caused by a badly contacting slider in a set l.t. control. This can usually be put right by using switch cleaner, though replacement is preferable. An open-circuit zener diode is sometimes the cause of a small picture with low voltages.

Suddenly reduced width is often caused by a resistor shunting the series regulator transistor going open-circuit – the transistor will then be called upon to pass excessive current and may also fail. Conversely, the transistor may go open-circuit leaving its shunt resistor to pass excessive current. In modern designs the resistor is fusible and in these circumstances goes open-circuit.

Due to the relatively low value of the resistors used in series regulator circuits, it's usually essential to isolate a suspect transistor in order to make reliable tests.

When the l.t. fuse has blown, the cause is more likely to be in the line output stage or possibly the field timebase or audio circuit than in the regulator/filter. Remember that indirect shorts in the line output stage can cause the fuse to blow, i.e. a short across one of the windings on the line output transformer. Suspects are the diodes and capacitors that provide the c.r.t. first anode and video output stage supplies.

In mains/battery monochrome portables the tube's heater is usually connected across the l.t. rail. This can be misleading where a short-circuit is suspected, so it's worth disconnecting the base when making checks.

Finally, when there's no output from a series regulator circuit though there's adequate input and no apparent cause of the trouble, make sure there's not a dry-jointed start-up resistor. Active filters start themselves of course, but a series regulator needs some means of getting voltages at the output in order to start up. The resistor in shunt with the regulator transistor may provide this function, or another feed path may be used. In the Thorn 1690-1691 series for example the 22kΩ start-up resistor R66 links the bases of the two transistors in the regulator circuit.■

Servicing the Philips G9 Chassis

Mike Phelan

THIS chassis, the 110° counterpart to the Philips G8 chassis, first appeared in early 1975, in the 26in. size only. The models encountered are the 581, which has rotary controls, and the 585, which has touch tuning and slider controls. The 26in. tube is the quick-heat type A66-410X. In appearance, these models are not unlike the later models in the G8 series. We'll start with a brief outline of the main features of the chassis.

Circuit Features

The power supply is of the half-wave thyristor rectifier/regulator variety, as in the G8, but with two additional safety circuits and slow start. The latter consists of Tr8020 and the associated components. At switch on, Tr8020 conducts, shorting out the 7·5V zener diode D8017 so that the control transistor Tr8007 conducts heavily. As C8021 charges, so Tr8020 switches off and the h.t. rises. The main over-voltage protection circuit is of the same type as used in the G8 chassis, with Tr8023 conducting should the h.t. voltage rise excessively, thus discharging the thyristor trigger circuit charging capacitor C8015. This action produces a pulsating picture. The additional protection circuits are as follows. First, in the event of excessive e.h.t. the 45V line, which is derived from the emitter of the line output transistor, will also rise. When it reaches 51V, zener diode D5134 on the line scan panel and diode D8025 on the power supply panel conduct. As a result Tr8007 saturates and the h.t. falls. The other trip reduces the h.t. when there's no l.t. supply, i.e. in the event of failure of the line output stage. In normal operation D8026 is reverse biased by the 45V line. In the absence of the 45V line D8026 and zener diode D8024 conduct, shorting out D8017 so that the voltage at the emitter of Tr8007 falls below 7·5V.

The line output stage is conventional, with a BU208 line output transistor, a tripler, and a diode modulator for EW correction. Three l.t. supplies are obtained from the line output stage. The EW modulator produces a 32V output across the reservoir capacitor C5155. This voltage is fed out at pin 2 of socket H: it's also dropped to 25V at pin 8 of plug K via R5151/C5160, and is applied to the junction of R5413 and R5142 which are connected in series with the emitter of the line output transistor. As a result, a "boosted" 45V line is produced at the junction of R5142 and C5138. This voltage is fed out at pin 1 of plug K.

The field timebase consists of a BRY56 silicon controlled switch oscillator, a linearity stage (BC158), a BD131 phase-splitter driver and a pair of BD343 transistors in a class B output stage.

The signals panel is identical to that used in the later versions of the G8 chassis (the G8 chassis was covered in the June-August 1978 issues of *Television*), with the well-known Philips/Mullard four i.c. (TBA560CQ/TBA540Q/TBA990Q/TBA530Q) decoder. The class A RGB output stages use BF337 transistors. The class A audio output stage employs a pair of BD131 transistors. A voltage regulator circuit, using a BD131 transistor (Tr3401), provides the 12V supply for the signals circuits (check at TP97) from the 25V input fed to the panel at pin 4 of edge connector A.

Touch tuning models incorporate an ETT6016 i.c. in the tuning head and a remote control amplifier to change channels only, the remote control transmitter being of the mechanical variety.

Power Supply Faults

Now for the trouble spots. Isn't it amazing how, on some chassis, one component stands out above all the other stock faults as causing more trouble than all the rest put together (remember that 10kΩ video load resistor in the Bush TV125 series?). The item concerned in the G9 chassis is C5138 (2,200μF): let it be imprinted in your memory, since every G9 you'll encounter will need C5138 checking and probably replacing. As we've already seen, it's the 45V supply reservoir/BU208 emitter decoupling capacitor. When it dries up, you get a small, pulsating picture. Since the main use of the 45V rail is to power the audio output stage, R3141 in the feed to the latter overheats, due to line pulses on the rail, and finally D8024, D8025 and D8026 on the power supply board will go short-circuit, with one or two blown fuses to add to the confusion. The line scan panel has to be removed or tilted to replace C5138, as the connections are behind the chassis rail.

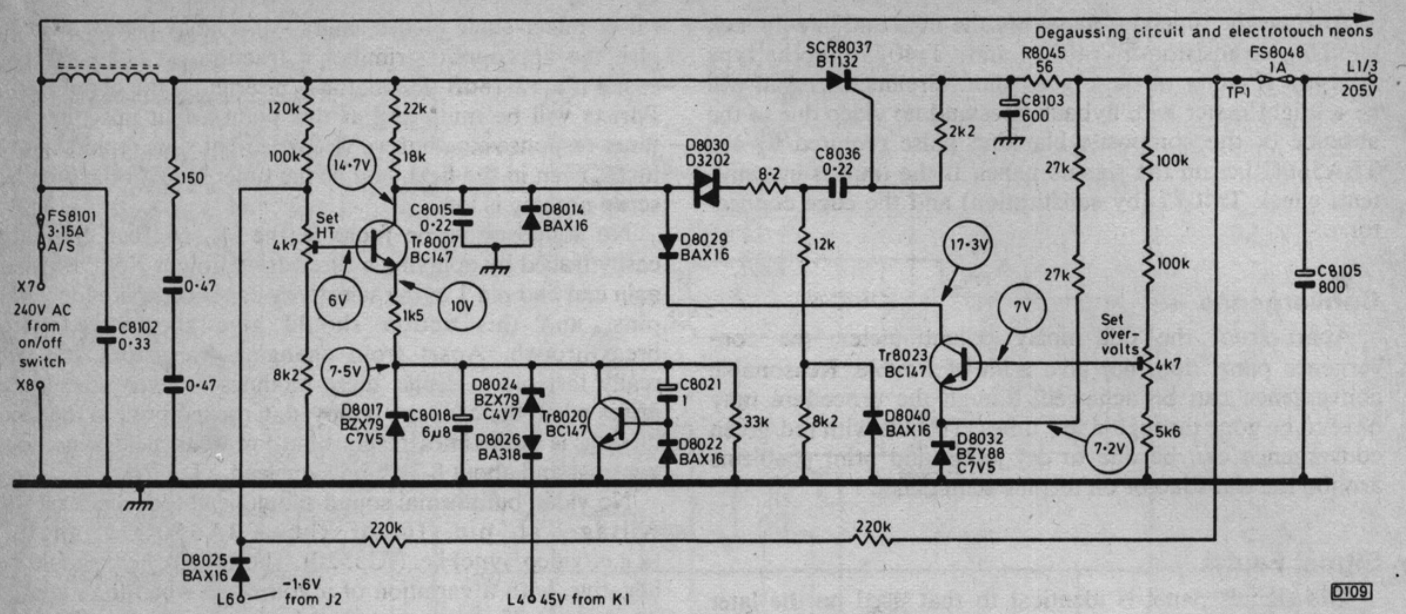

Fig. 1: Mains input and h.t. supply circuitry, Philips G9 chassis.

If the 3·15A anti-surge mains fuse FS8101 has gone open-circuit, check the thyristor for leakage, although mains fuses on this set do sometimes blow for no apparent reason.

If the mains fuse is intact but there's no h.t. at TP1, check the 56Ω power resistor R8045 for being open-circuit as a first step, though it's fairly unlikely to be at fault on this chassis. The next thing to do is to remove the 1A h.t. fuse FS8048 and disconnect D8025. If the h.t. (approximately 205V) returns at TP1, check D8025 and D5134 for leakage – the latter is the 51V zener diode on the line scan panel. This is one of those cases where it's more likely that the fault is in the trip circuit rather than something causing the trip to operate. If neither is faulty however check our friend C5138. Incidentally the 45V line is shown as 42·8V at the emitter of the line output transistor in the circuit diagram in the official manual: in practice the voltage is usually about 48-50V.

Returning to the power supply, if there's no life with D8025 disconnected, disconnect D8024 and check it for being short-circuit – if it is, check C5138 (again!). If there's still no h.t., check the thyristor (SCR8037, type BT132) for being open-circuit, then the control circuit. The over-voltage circuit can be isolated by disconnecting D8029. The two prime suspects in the G9 chassis are zener diode D8017 and clamp diode D8014.

A word of warning here: it's easier to get to the left-hand power supply panel after placing the convergence panel in its slots in the top cabinet rail, but ensure that the two screws are tight when refitting it otherwise it can collide with the thyristor's heatsink and shatter the mains fuse.

Line Scan Panel

If the h.t. is about half the value it should be, this means that no l.t. is being produced, due to a line timebase fault or FS8048 being open-circuit. If this fuse (or maybe FS5114 on the line scan panel) has blown, check the BU208, the flyback tuning capacitor C5131 (0·0091µF) and the tripler for shorts and examine the line output transformer closely for burn marks.

Another common fault, which is sometimes intermittent, occurs when either of the BYX55-600 diodes D5150/D5156 in the EW modulator circuit goes open-circuit. The l.t. rails fall, giving a 4in. field scan and no video.

The beam limiter circuit (Tr5169/Tr5172 etc.) seems to be more reliable than its counterpart in the G8 chassis, though the 12V zener diode D5174 fails on occasion. When it goes open-circuit, there's no brightness – this can be intermittent.

If the picture looks as if the tube is flat and the width alters with the brightness, examine the EW modulator transformer L5161 at the top of the line scan panel for dry-joints. The shift transformer L5159 also suffers from this problem.

The line driver transistor Tr5120 and the preceding trigger amplifier transistor Tr5102 form a Schmitt trigger to give a good squarewave current through the primary of the driver transformer L5119. Unlike their counterparts in the G8 chassis, these stages give little trouble, being required to drive only one output transistor.

The c.r.t. first anode supply is obtained, in the now conventional way, from the earthy end of the e.h.t. overwiding, C5157 (0·047µF) providing the reservoir. If this capacitor becomes leaky, the tripler will be destroyed.

Timebase Panel

The lower right-hand panel carries the EW raster correction circuit, the line oscillator and the field timebase. The line oscillator is of the Hartley type, and the only problems we've had here have been with the 18V zener diode D4240 which stabilises the supply to the oscillator. If it goes short-circuit the oscillator stops of course, but often it goes intermittently open-circuit, giving line speed drift. The oscillator is powered from the 25V rail once the line timebase has come into operation: to start it up, there's a 10kΩ resistor (R4218) which is connected to the 205V h.t supply (via pin 1 of plug G).

The field timebase is very reliable indeed, but as these sets get older troubles with electrolytics are to be expected. C4048 (1,000µF) couples the output to the scan coils, while C4038 (220µF) provides bootstrap action in the output stage. C4022 (10µF) is the charging capacitor (with C4020, 1·5µF); C4055 (100µF) is incorporated in the scan current earth return path, and both C4051 (47µF) and C4053 (33µF) affect the linearity.

If R4106 (15Ω) is found open-circuit (it's a spring-off type) the EW modulator driver transistor Tr4105 (BD131) is probably short-circuit.

Also on the timebase panel are the field and line flyback blanking transistors Tr4071 and Tr4075 (both type BC148). If either of these goes short-circuit, the result will be a bright raster with flyback lines and no video due to the absence of the composite blanking pulse required by the TBA560C i.c. on the signals panel. If the fault is intermittent, check Tr4075 (by substitution) and the edge connector.

Convergence

Apart from the odd noisy potentiometer, the convergence panel does not give a lot of trouble. Reasonable convergence can be achieved, though the procedure may have to be gone through a few times. Trouble with red/green convergence can be due to dry-joints and print problems around the transductor on the line scan panel.

Signal Faults

The signals panel is identical to that used on the later versions of the G8 chassis, and the faults tend to be the same. Starting from the front, a grainy picture means tuner trouble or sometimes a defective transistor in the vision selectivity module. If the tuner is at fault, either the r.f. amplifier transistor or one of the BB105B varicap diodes is probably defective – an exchange unit is the best solution. Drifting may or may not be due to the tuner – first override the a.f.c. by flipping out the push-button (or touch-button) unit, then apply freezer spray (or slight heat) to IC3510 (TAA550): if drift is then apparent, replace IC3510.

If the a.f.c. is inoperative, remove the a.f.c. module (U2700) and check the resistance between pins 7 and 8. The reading should be about 35kΩ in one direction and 50kΩ in the other direction. If there's no continuity, one of the small chokes connected to pins 7 or 8 is open-circuit. Shorting it out will save the cost of a new module. This sometimes causes a hum bar that varies with tuning however.

If the set drifts but can be brought back on tune by selecting the same channel again, check the continuity of the red and black leads from plug C (white). In the touch-tuned version, the ETT6016 i.c. can cause drifting, sticking on one channel, and inability to select any channel with two or more neons lit. The usual precautions must be taken when replacing it since it's a MOSFET device. Unfortunately there's no room to fit an i.c. holder. If the entire head is replaced, check whether R1759 (100kΩ) is present – if not, a thermistor and a 390kΩ resistor should have been supplied to fit on the remote receiver panel. Failure to do so will result in inability to tune in anything, as there will be no return path for the current through the isolating diodes D1760-D1765 (i.e. whichever one is selected).

The remote control hand unit contains a metal bar which is struck by a hammer. The hammer spring is tensioned and released by four small pins rivetted to the framework. Two of these sometimes fall out. If they can be retrieved, press them in and solder them as well. Otherwise, small bits of steel rod can be used. Adjustment of the hammer is fairly critical.

To return to the tuner itself, both drifting and lack of a.f.c. action can be caused by one of the varicap diodes being leaky. If you don't want to fit a new unit without first having a go at repairing the old one, proceed as follows. Remove the tuner and check the resistance between pin B and the case. This should be in excess of 20MΩ in one direction. If not, disconnect the 33kΩ series resistors (little rectangular black things) connected to the diodes until the leaky diode is discovered. The diodes should really be replaced in matched sets, but it's permissible to replace the r.f. or mixer stage diodes singly – if a noisy picture results, give the appropriate trimmer a fraction of a turn (this is easier if a 12-18dB attenuator is inserted in the aerial lead). Purists will be muttering at this point about upsetting the tuner response etc., but we've carried out such repairs many times, even in the field, and as the tuner would otherwise be scrap nothing is lost.

No sound or vision faults in the i.f. strip can be fairly easily traced by applying a screwdriver to pin 2 of the vision gain can and pin 1 of the selectivity can – these are the input pins, and this action should give shortwave radio breakthrough. Apart from changing transistors, it's not really feasible to repair these modules – severe instability arises when the cans are removed. Cracked print in the gain module is sometimes responsible for weak field sync, low contrast and about 8-10V on sync lead XI.

No video but normal sound should lead to a check on the voltage at pin 10 of the TBA550Q "jungle" (a.g.c./video/sync) i.c. (IC3520). The voltage here should be negative, with a variation of a volt or so when the signal is interrupted. If not, check whether the sound take-off coil in can U2500 (sound selectivity) is dry-jointed – by shorting pins 4 and 5. This action should restore the picture but kill the sound. If the video is arriving at pin 10 of the TBA550Q i.c., check whether it's coming out – look for a 2-3V variation at pin 12 (TP83). If not, the i.c. is the first suspect – as it is in cases of no sync.

Some of the electrolytics in this part of the set give faults that can be the cause of much head scratching. If C3161 (150μF) which decouples the supply to the a.g.c. crossover and the line discriminator balance networks is open-circuit the result is weak sync and bent verticals, but the best one is C3111 (68μF) which is the i.f. a.g.c. reservoir capacitor. When this dries up the effect on the screen looks like either the Aquadag on the tube not earthed or the tripler breaking down!

Severe patterning can be caused not only in the tuner but also if the RGB output leads to the c.r.t. base are allowed to drape near the luminance delay line. If the patterning seems to be in colour, accompanied by loss of saturation, suspect C3244 (22μF) which decouples pin 12 of the TBA560CQ i.c.

The Four-chip Decoder

The operation of the Mullard four-chip type of decoder should be fairly familiar by now. To recap however, in cases of no colour first measure the voltage at pin 9 of the TBA540Q i.c. (TP90). This should be at about 1-1·5V with a colour transmission, or 4-4·5V with a monochrome transmission or no signal. Zero or 8-9V indicates a stopped bistable, whereas if the voltage does not correspond to any of those quoted so far there's trouble in or around the TBA540Q or TBA990Q i.c. If the voltage is correct for colour, check at pin 7 (killer output) of the TBA540Q. The voltage here should be at least 3V: if this voltage is low, the TBA540Q i.c. is defective; if the killer voltage is o.k., the fault lies after the point where the burst is extracted (within the TBA560CQ i.c.), i.e. either the TBA560CQ i.c. is defective or there's a fault in the colour control circuit.

When TP90 (pin 9 of the TBA540Q i.c.) is at 4V, override the colour killer by unplugging PC5 and observe the results. An oscillator which is difficult to lock may be due to a defective crystal, or if accompanied by occasional phase reversal (misident) the cause will be either C3373 or C3374 (both 0·33μF) being open-circuit. Sometimes the colour-killer stage within the TBA540Q develops a fault, the voltage at pin 7 staying low when the voltage at pin 9 has

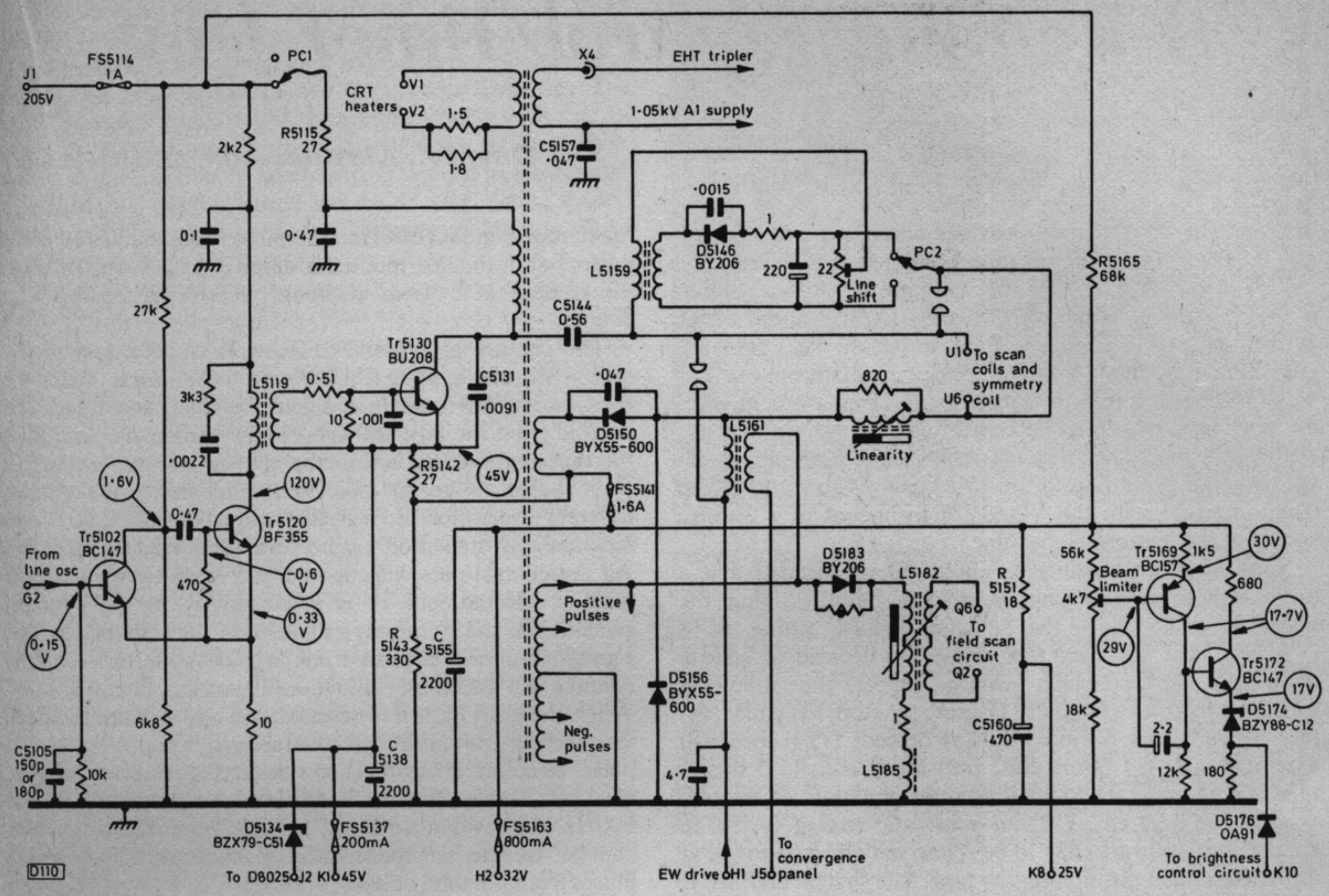

Fig. 2: Circuitry on the line scan panel. C5105 was added to prevent line jitter.

fallen below about 2V.

The TBA530Q matrixing i.c. develops the same faults as in the G8 chassis, i.e. one colour-difference signal missing, no luminance (but first check for 1-1·5V at pin 5), excess of one primary colour, or one primary colour missing from one side of the picture only.

Going off the subject slightly, it's useful to be able to recognise, in the absence of the R – Y or B – Y signal, whether the G – Y signal is correct, since this will show whether the fault lies before or after the G – Y matrix (within the TBA990Q i.c. here). If the G – Y signal is normal, the fault is *probably* within the TBA530Q i.c. When the fault is before the G – Y matrix, the G – Y signal will consist of a small portion of the remaining colour-difference signal, inverted, only. For example, with no B – Y the picture will be entirely pink and green, and with no R – Y bluish-green and yellow. If the result is after the G – Y matrix, i.e. the G – Y signal is correct, then with no B – Y the blues will be greenish and the yellows tending towards pink or orange, whereas with no R – Y the reds will be brownish purple and the greens almost correct. With no G – Y the greens are bluish and the flesh tones a sort of yellow ochre colour. Although it's unlikely on this chassis, for the sake of completeness excessive G – Y gives crimson flesh tones.

The RGB output transistors Tr3294, Tr3314 and Tr3334 can go open- or short-circuit, often intermittently, causing loss of or excess of one of the primary colours respectively. The other troublesome components in this part of the circuit are the 39kΩ resistors (R3331/R3311/R3291) connected to pins 1, 14 and 11 respectively of the TBA530Q i.c. If one of them goes open-circuit, that particular colour disappears. Often however one of these resistors goes high in value and the result, as with the G8 chassis, is not so easy to identify on first encountering it. The effect can quite easily be mistaken for a convergence error, but if a test card is displayed and one gun at a time is switched on it can be seen that the h.f. response is severely degraded on the colour concerned.

Sound

There are not many troubles with the sound stages – the most common one is the sound becoming distorted or failing altogether when the set has warmed up. A new TBA750Q (IC3530) intercarrier sound i.c. will cure that. The BD131 audio output transistors fail occasionally, burning up the feed resistor R3141 – but don't forget what we said earlier about C5138 on the line scan panel. Very weak sound is the outcome when the audio output coupling capacitor C3147 (150µF) dries up.

Conclusion

That about sums up the G9 chassis – one you either love or hate but is nevertheless quite reliable.

Malcolm Burrell adds: Quite a number of these sets have come my way recently. I've had trouble with both the 2,200µF electrolytics (C5138 and C3155) on the line scan panel – they are prone to leaking electrolyte on the board, and a burnup then occurs around the tags. A double capacitor can be taped to the chassis member and connected to the board with leads – this is more reliable. After servicing the line scan panel the set may well go dead a day or so later: to prevent this, check for dry-joints generally and for breaks in the print, especially on the narrow tracks and near those two 2,200µF capacitors!