
# TANDBERG CTV2-2 CHASSIS

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THE Norwegian firm Tandberg is probably best known for its audio and tape recording equipment. It also produces high quality colour television receivers however and two chassis have been used in the Tandberg models distributed in the UK, a hybrid one in their earlier 90° models and a solid-state chassis in their current 110° models. We are dealing with the solid-state CTV2-2 chassis in this present article.

The circuitry is typical of modern European colour receiver design, with a switch-mode regulated power supply, single transistor line output stage with diode width modulator to provide EW pincushion distortion correction, and varicap tuners, extensive use being made of i.c.s – especially in the decoder.

Most of the circuitry is carried on the hinged main chassis, which can be swung down to gain access. The line output, e.h.t. and associated components are on a printed panel on the right-hand side, the field output, luminance and RGB output stages being on the left-hand side. The tuners, i.f. strip, decoder, sound channel and line oscillator circuit are on printed circuit modules which plug into the left-hand side of the chassis.

The regulated power supply is in a screened compartment at the bottom of the chassis. It's fed from a bridge rectifier which in most models is mounted on a small board at the bottom of the cabinet, along with the c.r.t. heater transformer and the degaussing circuitry.

It is recommended that an isolating transformer is used when servicing these sets since with a bridge rectifier directly across the mains input the chassis is live to both sides of the mains supply.

## Signal Circuits

The signal circuits are relatively conventional. There are separate v.h.f. and u.h.f. varicap tuners, a discrete transistor i.f. strip and a TCA270 i.c. to provide synchronous vision demodulation, a.f.c. and a.g.c.

Apart from occasional tuner trouble such as tuning drift and low gain this section of the receiver gives very little trouble, the usual complaint of poor picture due to mistuning being cured by adjusting the a.f.c. discriminator coil L16 which is adjacent to the TCA270.

No sound or intermittent sound faults have usually been rectified by changing the TBA120AS intercarrier sound i.c. (circuit reference U101), the audio preamplifier transistor Q151 (BC149) or the driver transistor Q152 (BC328). Sound distortion, often intermittent, is quite often due to the loudspeaker.

There are several transistors along with the luminance processing i.c. U200 (TBA500P) on the main printed board on the left-hand side of the chassis. Along with amplification the TBA500P carries out black-level clamping, peak white limiting and, in conjunction with Q203 (BC148B), beam limiting. Failure of Q203 results in a dark raster with no luminance, as does incorrect adjustment of its base preset control R207. If there is luminance but insufficient brightness on the other hand it is likely that the coarse brightness control R243 requires adjustment.

Intermittent loss of luminance but with the colour information still present throws suspicion on the luminance delay line FL200, especially if it is of the type which resembles a black rod. These have also proved troublesome in some other colour chassis of Scandinavian origin.

## Decoder

The decoder consists of four i.c.s and their associated components. The TBA510, TBA540 and TBA990 are on one of the pluggable subassemblies: the final i.c. associated with decoding, the TBA530, is on the main left-hand panel.

Fault finding is easier if the functions of the i.c.s are understood. The TBA510 contains gain-controlled chrominance signal amplifiers, the colour-killer circuit, plus burst gating and blanking. The saturation control acts on the chrominance channel in this i.c. The TBA540 is the reference oscillator with its associated phase detector and control loop. A second detector in this i.c. produces the a.c.c. and colour-killer bias voltages and an ident bias signal. The TBA990 contains the PAL switch, the chrominance demodulators and the G — Y matrix. In addition to the three colour-difference signal outputs there is a half line frequency squarewave output which is fed back to the a.c.c./ident/colour-killer detector in the TBA540. The TBA530 simply matrixes the luminance and colour-difference signals to provide R, G, B output signals.

When working on the decoder it is useful to be able to disable the colour killer. To do this, open the link between points G1/1 and G1/2 on the decoder subpanel.

An unusual fault experienced several times has been too much colour with the a.c.c. not functioning, usually when the set is hot. On one occasion this happened on one channel only. It can be remedied temporarily by spraying the TBA510 i.c. with freezer, and is a form of thermal runaway in this i.c. To overcome the problem Tandberg recommend changing the values of R415 and R417 associated with pins 11 and 12 from 1kΩ to 2·2kΩ. This modification is incorporated in later sets.

Otherwise, the few decoder faults encountered have been straightforward, such as faulty capacitors – for instance the 18pF coupling capacitor C401 in the TBA510's input circuit.

In areas where the signal is poor we have had some cases where the decoder has been working satisfactorily but the set has suffered from colour drop-out. In such cases the

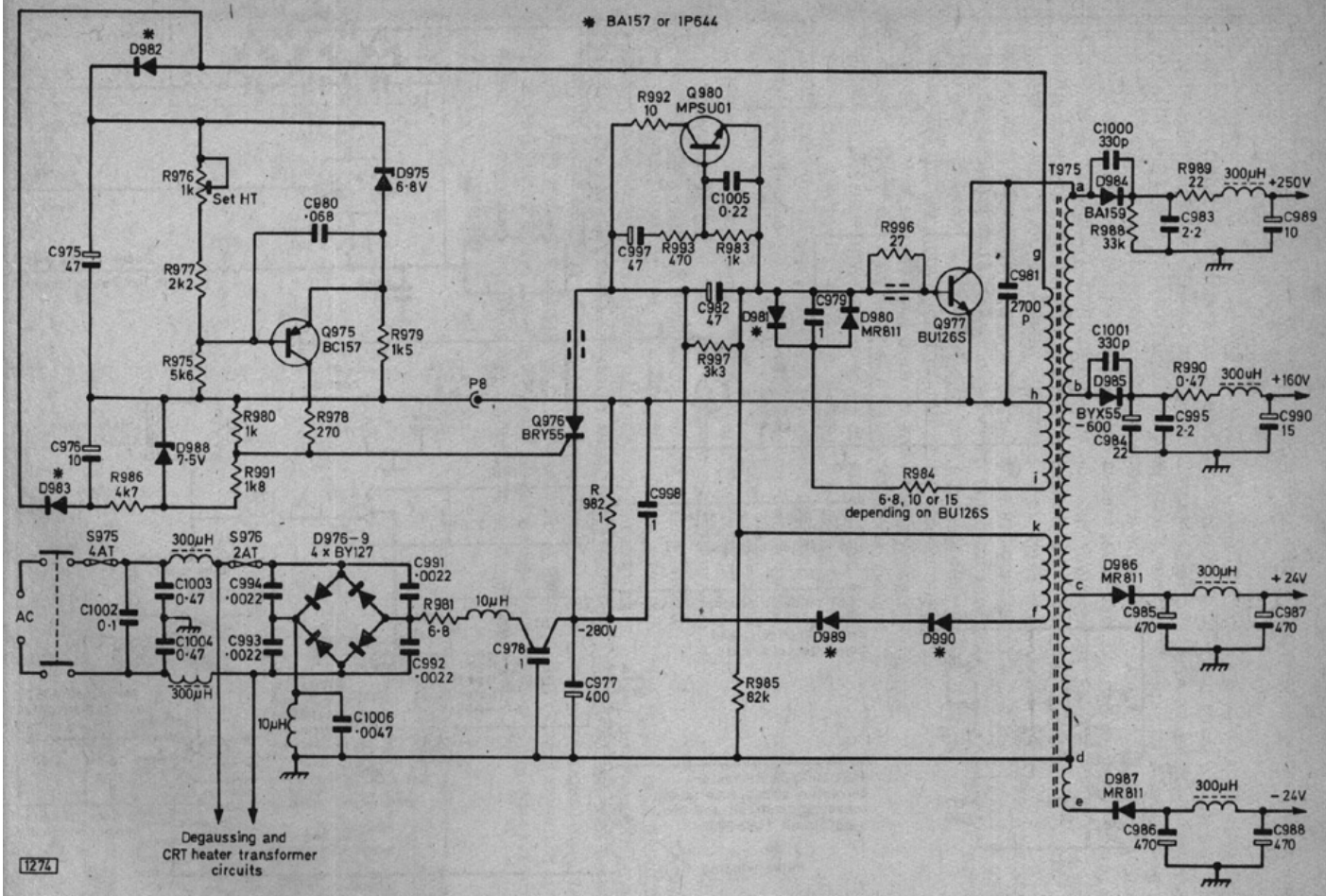


*Fig. 1: The switch-mode regulated power supply circuit used in the Tandberg CTV2-2 chassis. R976 should be set for 160V h.t., a suitable measuring point being plug pin D2/6. All other output voltages will then be correct. R976 is accessible through a hole in the power supply unit cover: use an insulated screwdriver to avoid short-circuiting R976 to chassis.*

threshold at which the colour killer operates can be lowered by increasing the value of R438 from 390Ω to 460Ω.

## Switch-mode Power Supply

The regulated power supply uses a chopper arrangement, the chopper itself consisting of a blocking oscillator whose on/off time is varied by feedback to give the required regulation. 160V, 250V and +24V and −24V regulated supplies are given from a −280V rail provided by the bridge rectifier across the mains input. The operation of the circuit was described in detail in the October 1975 issue of *Television*. The article also provided useful fault tracing hints. The circuit is shown in Fig. 1.

Blowing of the 2A mains fuse is usually caused by failure of the BU126 chopper transistor Q977. This usually damages the BRY55 thyristor Q976 and the BC157 transistor Q975. Feedback from the blocking oscillator transformer T975 controls the conduction of Q975 which sets the firing point of Q976 thus varying the blocking oscillator's triggering. The BU126 itself can be damaged by a faulty C981 in parallel with it. And since the value of R984 depends on the gain of the BU126, it is a good idea to change all these components whenever the BU126 has to be replaced.

When presented with an overload, the oscillator frequency falls and the power supply produces a distinctive buzz. Typical faults which can cause this condition in the power supply are failure of any of the four supply rail rectifiers D984/D985/D986/D987 or their associated reservoir capacitors. A method of checking which supply rail is causing the overload is to disconnect each diode in turn and see whether the power supply operation returns to normal. Disconnect only one or two diodes at a time since if the transformer is left without a load it is possible for the BU126 to be destroyed. Outside the power supply, the line output transistor going short-circuit is the most likely cause of the overload condition arising.

A faulty BRY55 thyristor can cause a hum bar with associated line sync pulling. This is similar to the symptom when the bridge rectifier reservoir capacitor C977 loses capacitance: this shows up as hum modulation of the picture width.

## Field Faults

Field faults have almost always been due to failure of the output transistors Q806 (2N5298) and Q807 (2N5107), and, occasionally, the driver transistor Q805 (SPS5384) as well. The output stage is connected across the +24V and −24V rails. Thus shorts in both transistors can be a little difficult to trace since this condition loads both the +24V and −24V rails. The result is that the power supply operates in the overload cutout mode, so you don't get the characteristic field collapse symptom. Disconnecting the power supply rectifiers one by one will not clear the overload as two supply rails are shorted.

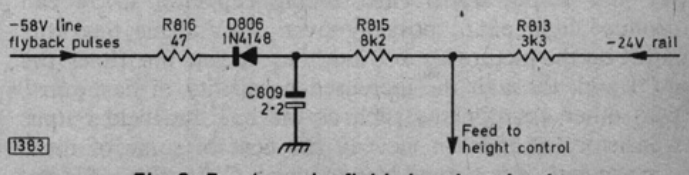


*Fig. 2: Feeds to the field charging circuit.*

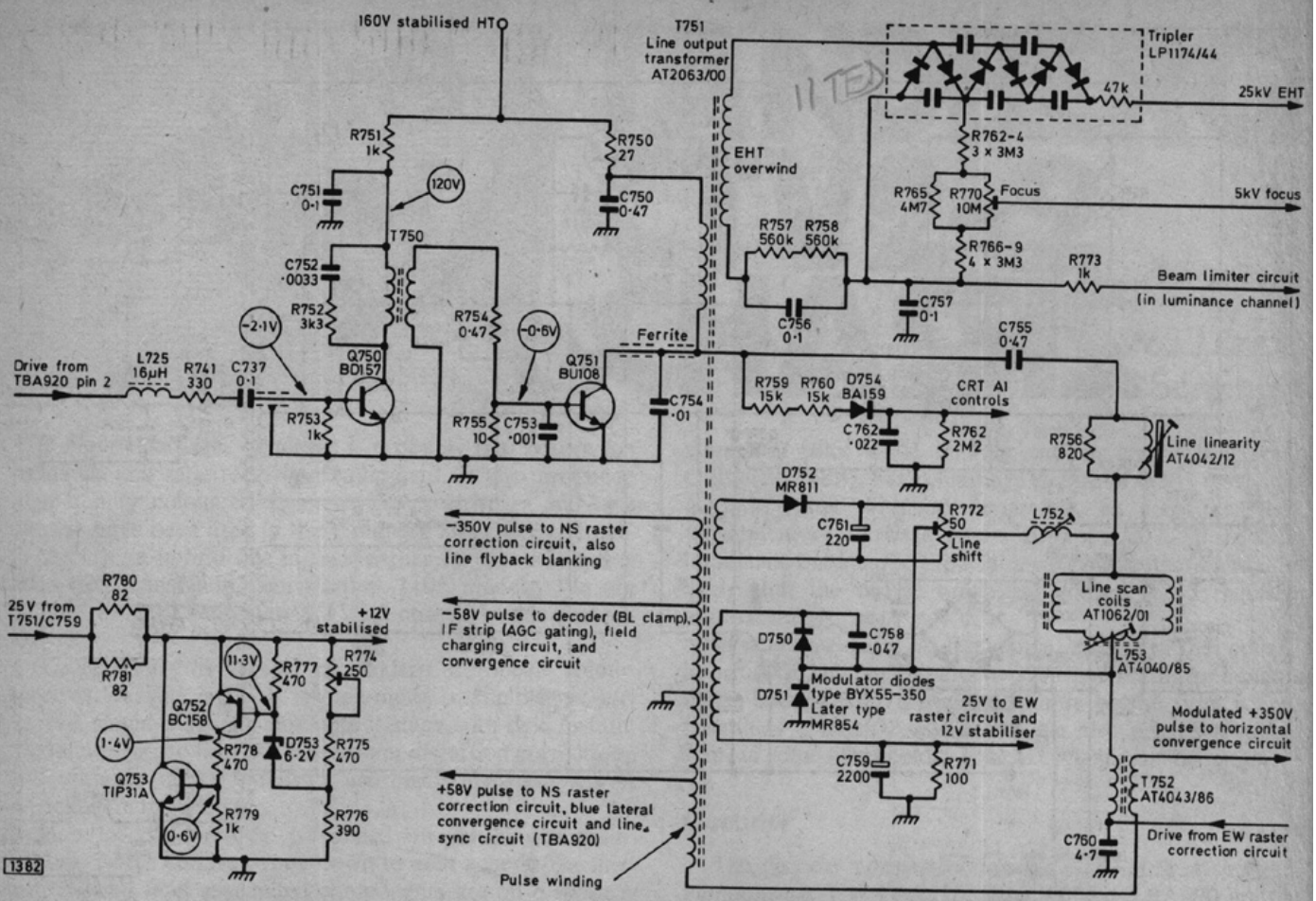


*Fig. 3: The line driver and output stages. The width control is in the EW raster correction circuit. The 12V supply shunt regulator is shown below left: adjust R774 for 12V on plug pin E1/1. The burst gating, burst blanking and bistable drive pulses are derived from the +58V pulse from the line output transformer pulse winding and are shaped by Q465 on the decoder board.*

The field charging circuit is fed from the −24V rail and also receives a feed obtained by rectifying the −58V line flyback pulses. The arrangement is shown in Fig. 2. Rectifier D806 rectifies the −58V line pulses, charging its reservoir capacitor C809. If D806 goes short- or open-circuit, the result will be insufficient height – with the surge limiter resistor R816 cooking in the case of D806 going short-circuit.

## Line Output Stage

The line output, e.h.t. and focus hardware make up the right-hand part of the main chassis. There is a single line output transistor, BU108 in earlier production and BU208 in later versions, with an e.h.t. tripler and diode width modulator for EW pincushion distortion correction. The circuit is shown in Fig. 3.

Usual component failures in this section are, as may be expected, the line output transistor Q751 going short-circuit, and line output transformer and tripler faults. In a few instances however these failures have been due to other components being faulty. If C756 at the "earthy" end of the e.h.t. overwind goes short-circuit a high current flows in the line output transformer and this in turn can blow the line output transistor and the tripler. Change in the value of the line output transformer tuning capacitor C754 can produce high e.h.t., possibly over 30kV. This has little effect on the picture but obviously endangers the tripler, the c.r.t. and, through the increased possibility of flashovers, puts other components such as the line and field output transistors at risk. In view of the cost of some of these components, it is a good idea to check C756, the 160V h.t. line voltage and the e.h.t. when carrying out a repair in this section.

The width modulator diodes D750 and D751 have proved to be somewhat unreliable, going open- or short-circuit, frequently intermittently. The usual symptom is intermittent sound and vision, since the 12V rail for the signal stages is produced by regulating the rectified output from the modulator diodes. Thus when faulty these diodes give a dark raster with obvious pincushion distortion, no vision and sound, and the brightness control is inoperative. Tandberg have since stopped using BYX55-350 diodes in this position, substituting the Motorola type MR854 diode instead.

## Conclusion

As this chassis is in many ways typical of the current generation of large-screen 110° colour receivers many of the faults described can appear in receivers of other makes. ■

# BOOK NOTE

There seems to be some confusion in the minds of some of our readers over the publishers of the two books reviewed in our January issue (page 136). The *Guide to World-Wide Television Test Cards* is published by HS Publications, 7 Epping Close, Mackworth Estate, Derby DE3 4HR, at £1.30 including postage. *Questions and Answers on Colour Television* is published by Newnes-Butterworths whose address is 88 Kingway, London WC2B 6AB. The price is 75p.