the other concerned with generating the reference signal. This latter path starts with the gated burst amplifier 3VT7.

Burst Blanking

The first step in the chrominance path is to blank out the burst signal, which would otherwise affect the clamping action in the RGB output circuits. Blanking is effected by feeding a pulse from the line output transformer to pin 8 of plug 3Z1: this pulse is of approximately 110V amplitude, but is clipped to 18V by 3D4 whose cathode is connected to the decoder's 18V rail.

The 18V pulse thus derived is used to switch off diodes 3D2 and 3D5 which are connected back to back in the chroma signal path to the base of 3VT2, the delay line driver. These diodes therefore switch off the chroma signal feed to this transistor during the burst period, removing the burst from the chroma path.

Delay Line Circuit

From 3VT2 the amplified signal passes into the delay line, while the direct path signal from the emitter of this transistor is fed to the centre-tap of the output from the delay line, where the normal addition/subtraction produces the R – Y and B – Y signals ready for insertion into the i.c. Balancing of the delayed and direct signals is obtained by adjusting the gain of 3VT2 by 3RV3.

Burst Processing

The other signal path is via 3C33 to the base of 3VT7, the first burst gate. As the collector supply voltage for this transistor consists of the same 18V pulse previously mentioned, it follows that this transistor conducts only during the burst period. The chroma information is therefore blocked at this point and only the burst appears across the primary of the phase switching transformer 3T5.

This transformer has two secondaries feeding two diodes, 3D11 and 3D12, which convert the swinging burst to a constant phase burst. Correct switching of these two diodes is accomplished by the squarewave output from the bistable circuit around 3VT3 and 3VT4. These two transistors are controlled by the steering diodes 3D7 and 3D8, which are in turn switched on by the 18V pulse already mentioned.

Passive Subcarrier Regenerator

To get back to the constant-phase burst at the cathodes of 3D11 and 3D12, this passes via 3C38 to the base of 3VT8, the second burst gate and crystal driver. In this decoder there is no local oscillator as such, a ringing circuit tuned to the subcarrier frequency being used instead. 3VT8 carries out this function, by supplying a constant-phase burst and "ringing" the crystal 3XL1 and its associated choke 3L21. 3VT8 is biased so that it will conduct only when a positive pulse is applied to its base, thus preventing the passage of signals during the line-scan periods. This positive pulse comes from the secondary of 3T1, which generates an overswing when 3D3 is switched off by a pulse from the line output transformer – yes, you guessed, the same old pulse again! The purpose of 3T1 is to delay the pulse in time so that 3VT8 conducts accurately during the whole of the burst period. When 3VT8 conducts, the constant-phase subcarrier burst "rings" the oscillator crystal, the resultant 4·43MHz regenerated carrier then being fed to 3VT9 for amplification.

The purpose of 3TC2 is to tune-out the residual burst, by feeding a controlled amount of burst into the base of 3VT9 in anti-phase with the original. After amplification, the subcarrier passes to the emitter-follower 3VT10 and from there to the i.c.

Automatic Chrominance Control

A.C.C. is effected by sampling the subcarrier present at the regenerator stage and doubling its voltage by 3D13, 3D14 and 3C40. This voltage biases the emitter-follower 3VT6 which supplies a gain-control voltage to the chroma module on the i.f. strip.

Colour Killing and Bistable Phasing

It will be remembered that diodes 3D2 and 3D5 were switched off during the burst period to stop the burst reaching the delay-line driver 3VT2. Obviously this is an ideal place to cut off the colour signals in the decoder, and this fact is made use of for colour killing purposes on monochrome reception. 3VT11 controls the phase of the bistable circuit and also biases the colour-killer transistor 3VT1.

If no subcarrier is present, as in monochrome reception, there will be no negative voltage developed at the anode end of 3D15 and, provided 3RV7 is properly adjusted, there will be no bias on the base of 3VT11. This transistor will be switched off therefore and its collector will be at chassis potential. The base of 3VT1 is connected directly to the collector of 3VT11 and is therefore also switched off, its emitter also being at chassis level. The collector of 3VT1 is taken to the 18V supply, and as this is connected via 3R6 to the cathodes of 3D2 and 3D5, these are both switched off, thus opening the chroma path and killing all colour. With the subcarrier present on colour, 3VT11 and 3VT1 switch on. 3R6 is then returned to chassis instead of the 18V rail, and 3D2/5 switch on.

Bistable phase is controlled by 3VT11 in the same way. If diodes 3D11 and 3D12 are switching at the wrong times – as would be the case if the bistable was out of step – their output will almost cancel out and a low output will be obtained from the regenerator circuit. If 3RV7 is properly set, the negative voltage generated by diode 3D15 will be insufficient to switch on 3VT11, its collector voltage will drop to chassis potential and, besides switching off the colour-killer, this will switch diode 3D6 hard on, bypassing the 18V pulse from its normal path to 3D7 and instead diverting it via 3C7 to chassis. The absence of this switching pulse from the anode of 3D7 means that 3VT3 is not switched, therefore the bistable circuit "misses a beat" and the phase is corrected.

Phase Shifting

When we left 3VT10, we had an amplified subcarrier of correct frequency at its emitter. Before we can feed this into the i.c. and let that piece of micro-technology do the rest, it's necessary to do a bit of phase-fiddling. The B – Y subcarrier has to be shifted through 90°, and this is the purpose of 3T4 and 3TC1 plus their associated components. The resultant is fed to pins 4 and 5 of the i.c.

The R—Y subcarrier needs a bit more done to it however. In order to demodulate the PAL signal correctly its phase must be reversed on alternate lines, in step with the alternations at the transmitter. The 180° phase change is carried out by alternately switching the two diodes 3D9 and 3D10 in such a way that the subcarrier output from 3T2 is always in the correct sense. The diode switching is done by the squarewaves from the bistable 3VT3/4. After further modification by 3T3, the phase-alternating subcarrier is fed to pins 16 and 17 of the i.c.

The SL901 IC

The SL901 integrated circuit carries out demodulation plus matrixing of the R and B signals to produce the G output. We've seen how the necessary information is

Table 1: SL901 Voltages

The voltages on the pins of the SL901 i.c. should be within the limits shown below, when measured with an 20kΩ/V meter (Avo 8) under normal signal conditions. Irreparable damage to the i.c. can be caused by shorting adjacent pins, so great care is required when making these voltage checks: it's best to take measurements from adjacent print areas.

Pin	*Voltage*	*Pin*	*Voltage*
1	1·8-2·6V	11	Chassis
2	4·5-5·5V	12	3·5-9V
3	4·5-5·5V	13	3·5-9V
4	6·5-7·8V	14	11-14V
5	6·5-7·8V	15	9·8-14V
6	9·8-14V	16	6·5-7·8V
7	3·5-9V	17	6·5-7·8V
8	1·8-2·6V	18	4·5-5·5V
9	Approximately 0·7V below pin 10	19	Chassis
10	4-6V	20	17-19V

extracted from the chroma signals ready for feeding into the i.c. All that remains is to supply the actual picture information and we're away! The video or luminance signals are supplied via pin 3Z1-5 to the delay line 3L17 from where they pass via 3C30 to the base of emitter-follower 3VT5. The signals at the emitter then pass through a subcarrier rejector 3L15/16 to the i.c.

RGB Channels

The red, green and blue video outputs obtained from the i.c. are fed to three identical output stages, each of which is provided with a preset control for grey-scale purposes. The three output transistors 3VT15, 16 and 17 have their collector voltages clamped by diodes 3D19, 20 and 21, the clamp pulse from the line output transformer coming into the decoder at pin 3Z1-3.

This same pulse is used to drive 3VT18, the brightness pulse inverter. The inverted pulse, of amplitude set by the brightness control 3RV11, is fed in to pin 8 of the i.c. where it is mixed with the decoded signal. As the clamp pulse occurs at the same time as the brightness pulse, it follows that the brightness control sets the voltage at which the three output transistor collectors are clamped. As this is also the c.r.t. cathode potential, picture brightness control is achieved.

Decoder Servicing

It may seem that undue attention has been given to the operation of this decoder. This is not because this decoder is particularly difficult to understand, the main object being to make clear what happens in each stage. How anyone can gaily start out on fault-finding if he doesn't know the function of each stage is beyond the writer to understand!

The main snag with this decoder as far as servicing goes is that it is impossible to work on it to any great extent without removing it from the chassis and operating it with extended leads. Special leads are available from Rank Radio International for this purpose.

Preliminary Tests

As with any decoder, voltage tests at relevant places usually indicate fault areas and narrow the field down when chasing colour faults. The first step is always to demobilise the colour-killer and see what then gives. It's surprising how many decoders suffer from defective colour-killers, the fault disappearing as soon as the culprit is disarmed! On this decoder shorting 3TP11 to 3TP14 over-rides the colour-killer action, by switching 3VT1 on and removing the reverse bias on diodes 3D2/5. It takes a little time to decide whether the fault lies in the SL901 i.c., but as always voltage readings will usually indicate where the fault lies (see Table 1).

Common Faults

In cases of no colour, first make sure that the decoder's 18V supply is present. The 18V zener diode 8D1 in the power supply and 3C16 are both suspect.

Some of the stock faults on the A807 decoder panel are as follows.

Very low luminance, colour o.k.: Check the luminance delay line 3L17 and its connections, or coils 3L15 and 3L16. If shorting pins 9 and 10 of the i.c. cures the trouble, the i.c. is faulty.

No luminance, colour o.k.: Usually 3VT5, may be 3C30.

Intermittent colour: Apply freezer to the i.c. If the colour returns, replace it. If not check the setting of 3RV7, or 3VT11 and 3D15. Other possibilities are 3C43 (100μF) which decouples the supply to the crystal driver; 3VT6; 3C49. The trouble may be in the i.f. strip (2VT7-2VT11).

No colour: Check the 18V supply. Almost any of the transistors can be responsible, including those on the i.f. board handling the chrominance signal: 3VT11 seems to be the most common offender however, as over-riding the colour-killer will prove. Note that in this decoder the bistable transistors can be responsible for loss of colour, since the burst feed to the carrier signal regenerator will be affected. 3D14 in the a.c.c. detector circuit may be short-circuit.

Unstable colour at high saturation: Check 3VT6.

Colour bands: Check 3D3.

Streaky colour at high saturation settings: 3D11 and 3D12 out of balance.

Hanover bars: Check the setting of 3RV3, then 3VT2.

One colour missing, poor monochrome: I.C. faulty, but check the RGB signal coupling electrolytics 3C52/3/4.

One colour missing, monochrome wrong: Check RGB driver and output transistors.

One colour predominant: Compare RGB output transistor collector voltages. The low reading indicates the faulty channel. Check output and driver transistors and replace if either one shows a leakage on the ohms range of an ordinary Avo. If both are o.k. check the appropriate clamp diode 3D19/20/21, capacitors 3C55/6/7 and 3C61/2/3, and resistors 3R82/3/4. The diodes 3D17/8/9 are not required and may be removed.

Low brightness: Check 3VT18 and its emitter resistor 3R104.

Uncontrollable brightness: Check the clamp/brightness pulse feed capacitor 8C11 (0·1μF, 1kV) on the main chassis.

Luminance ringing: Dry-joint on luminance delay line.

As with all modern equipment, it pays to suspect any very small electrolytics in a faulty circuit: even tantalum types fail fairly frequently, but drilytic ones have a limited life.

If one is working from the Bush/Murphy service manual, note that in one of their modification sheets it states that the pulse clipper diode 8D4 is shown the wrong way round in the circuit on page H-3: this is very naughty, H-3 is perfectly o.k., it's page E-3 that's wrong!

TO BE CONTINUED

Servicing the Rank A823 Colour Chassis

Part 2

R. W. Thomson

THE timebase panel, type A803, is situated at the extreme right of the chassis and contains the sync separator, the field oscillator and output stages, the flywheel line sync and line oscillator stages and the line driver transistor. The latter drives the two series-connected BU105 line output transistors, which are housed within the can screening the line output transformer, the e.h.t. tripler and the focus unit. Fig. 4 shows the sync separator and line generator circuits.

Sync Circuit

5VT1 is the sync separator, which is biased during the scan period to a point just beyond cut-off. The arrival of a sync pulse drives 5VT1 into conduction, pulling the collector voltage down far enough to cut-off 5VT2 whose base is d.c. connected to the collector of 5VT1. The fast interruption of current through the primary of 5T1 causes this inductance to "ring", similar waveforms being generated in the secondary winding 5L2. 5C7 tunes the primary 5L1, and a sinewave of approximately 50V p-p is developed across the secondary 5L2 as a reference waveform for the discriminator diodes 5D2 and 5D3. The "hot" end of 5L2 is connected to the junction of these two diodes. When 5VT1 returns to the cut-off state, 5VT2 turns on again, taking diode 5D1 into conduction and damping any further oscillation in 5T1 until the next sync pulse arrives.

Positive and negative pulses from the line output transformer are fed to the outer ends of diodes 5D2/3. The resultant phase comparison of the two pulses with the sinewave from 5L2 creates a voltage across the balance control 5RV2 which, when correctly adjusted, supplies the correct voltage conditions for varicap diode 5D4.

Line Oscillator and Driver

Any change in the capacitance of 5D4 is multiplied by the reactance multiplier 5VT4, varying the reactance across 5T2, thus keeping the frequency and phase of the line oscillator in strict relationship with the sync pulses. The line oscillator transistor 5VT5 is driven hard on and off by the feedback pulses from 5C21, and in consequence a rectangular waveform appears across 5C23 to drive 5VT6/7. 5D5 protects the base-emitter junction of 5VT5, while 5D6 d.c. restores the waveform at the base of 5VT6. The emitter-follower 5VT6 drives the base of 5VT7 at low-impedance, ensuring that the latter is effectively bottomed by the drive pulse. This keeps the dissipation in 5VT7 low, hence the absence of a heatsink on this BD131, a transistor which usually runs very hot in other types of circuit.

Line Generator Faults

It will be noted that the primary of the driver transformer 6T1 is shunted by the damping network 5C25 and 5R35. This is essential to avoid the back-e.m.f. from the primary destroying 5VT7. These two components, particularly the capacitor 5C25, should be checked in all cases of BD131 failure since this is a prime cause for the failure of this transistor, an event which is regularly encountered in these sets. The result is no e.h.t. of course, but since 5VT7 usually goes short-circuit the l.t. fuse 8F1 blows and there is no sound either – in fact nothing except the tube heater glowing. Also check the connections to 2R35/2C25 should 5VT7 have failed since a dry-joint here can be responsible. The BD131 can also go open-circuit of course, but this time the fuse doesn't fail.

The capacitors in this area can be troublesome. 5C14, 5C20, 5C21 and 5C23 have all been found responsible for no e.h.t. Intermittent loss of e.h.t. has been traced to 5C7, 5C17 and 5C18 – also 5D6, which can be checked with freezer. Loss of line sync can be caused by 5C14, 5C20 (also check whether it's dry-jointed), 5C21 and 5C23; also the flywheel sync discriminator diodes, usually 5D2. Intermittent loss of sync can be 5C17/18 or the line oscillator coil (5T2) former warping. Intermittent line jitter can be 5C17/18 again. Finally 5C22 can be responsible for bent verticals, maybe intermittent.

If false line lock is experienced with early sets, look at 5T1 and see whether it bears a green spot. If it doesn't, replacing it with a modified transformer will cure this fault. Later transformers had a green spot to indicate that the phase of the primary/secondary had been changed.

Line Output Stage

As with other early solid-state designs there are two line output transistors, connected in series in order to share the line flyback pulse between them. Loss of e.h.t. (with 8F3 blown) due to failure of the line output transistors is not common. When it does happen the cause is lack of balance between the two: if the base drive waveforms are not adjusted so that the two transistors switch off at the same time, the first one to switch off will have the full flyback pulse voltage across it. To prevent this, chokes 6L4 and 6L5 are included in the base drive circuits: one has a movable core which is adjusted to equalise the decay of the base currents and ensure that the two transistors switch off at the same instant. The way of doing this is described below – the method for later versions differs because with these both coils are adjustable.

The e.h.t. tripler and focus arrangements follow the normal lines in this type of chassis, but a point worth mentioning is the extremely high reliability of the line output transformer. The only one I've had to replace didn't fail of its own accord but due to a non-soldered joint that somehow missed the factory's inspection department. So in cases of no e.h.t., the line output transformer is the last thing to suspect.

In cases of no e.h.t. where 6R6 is of the fusible type check whether this has gone open-circuit. If so, check the line output transistors and the flyback tuning capacitors 6C5 and 6C6. The main cause of line output stage failure in early sets was these two polystyrene capacitors, so much so

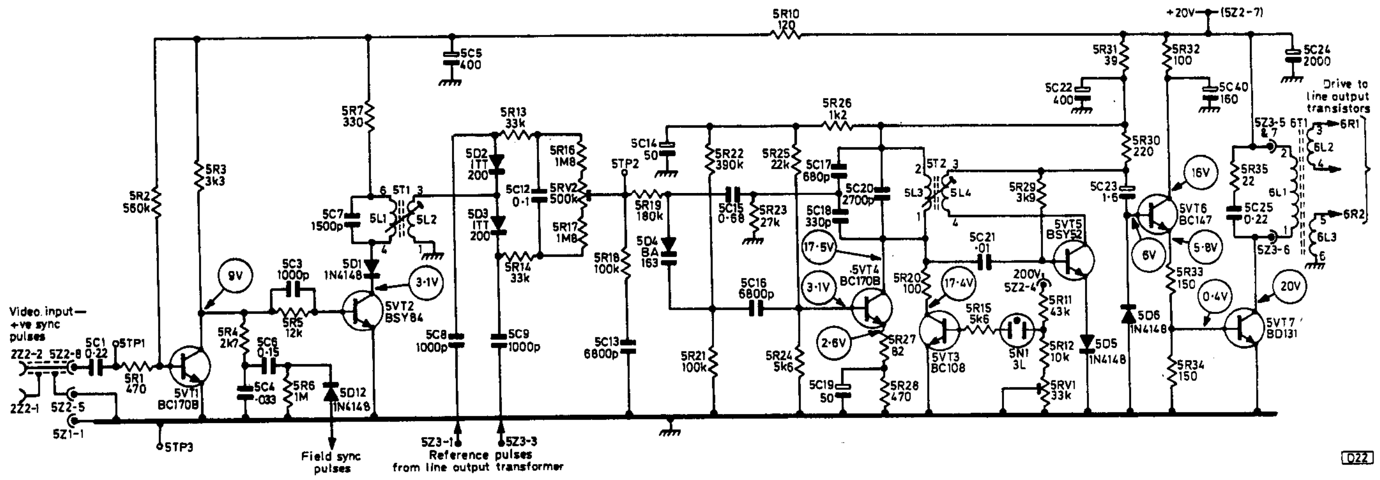


Fig. 4: Sync separator and line generator circuits. See Fig. 7 for modifications. 5TP4 (not shown) is a chassis connection.

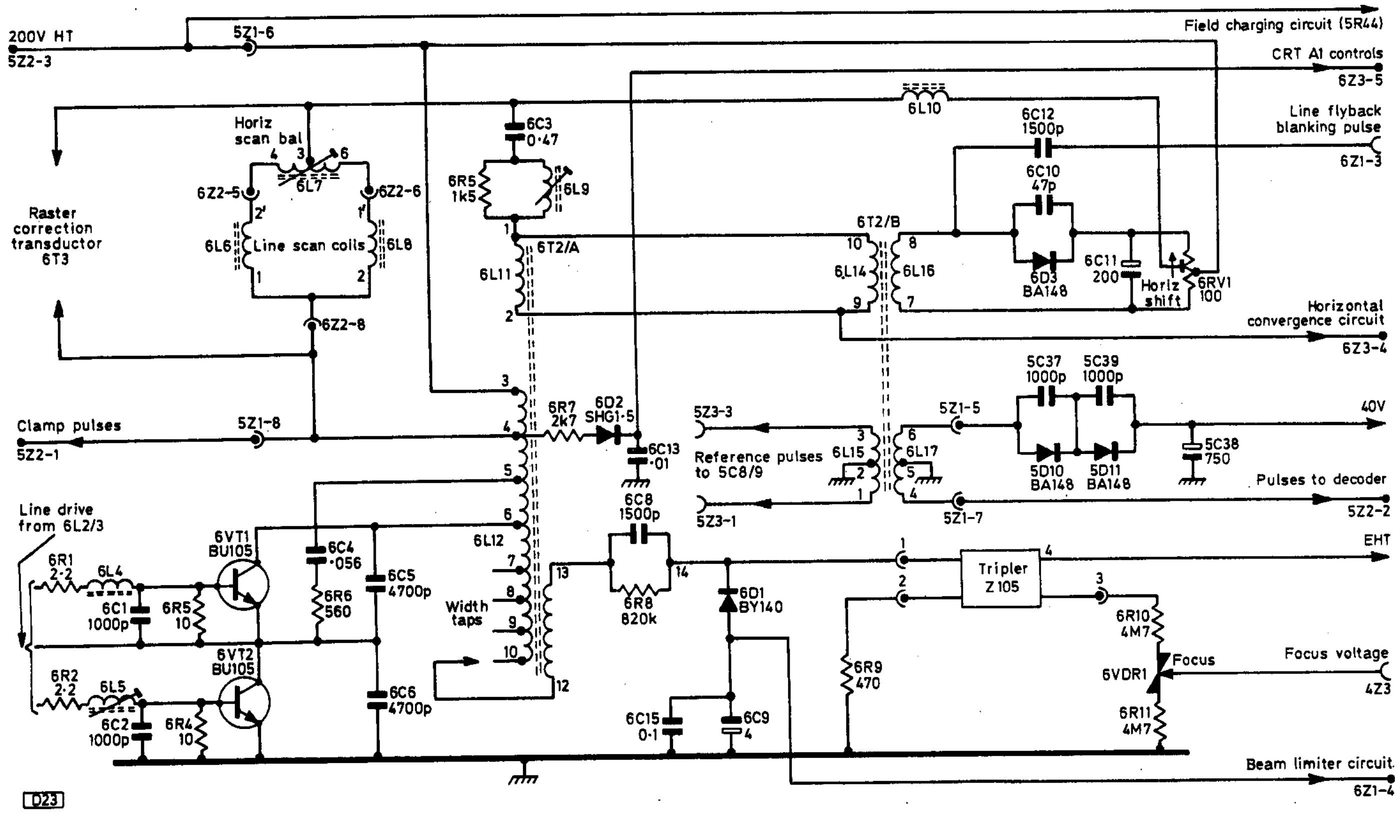


Fig. 5: Line output stage circuit. See Fig. 7 for modifications.

that many engineers automatically replaced them with alternative types before putting sets into service. The capacitors chosen were the tubular types supplied at the time by RS Components – listed as 800V a.c. buffer types. Subsequently Rank themselves started to use these capacitors. Although they are not close tolerance types, they worked and still do.

Adjustments

Balancing the line output transistors is, as you've now gathered, highly important. The writer checks this every time a receiver comes into the workshop, no matter for what reason. Perhaps this is the reason why the failure rate of line output transistors has been so low in the receivers I've handled. It doesn't take long to rebalance the stage, which *does* go out of balance over the years. The procedure for early versions is as follows:

(1) Note the voltage at 8F3 on the power panel, then switch off the set.

(2) Solder a 390kΩ resistor in parallel with 8R9. Switch on and set 8RV1 to give 100V at 8F3.

(3) Tune the set to a test card or pattern generator or other stationary picture source, relock the line hold if necessary, and switch off again.

(4) Swing the scan output panel out on its hinges, and connect the meter's negative lead to the pin carrying two red wires on the scan control panel. Connect the positive meter lead to the fuse 8F3. Switch on again and adjust 6L5 for minimum reading on the meter, starting with the 250/300V range and progressively changing downwards until on the 10V range. A reading of less than 3·5V should be obtained. This will be the point at which the circuit is working most efficiently, with both transistors driven equally.

(5) Switch off and remove the meter leads and bridging

resistor. Check that 8R9 is a good, sound 390kΩ resistor. Replace the panel and the job's done.

If adequate width is obtainable with 200-210V at 8F3 all is well, but if the width is excessive or insufficient the tapping at tags 7, 8, 9 or 10 on the line output transformer should be selected for correct picture size in the horizontal direction, adjustment of field balancing being necessary if any change is made.

The line oscillator is easily adjusted by shorting pins 5TP2 and 4, then adjusting the core of 5L3/4 until a near stationary picture is obtained. 5RV2 should be adjusted to the centre-point between break-up in either direction, and if the displayed picture is not right in relation to the raster the core of 5T1 should be used to correct this.

Overvoltage Protection

Overvoltage protection of the line output transistors is provided to avoid over-running and possible destruction of these components, plus the avoidance of excessive e.h.t. This is done by having a normally non-conducting transistor 5VT3 shunted across the line oscillator coil 5L3. If the h.t. rises above a voltage preset by 5RV1, neon 5N1 strikes and 5VT3 switches on, effectively shorting 5L3. This stops the oscillator and switches off the output transistors. The circuit remains in this condition until the set is switched off and the neon is extinguished.

To set this stage accurately, two spare resistors, of 220kΩ and 270kΩ, should be connected in series across 5R11. A temporary short is then made across the 270kΩ resistor, the receiver switched on, and 5RV1 adjusted until the neon strikes. After switching the set off and removing the temporary short across the 270kΩ resistor, switch the set on again and the neon should, if properly set, remain unlit. If it does strike, either the procedure has been carried out too roughly or there is a fault in the circuit. The overvoltage circuit should be reset whenever the set h.t./e.h.t. control 8RV1 has been adjusted.

Note that a diode was added in place of 5R20 fairly early on in the life of the A823 chassis. This was to allow the use of low-gain transistors for 5VT3.

If the overvoltage neon keeps striking despite correct setting up, check the transistor 5VT3 and the value of 5R11. The neon itself can be faulty, striking to produce loss of raster a short while after switching on.

Modifications

Various modifications were made in the line output stage before the introduction of the later A823A version of the chassis. Fig. 7 shows the changes, which include adjustable coils in the drive to each line output transistor. The procedure for balancing the output transistors is in this case as follows:

(1) Switch off, remove fuse 8F1 and fit an additional 390kΩ resistor in parallel with 8R9.

(2) Switch on and reduce the h.t. to approximately 100V by means of 8RV1.

(3) Switch off, replace 8F1 and set the cores of 6L4 and 6L5 to be flush with the top ends of their formers. Connect a meter on the 250V a.c. range across 6R6.

(4) Switch on and rotate the core of 6L5 clockwise, by no more than three turns, for minimum reading on the meter (after three turns the reading will not change due to the coil inductance being at maximum). If the adjustment results in an increased reading on the meter, return the core to the flush position and then rotate the core of 6L4 inwards. When the minimum reading has been obtained with either coil the other must then be adjusted to finally achieve balance. Rotate the cores slowly, because the minimum reading may be missed due to the damping in the meter. Reduce the meter range as adjustment proceeds, making the final adjustment on the 10V range.

(5) Return the h.t. voltage to normal by removing the added 390kΩ resistor and resetting 8RV1.

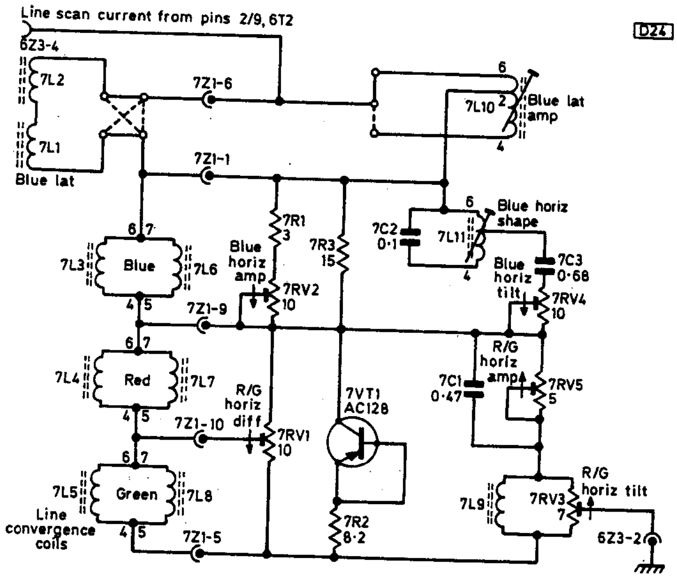


Fig. 6: Horizontal convergence circuit.

Fault Summary

It's possible for the line output stage to work after a fashion with only one of the line output transistors operational. This will result in an unusually large raster due to the low e.h.t. In addition to balancing the line output transistors, their base circuit series resistors 6R1/2 should be checked since they tend to change value. It's best to change line output transistors in pairs.

In addition to the line output transistors going short-circuit, several other components in the line output stage can cause the h.t. fuse 8F3 to blow. One is the tuning capacitors (6C5/6) previously mentioned, another is the c.r.t. first anode supply rectifier 6D2 and/or its reservoir capacitor 6C13 (in either case 6R7 will probably be burnt). Other causes are the horizontal shift circuit rectifier diode 6D3 and its reservoir capacitor 6C11, the scan-correction capacitor 6C3, shorting turns in the pincushion distortion correction transductor 6T3 (which may smoke!), and, not so common, short-circuit scan coils.

The tripler gives its share of trouble, from ballooning when the brightness control is advanced to no e.h.t. Depending on what's wrong within it, 6R9 may be found in a charred condition.

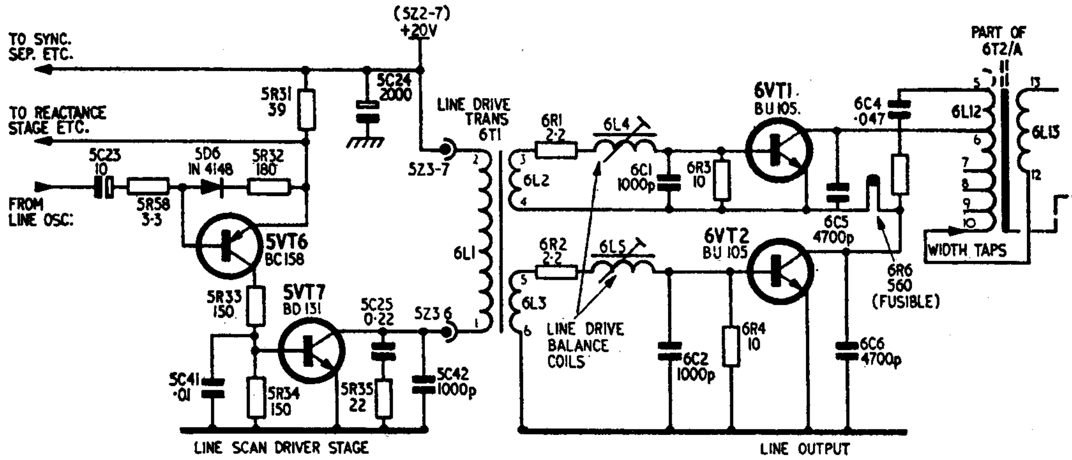
A not uncommon fault is a narrow picture (may be about 2in. wide), with smoke from the convergence board. The cause is the R/G horizontal tilt control 7RV3 on this board burning up – the line scan current returns to chassis via this control.

The old fault of striations across the screen is due to the usual cause – the linearity coil damping resistor, in this case 6R5. The striations are usually down the left-hand side of the screen only.

Focusing

Focus is effected in the now well-established manner, using a tapping on the tripler to supply a resistor chain

Fig. 7: Line driver and output stage modifications. In addition, 5R20 replaced by a 1N4148 diode, 5C43 (390pF) added from 5VT1 base to chassis, 6C9 changed to 5µF and 6D1 to type BY182, and 6L25 added between 6L17 pin 6 and 5Z1-5.



consisting of two 4·7MΩ resistors, 6R10 and 6R11, at either side of a variable focus unit comprising a VDR and a sliding contact tapping from it. The faults in this system are well-established too! If the top resistor in the chain (6R10) goes high, focus is lost and is outside the range of the control; whereas if the other one (6R11) gives up, the full output from the tripler is allowed to reach the c.r.t. unattenuated, usually causing the spark gap 4SG3 to burst into flame and melt. Occasionally the series resistor 4R8 goes high, and this should always be checked when investigating focus faults.

TO BE CONTINUED

Service Notebook

G. R. Wilding

Fuse Failure

After working normally until switch off the previous evening, a Philips colour set fitted with the G8 chassis was found to be completely dead the next day. This is common enough of course, and is usually due to the switch-on surge blowing an elderly fuse or causing an ageing component in the power supply to break down and blow the fuse. Inspection showed that the 3·15A mains fuse was open-circuit and blackened internally, but the usual cause of this in these models, the BT106 thyristor rectifier, was o.k. No other fuses were blown, and there were no signs of any damaged components nor of any short-circuits, so we replaced the fuse and switched on. The result was a good picture and sound. The static and dynamic convergence were somewhat away from optimum however, and as a test card transmission had conveniently commenced we spent quite some time adjusting the magnets and presets.

As usual with a fault of this nature, we then switched the set off and on several times to see whether the new fuse might blow. We then switched off and replaced the back. On switching on again – no results! The mains fuse had blown, but as before there were no signs of a short in the BT106 or anywhere else. Since these thyristors do commonly break down after some years' service however we fitted a replacement. Some weeks later there has been no further call for service so it seems that the original must have been shorting intermittently.

Loss of Sound

One of the few stock faults on Decca hybrid colour receivers (series 10 and 30) is complete loss of sound from the PCL82 audio circuit. In most cases it will be found that the valve is running quite cool, due to the wirewound resistor R82 on the power supply panel being open-circuit. The resistor is not of the same value, nor used for the same purpose, in the various versions of these chassis however. In the 17in. Model CS1730 and the 10 series chassis it's 12kΩ and supplies the pentode section's screen grid and the triode anode's 220kΩ anode load resistor. In the later 30 series chassis, with the vertically mounted tuner, R82 is 1·8kΩ and feeds the screen grid and both anodes. The best way to change the resistor is first to unclip the vertically mounted timebase panel, after which it will be found readily accessible on the horizontally mounted power supply panel.

Failure of this resistor is generally due to ageing, but in several cases I've found that after replacing it and retesting the sound quality soon deteriorated. The cause was a leak in the 0·1µF coupling capacitor (C82) between the two sections of the valve. As a result it was also necessary to change the valve and the pentode section's bias resistor.

Philips 210 Chassis

A dual-standard Philips monochrome set fitted with the 210 hybrid chassis produced a very elongated picture, especially in the top half of the screen. The main and top field linearity controls had only marginal effect, so clearly there was something wrong with the negative feedback loop used to provide field linearity. There are several components involved here, the source of the feedback being a tertiary winding on the field output transformer. Unfortunately the winding turned out to be open-circuit, necessitating a replacement transformer.

There are many tens of thousands of these sets still in service and, apart from the two droppers which develop open-circuit sections more than most, they've proved very reliable. The right-hand section of the left-hand dropper, R1544, is particularly vulnerable since it consists of many turns of fine wire to give a resistance of 2·85kΩ. It's used to drop the h.t. supply to a voltage suitable to feed the transistor circuits. In cases of an unmodulated raster with no sound therefore, first check R1544. I find it's worthwhile carrying exact replacements for both droppers: there's no temporary substitute possible for R1544, while there's insufficient room under the heat dissipating plate to satisfactorily mount those resistors which are usually so useful for bridging open-circuit dropper sections.

Servicing the Rank A823 Colour Chassis

Part 3

R. W. Thomson

THE 40V rail used to power the field timebase is obtained from a winding on the line output transformer. There are two series-connected rectifier diodes, 5D10/11, with 5C38 the reservoir capacitor. The actual voltage obtained depends on the h.t. supply voltage to the line output stage and on the width tapping selected, so if either is altered the 40V line should be checked and the field output stage balanced. Naturally should 5C38 be short-circuit or either of the rectifier diodes defective there will be no 40V rail and field collapse.

Field Oscillator Circuit

The field oscillator consists of the small four-layer (pnpn) semiconductor device BRY39 (5THY1). This is known as a silicon controlled switch. When it briefly fires it switches on the following transistor 5VT9 and in consequence the field charging capacitors 5C30/31 are discharged providing the field flyback. The BRY39 will conduct whenever its anode voltage is higher than the voltage at its anode gate – set here by 5RV3. It will then become an effective short-circuit. If the current flowing through it falls below the hold-on value, the device will switch off again. The point at which 5THY1 switches on is set by the timing components 5C29/5R41 – 5D7 is biased on by 5R40, holding the left-hand side of 5C29 at chassis potential: consequently the other side of 5C29 charges towards 40V via 5R41. When 5THY1 fires the current through, and voltage across, 5R42 switches 5VT9 on. The field charging capacitors, which are charged from the h.t. supply, are then discharged.

The conduction of 5THY1 discharges the timing capacitor 5C29, and the conditions at the anode of 5D7 at this time are such that it switches off. Once 5C29 has discharged, the current through 5THY1 is insufficient to hold it on. In consequence it switches off and as 5D7 is now once more forward biased the charging cycle is repeated. Synchronisation is effected by feeding a negative-going field sync pulse to the anode gate of 5THY1, so that it switches on just before the point at which it would conduct due to the charging of 5C29.

Field Driver and Output Stages

The positive-going sawtooth waveform generated across the field charging capacitors is fed to the base of the emitter-follower driver transistor 5VT10, which is thus driven towards cut-off. The positive-going sawtooth at its emitter drives 5VT12 which, in conjunction with 5VT11, provides the field output. 5VT11 is driven from the collector of 5VT12, which is the "prime mover" during the forward scan. 5VT11 provides a complex action during the flyback as a result of which the spot is returned from the bottom to the top of the screen – what happens is that the scan coils provide a half-cycle of oscillation in conjunction with 5C35, 5D9 conducting when the oscillation tries to swing negatively, thereby clamping the voltage at 5VT11's collector at 40V.

Scan Current Path

The scan current flows via the coils, 6RV2, the pincushion distortion correction circuit and 7C5 to the vertical convergence circuit, then to chassis.

Common Troubles

Most troubles in the field timebase are caused by the same few components. Field bounce, judder, poor lock and/or height fluctuations are nearly always eradicated if the field charging capacitors 5C30/31 and the output bootstrap capacitor 5C34 are replaced as a matter of course, although judder can be due to faults in the power supplies (see later). As mentioned in the first part, 2C37 on the i.f. panel can be responsible for poor locking: another possibility here is 5C5 (400μF) which decouples the supply to the sync separator. Field collapse is usually due to the BD131 transistors in the output stage, though absence of the 40V supply is occasionally responsible. Intermittent loss of field scan can generally be eliminated by resoldering the connections to 6L20 or replacing 6RV4 – these components are in the pincushion distortion correction circuit on the scan control panel.

Fault Summary

Other causes of field collapse are 5R54, 5R55 or 5R49 in the output stage going open-circuit, a defective driver transistor (5VT10) or faulty scan coils.

Lack of height can be due to leakage in 5VT10/11/12, 6RV4 having a defective track, 5C30/31 drying up or, occasionally, the scan coils. Check that the 40V line is not low. Another fault which has been traced to the scan coils is very intermittent (every few hours) field bounce.

Foldover at the bottom can be caused by 5C30/31 or 5D7; foldover at the top with bottom cramping indicates faulty output transistors; while 5VT10 and 5VT9 can also be responsible for foldover.

The small preset controls 5RV5 and 5RV6 often cause field bounce.

No field sync means that the sync separator transistor 5VT1 has failed. The field deflection current coupling capacitor 7C5 on the convergence panel can be responsible for intermittent field jitter.

Output Stage Adjustment

The working point of the field output stage is set by 5RV5 – there will be bottom cramping if it's incorrectly set. To adjust, first set the height, hold and linearity controls, then measure the rail voltage (approximately 40V) at 5Z1-4: divide the reading by two and add two, i.e. $40/2 = 20 + 2$

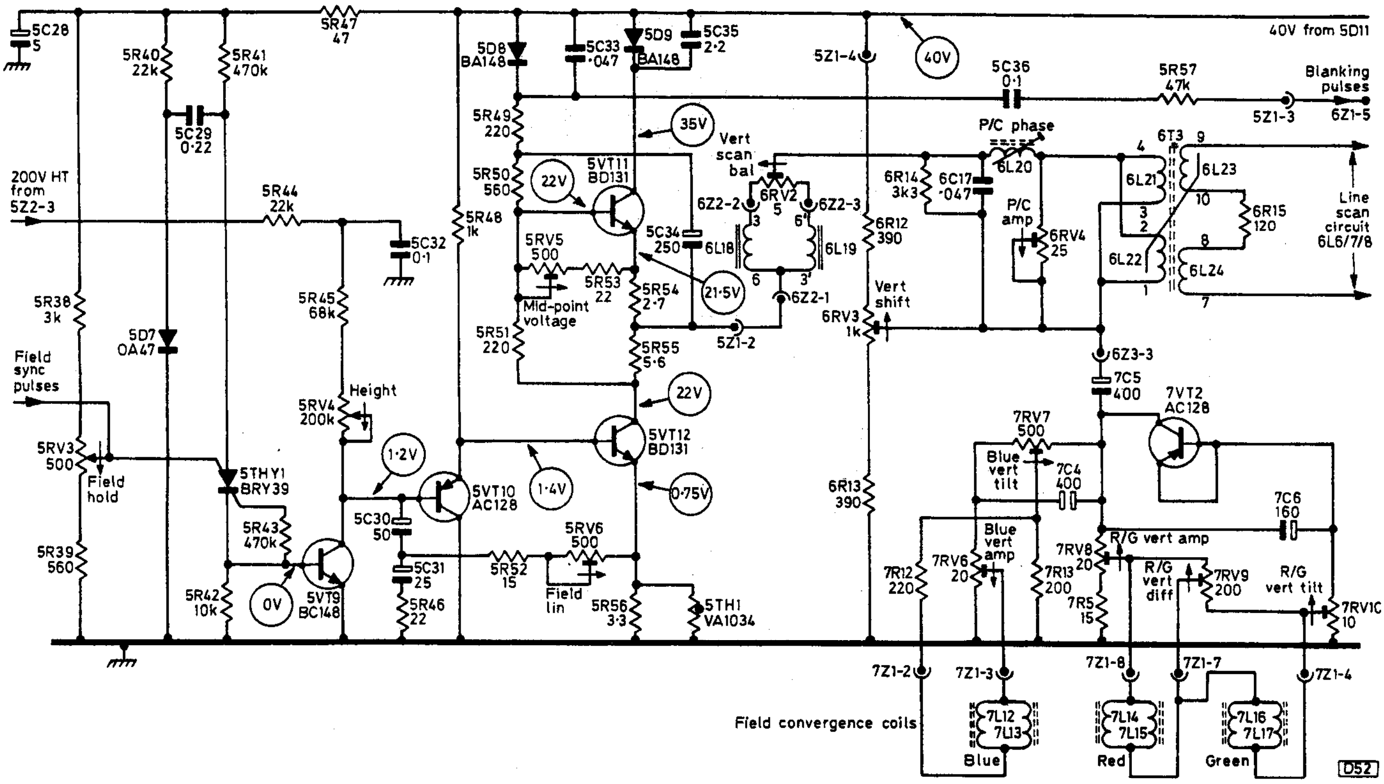


Fig. 8: The field timebase, vertical convergence and pincushion distortion correction circuits. Modifications: 5R46 later 18Ω, 6C18 0·1μF added between 6Z2-1 and chassis, 5D13 1N4148 added between the base and emitter of 5VT10, with its cathode to 5VT10's emitter, 5VT11/12 later changed to type 2N5496. See also Fig. 11.

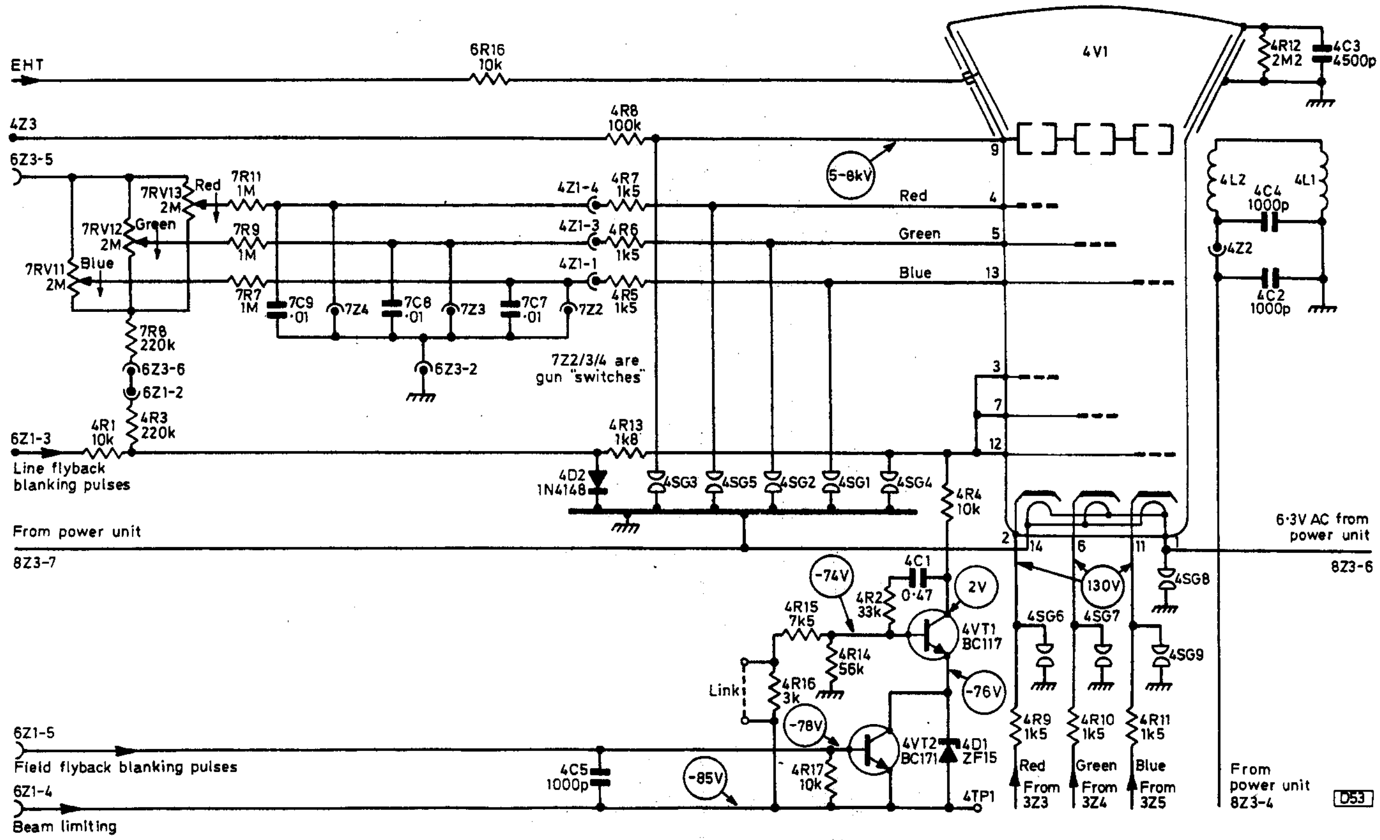


Fig. 9: C.R.T. circuitry.

= 22V, then set 5RV5 to obtain this voltage between 5Z1-2 and chassis.

CRT Base and Convergence Panels

There are two transistors, 4VT1 and 4VT2, on the tube base panel. They are concerned with beam limiting and field flyback blanking, and can become defective due to tube flashovers. The effect produced is flyback lines (of course) and sometimes a dull picture. 4R3 on the tube base panel goes high in value, with the result excessive brightness and poor grey scale since the first anode supplies become excessive. If it goes open-circuit however the beam limiter diode 4D2 is left without any forward bias and there is loss of brightness. 4R5/6/7 can go open-circuit, removing the appropriate first anode supply and thus the colour concerned from the display.

The latter fault also occurs of course should 7C7/8/9 on the convergence board go short-circuit or 7R7/9/11 or the first anode presets 7RV11/12/13 go open-circuit. Two other convergence panel faults have been mentioned previously – 7RV3 (reduced line scan as it burns up) and 7C5 (intermittent field jitter).

Brightness Pulse

Varying brightness with no brightness control action was a common fault in early sets, due to 8C11 which couples line-frequency pulses to the brightness circuit and the RGB clamps. It was subsequently up-rated, but this fault is still encountered occasionally. The associated clipper diodes 8D4/5 can become leaky, with the result that the brightness control has little effect.

Power Supply Panel

The power supply is the weakest part of the design and is responsible for the greatest number of faults on these sets. The mains transformer 8T1 (see Fig. 10) supplies the 6·3V for the c.r.t. heaters and feeds the l.t. bridge rectifier which provides the 18V, the two 20V and the 25V rails required by the decoder, the i.f. and the scan drive panels. The regulated h.t. supply for the line output stage, the RGB output stages etc. is provided by thyristor 8THY1 and the associated components. It's in this latter department that most troubles arise. Thyristors can do odd things: they can introduce peaks and troughs and all sorts of disturbances on the lines they are supposed to be regulating, and the device used here (BT106) provides its fair share of these.

Regulator Circuit Operation

The operation of the regulator circuit is fairly simple. 8C7 is charged via 8R10 during the positive-going mains half cycles, and when the voltage across it reaches the breakover voltage of the diac 8D3 this device conducts, providing a triggering pulse to fire the thyristor 8THY1. This happens during the latter part of the mains half cycle. 8VT1 provides the control action. A sample of the h.t. appearing at the output of the h.t. filter 8C9/8R15/8C10 is fed back via 8R9 to the base of 8VT1, which is also fed with a sample of the mains supply via the network 8R6/8R7/8RV1. In this way 8VT1 samples the h.t. line and the mains input, its collector voltage varying accordingly. This in turn controls the time 8C7 takes to charge sufficiently to fire 8D3.

LT Supplies

The only l.t. line which is stabilised is the 18V decoder supply. Early models use a Z3B180CF zener diode (8D1) for this purpose, later versions a type Z5D 180CF which is easily identified by its heatsink.

The BY164 bridge rectifier used in early sets was later abandoned in favour of four BY126s, a not entirely satisfactory arrangement since hum is often introduced by one of these diodes having a slightly higher than average forward resistance. Frequently one diode goes short-circuit, blowing the l.t. fuse 8F1. The Radiospares REC65 is a reliable replacement.

Thermistors

The VA1104 thermistor 8TH2 is there to prevent a destructive surge at switch on. It suffers eventually however, going open-circuit to remove the h.t. supply. If the disc's edges are at all chipped the device should be replaced. Leave the leads as long as possible to keep heat away from the board. In later models there's a ceramic mount under the thermistor, but even this isn't really high enough and it pays to use as much wire length as possible, folding the ends over under the board and soldering flat to the print.

The other thermistor in the power supply, 8TH1, is of the positive temperature coefficient variety and operates in the normal way with 8VDR1 and 8R5 to provide degaussing each time the set is switched on. The main trouble here is that 8R5 goes up in a cloud of smoke if the set is switched on with plug 4Z2 or 8Z3 disconnected. Apart from this accidental occurence these components are trouble free.

Modifications

A number of modifications were made to the h.t. supply circuit – mainly shifting the temperature compensating zener diode 8D2 from 8VT1's base to its emitter circuit and one or two component value changes. The following changes should be made to the panel when servicing it:

Change 8R7 to 9·1kΩ, 8R10 to 68kΩ, 8R11 to 820Ω and 8R13 to 1kΩ (particularly useful, this one, in removing picture jitter). Add a second 68Ω resistor in parallel with 8R10, and move 8D2 to 8VT1's emitter circuit. There were more variations with the A823A/AV/B series, including the use of a 4EX581 trigger diode in position 8D3, with 8R12 increased to 47Ω, to further improve the performance regarding jitter.

Power Supply Faults

8R6 and 8R9 were prone to going high in value on early panels, but although their type was changed the latter ones aren't all that reliable either. The effect is high h.t. (sound but no raster due to the overvoltage circuit operating) and it pays to use 1W replacements. If 8R6 or 8R7 decrease in value the result is low h.t. – which can also be caused by 8VT1 being defective.

If rapid h.t. fluctuations occur, check 8D2 and 8D3 by replacement – also 8C7. If the trouble persists, check the reservoir/smoothing electrolytics 8C9/10, particularly if the receiver has seen some years' use. Low capacitance here can cause field jitter and intermittent field roll, 8C10 being the most common culprit in this respect. A small picture with ripple is another fault condition produced when 8C9/10 are in need of replacement.

Some fairly common faults are:

Mains fuse 8F2 blown, c.r.t. heaters not alight, due to 8THY1 being short-circuit. In this event check the condition of 8TH2. If 8THY1 is in order, check 8C5.

C.R.T. heaters alight, sound present but no raster, with the h.t. fuse 8F3 blown, check 6C3. If o.k., check 6C13 and 6R7 – if 6R7 is burnt, either 6C13 or 6D2 is short-circuit. If the same symptoms are present but 8F3 is o.k., check for voltage at either side of the fuse. If present, check at 8R17 which may be open-circuit or the wiring desoldered. If everything is in order here, check 6R9. If this has burnt up the e.h.t. tripler is short-circuit. If 6R9 is intact, check for

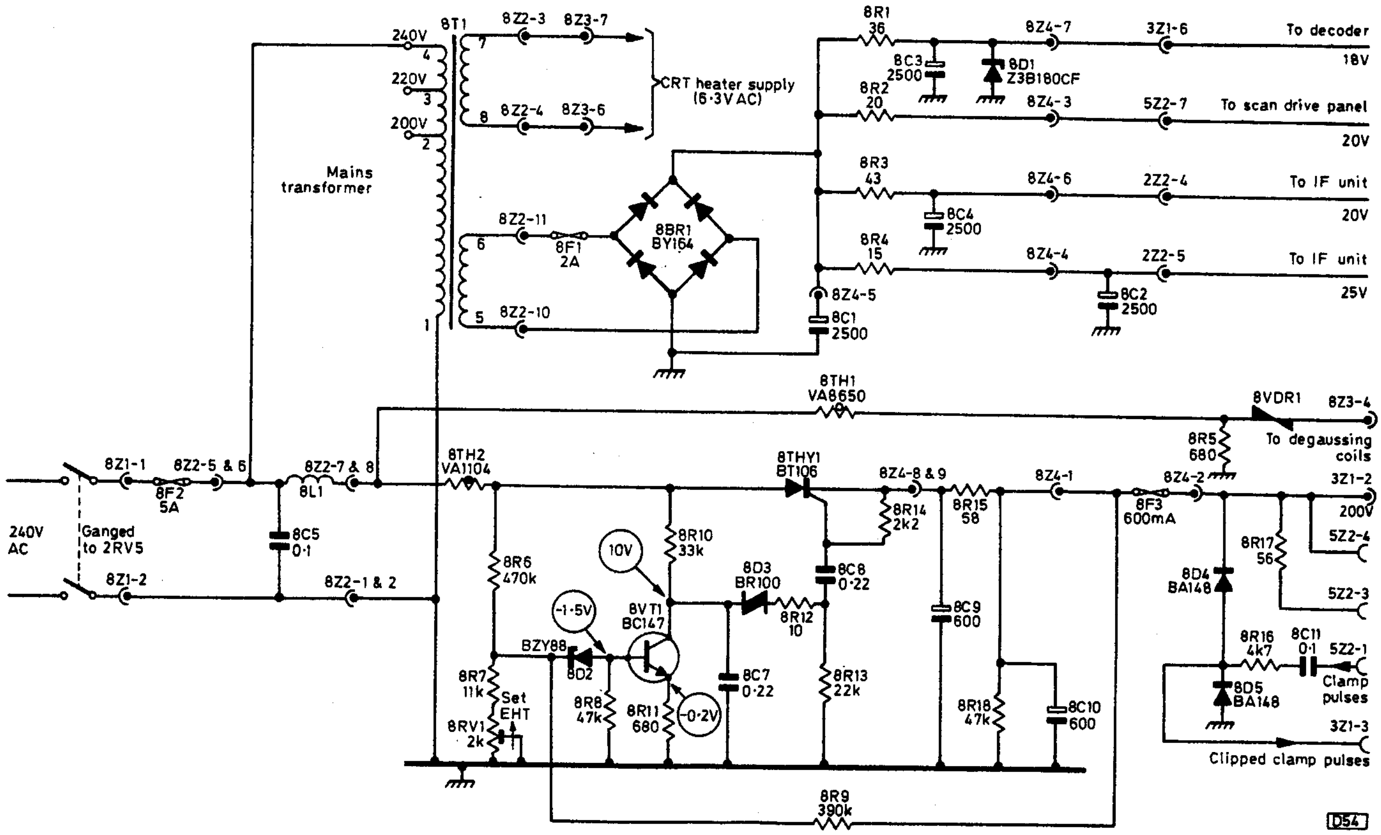


Fig. 10: The original power supply circuit. See Fig. 11 for modifications.

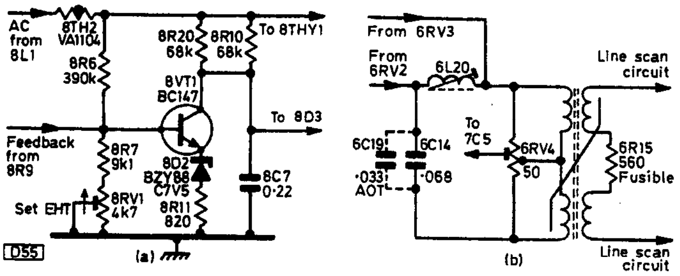


Fig. 11: Modifications (a) to the h.t. regulator circuit and (b) to the pincushion transductor circuit.

approximately 500V at pins 4, 5 and 13 of the c.r.t. If missing, either the tripler is open-circuit or the BD131 line driver transistor has died. It usually goes short-circuit, blowing the l.t. fuse 8F1, but sometimes goes open-circuit. As previously mentioned, check 5C25 and 5R35 if it has failed.

If there is no voltage at the fuseholder check for a.c. at the anode of 8THY1. If o.k. here, check for d.c. at 8R15. Absence of voltage here means that 8THY1 is open-circuit. Voltage at one side of 8R15 but not at the other means that it's open-circuit. When replacing 8R15/17, bend the tags backwards towards the rear of the receiver so that the soldered joints will not be over the heat rising from the resistors. It pays to make good mechanical joints to these resistors before soldering, as this is a common source of dry joints and intermittent loss of h.t., sometimes being the cause of 8THY1 failing.

Short 8THY1 life (sometimes very short, milliseconds!) can usually be traced to an intermittent or complete short in 8C9/10.

Failure of 8F1 usually means that 8BR1 is short-circuit. If not, check the BD131 on the timebase panel as mentioned above. With 8F1 open-circuit there's no sound or raster, the only signs of life being that the c.r.t. heaters are alight.

The l.t. smoothing resistors 8R3 and 8R4 sometimes increase in value, requiring replacement. If 8R4 is burnt, check whether there is a short-circuit transistor in the audio output stage.

8R2 is often found open-circuit, giving the sound but no raster symptom.

High h.t. can also be due to a defective thyristor.

A short-circuit 8D1 removes the colour.

If hum bars are experienced, make sure that the earthing screws of 8C1-4 are clean.

The mains transformer can be responsible for a dead receiver, i.e. no raster or sound and the c.r.t. heaters out, when it's primary winding goes open-circuit – but the h.t. will still be there to give you a shock!

8D3 can be troublesome, going short- or open-circuit to remove the h.t. supply or causing picture jitter when its forward resistance increases.

Decoder Tip

This brings us to the end of our faults survey on the original version of the A823 chassis, but here's a final decoder one. The phase of the reference signal fed to the R – Y demodulator in the i.c. on the decoder panel is set by transformer 3T3, whose earthy side is decoupled by the 100μF electrolytic 3C21. If 3C21 goes open-circuit, the phasing will be affected and the demodulation wrong. There will be a colour shift therefore, with red changing to muddy brown and green weak, along with poor definition. These symptoms can also be due to an ageing tube however, so when they're met it pays to check 3C21.

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Servicing the Rank Z504 Scan Drive Panel

John Coombes

THE original version of the Rank A823 solid-state, 90° colour chassis was covered in some detail in a series of articles which appeared in the November 1977 – January 1978 issues of this magazine. Although the power consuming sections of the chassis – the line output stage, power supply unit and convergence circuitry – remained much the same in later versions, there were considerable differences elsewhere – a modified i.f./sound output panel, a two-chip decoder panel, and a new scan drive panel with almost entirely different sync and line generator circuitry. The i.f. panel calls for little comment, and the two-chip decoder panel was dealt with in an article in the March 1976 *Television*. One small correction to the latter is required: an all red, green or blue picture arises if the clamp diode in the channel concerned goes either short- *or* open-circuit. The purpose of the present article is to deal with the Z504 scan drive panel, whose circuit is shown in Fig. 1. It will be noticed that a much more conventional flywheel line sync/line oscillator circuit is used. In the sync separator department however a noise-cancelling circuit (5VT1/5VT3) was added, though this was later deleted. The field timebase is virtually identical to the original one: since different component reference numbers are used however, we shall have to go over this ground again here.

Field Timebase Faults

One of the most common faults is simply field collapse, due to a defective field output transistor (5VT9/10). Another common cause of this fault is failure of 5D12, 5D13 or 5C39, as a result of which there is no 40V supply to the field timebase. If these points are in order, it's worth checking the field scan balance control 6RV2 on the scan control panel, since this may have developed a dud spot. Another fairly common fault on this panel is intermittent loss of field scan due to a faulty connection at the base of the pincushion phase coil 6L20. Returning to the scan drive panel, a less common cause of field collapse is either 5D8 or 5D10 going open-circuit. If it's necessary to replace any of the diodes mentioned so far (5D8/10/12/13) it's better to use a BY206. Another possibility is a defunct field oscillator – the silicon controlled switch 5THY1. In this event however there will probably be a burn-up in the output stage. Note that voltage readings should not be taken around 5THY1 since this will stop the oscillator with the result just mentioned. So beware! If you suspect field oscillator failure, check the voltage at the emitter of the driver transistor 5VT7 – you should find about 1·4V here. It may be necessary to replace 5R47 and/or 5R48.

Lack of height is another fault which is not uncommon. Suspects are the field output transistors 5VT9 and 5VT10 (mainly the latter) and the driver transistor 5VT7 if the loss is not too severe. Where there is severe loss of height, check the bootstrap capacitor 5C35 which could be open-circuit, and the presets in case of dud spots. The presets can be cleaned, but it's best to replace them as necessary. Lack of height, maybe intermittent, can also be due to the pincushion amplitude control 6RV4 on the scan control panel.

If the customer's complaint is of teletext dots across the top of the screen, check the setting of the midpoint control 5RV4 before making checks for lack of height. The adjustment is simple: measure the voltage at pin 4 of 5Z1, which should be about 40V, divide by two then add two, e.g. 22V, and adjust 5RV4 to obtain this voltage at pin 2 of 5Z4.

The setting of 5RV4 and the condition of the field output transistors are also the suspects in the event of foldover.

The field charging capacitors 5C24 and 5C25 are suspect where the fault is poor linearity. 5C24 has been found to cause intermittent height/linearity variations on occasion. Another suspect is the field linearity preset 5RV3, particularly where the fault is intermittent. The diode (5D5) in the field charging circuit can be responsible for many different symptoms: the most common however is poor linearity, with bottom cramping and expansion at the top of the screen. The driver transistor 5VT7 is also suspect when this fault is present.

Intermittent field bounce can occur when the 40V reservoir capacitor 5C39 is defective. This can sometimes be observed visually, when white goo oozes from the side of the capacitor. Another suspect for this fault is the bootstrap capacitor 5C35.

In the event of field jitter, check the setting and condition of the field hold preset control 5RV1. The field oscillator SCS 5THY1 can cause this trouble. More likely however is a fault in the main power supply – a faulty thyristor 8THY1 or trigger diac 8D3. Make sure that 8R13 is the later value (1kΩ).

Lack of field sync can be due to the sync separator transistor 5VT2. In some sets the differentiating network 5C17/5R20 was omitted. Check whether these components are present when intermittent field roll is experienced – especially in areas where there is co-channel interference. The noise-cancelling circuitry – 5VT1/3 and associated components – was omitted in later production, with 5VT2's emitter taken direct to chassis.

Line Timebase Faults

On the line timebase side, probably the most common fault is no e.h.t. due to the line driver transistor 5VT12 going short-circuit. In this event the 2A fuse 8F1 will blow of course. 5VT12 has also been known to go short-circuit collector-to-base, producing the same symptom (no e.h.t.) with damage to its base resistor 5R51. In the event of 5VT12 failing again a few days later, check the driver transformer damping components 5C40/5R54. The capacitor sometimes goes open-circuit, while the wirewound resistor may well be dry-jointed (it gets very hot). Two capacitors in this area can be responsible for no line drive – sometimes intermittent – the electrolytic decoupler 5C31 and 5C42.

Over-voltage protection is provided by 5D14, 5D7 and 5VT8. 5D14 rectifies the line flyback pulses, developing a positive voltage across 5C43. If the amplitude of the flyback pulses is excessive, this voltage will rise sufficiently to switch on 5D7, which then turns 5VT8 on, killing the line oscillator. A defective trigger diode (5D7) can cause false tripping.

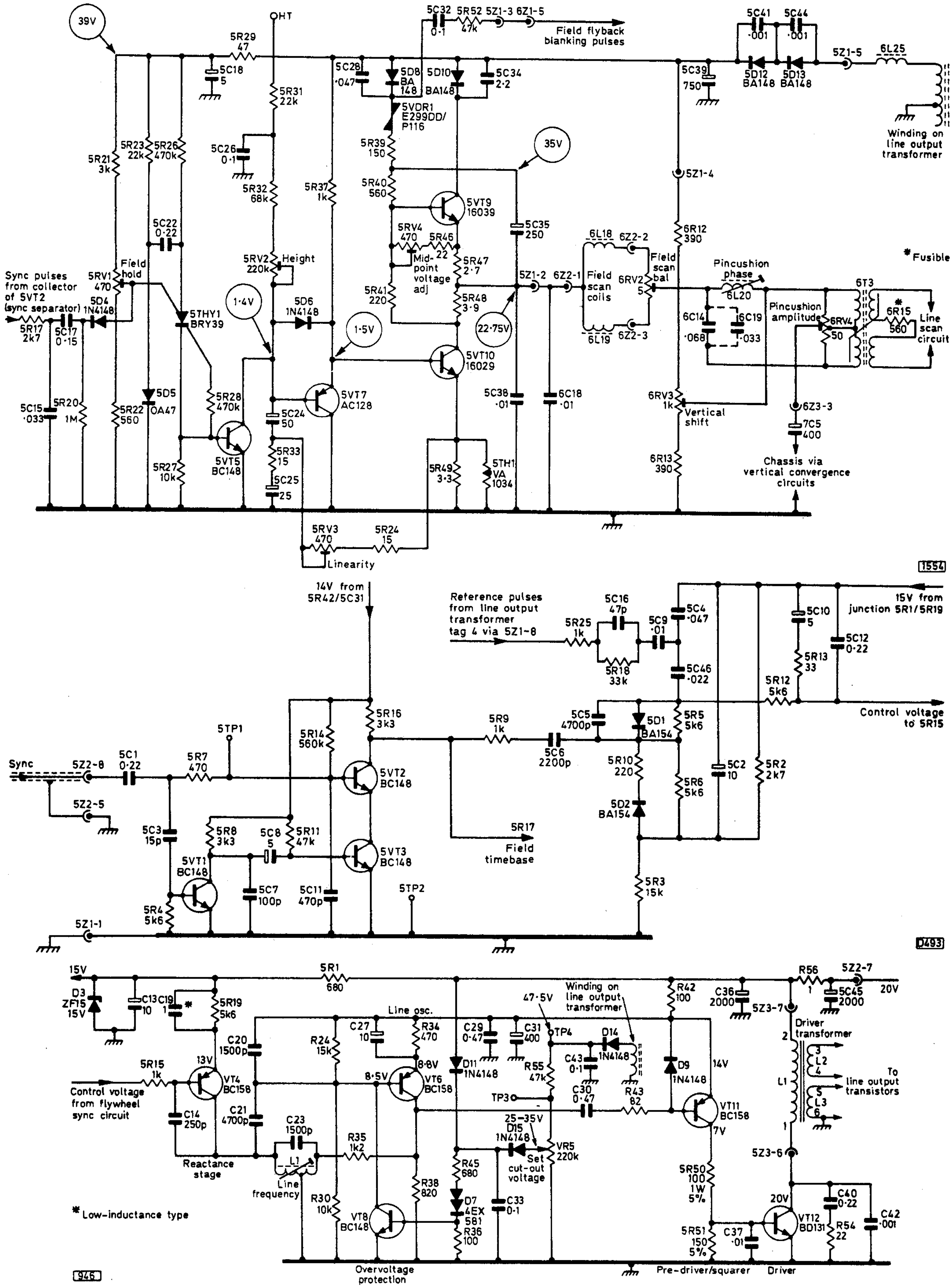

Fig. 1: The circuitry on the Rank Z504 scan drive panel. Top, field timebase circuit – plus some of the external circuitry. Centre, the sync separator and flywheel line sync circuits. 5R7 later changed to 560Ω, with 5VT1/3 and associated components deleted. Bottom, the line generator and driver circuits.

Line oscillator failure, or possibly incorrect frequency, should direct attention to the polystyrene capacitors in the line oscillator circuit – 5C14/5C20/5C21/5C23. Another cause of incorrect line frequency is when the 15V zener diode 5D3 is faulty and fails to stabilise the voltages applied to the reactance transistor 5VT4.

Loss of line sync, or weak line sync, is usually done to the flywheel line sync discriminator diodes 5D1 and 5D2. Line sync disturbances such as cogging and pulling can be caused by the 10μF electrolytics 5C13 and 5C2. 5C31 can be responsible for bent verticals – in addition to no or intermittent line drive.

Line output stage faults were covered in detail in the earlier articles. A couple of further points. The transductor 6T3 on the scan drive panel can be responsible for field collapse. A faulty transductor may result in the thermal cutout resistor 6R15 springing open. The set will continue to operate, but the sides of the picture will be curved, with incorrect pincushion adjustment. The 2·2Ω resistors in series with the bases of the line output transistors 6VT1/6VT2 can cause trouble, going open-circuit or increasing in value. They can well increase to 4Ω or 5Ω, upsetting the line output stage with the result of low e.h.t. and a large picture. ■