CHAPTER 7

PHILIPS G9 CHASSIS

The Philips G8 chassis is dealt with in Volume Two of *Newnes Colour TV Servicing Manual.* The G9 has some features in common with the G8, but employs a 110 degree picture tube instead of the 90 degree counterpart in the G8. It thus employs beam correction circuitry not found in the G8. There are other differences also. It is the purpose of this chapter to highlight the differences, while presenting all the circuit sections and essential servicing data.

At the outset, it is noteworthy that only one printed circuit panel is interchangeable between the two versions. That is the i.f./chroma panel, or 'signal' panel as it is more commonly called. The power, timebase, line scan and convergence panels are not interchangeable owing to the extra circuitry required with 110 degree picture tubes.

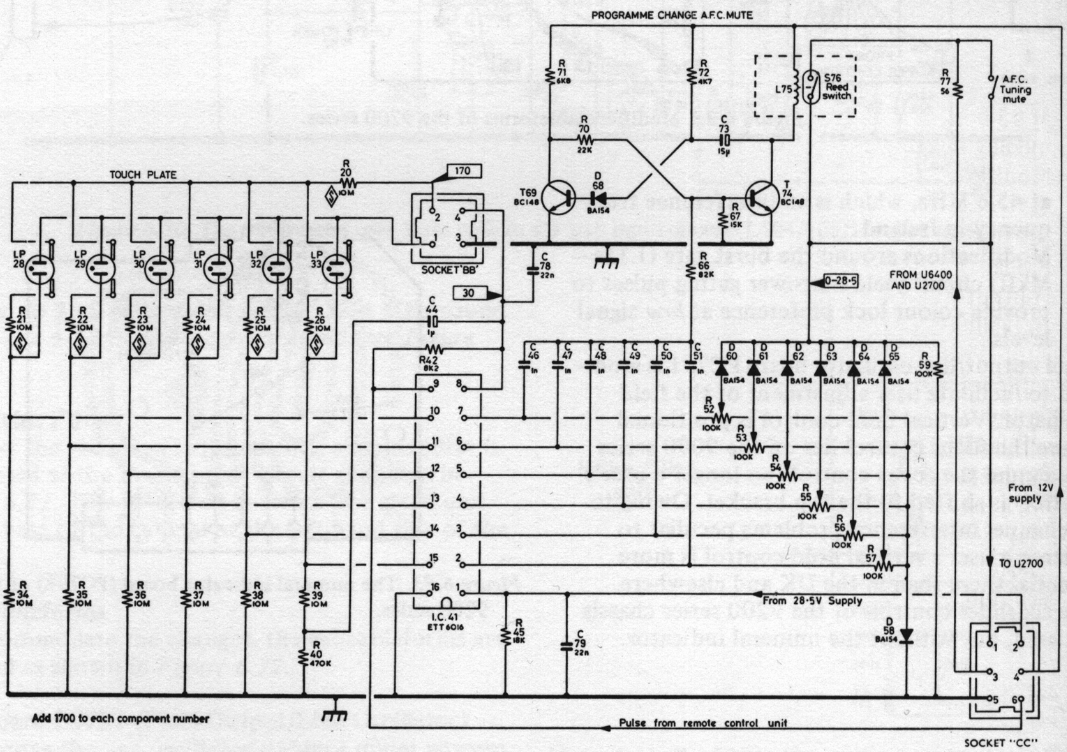


Figure 7.1. Circuit diagram of 'electrotouch' version channel selector. This also relates to the remote tuning facility (Figure 7.6).

FRONT-END

Like the G8, the G9 employs touchbutton ('electrotouch', see below) tuning. However, the circuit action is a little different in that the switching is instigated by the shorting of one set of contacts with the finger. The circuit is given in *Figure 7.1*. This yields a voltage change to IC41, thereby causing the i.c. to 'latch on', rather like an electronic switch. The switching action passes a stabilised 28·5 V supply to the varicap tuner via the appropriate tuning potentiometer.

Each touchplate has a neon associated with it, and this strikes and hence glows when a corresponding button is touched, thereby revealing to the operator which channel has been selected.

T69/T74 constitute a monostable. This senses the difference-switching voltage and activates reed switch S76 in T74 collector. The purpose of all this is to nullify momentarily the a.f.c. each time a channel is changed to prevent the circuit from holding on to the previous channel. The G8, it will be recalled, uses a mechanical a.f.c. switch for a similar reason.

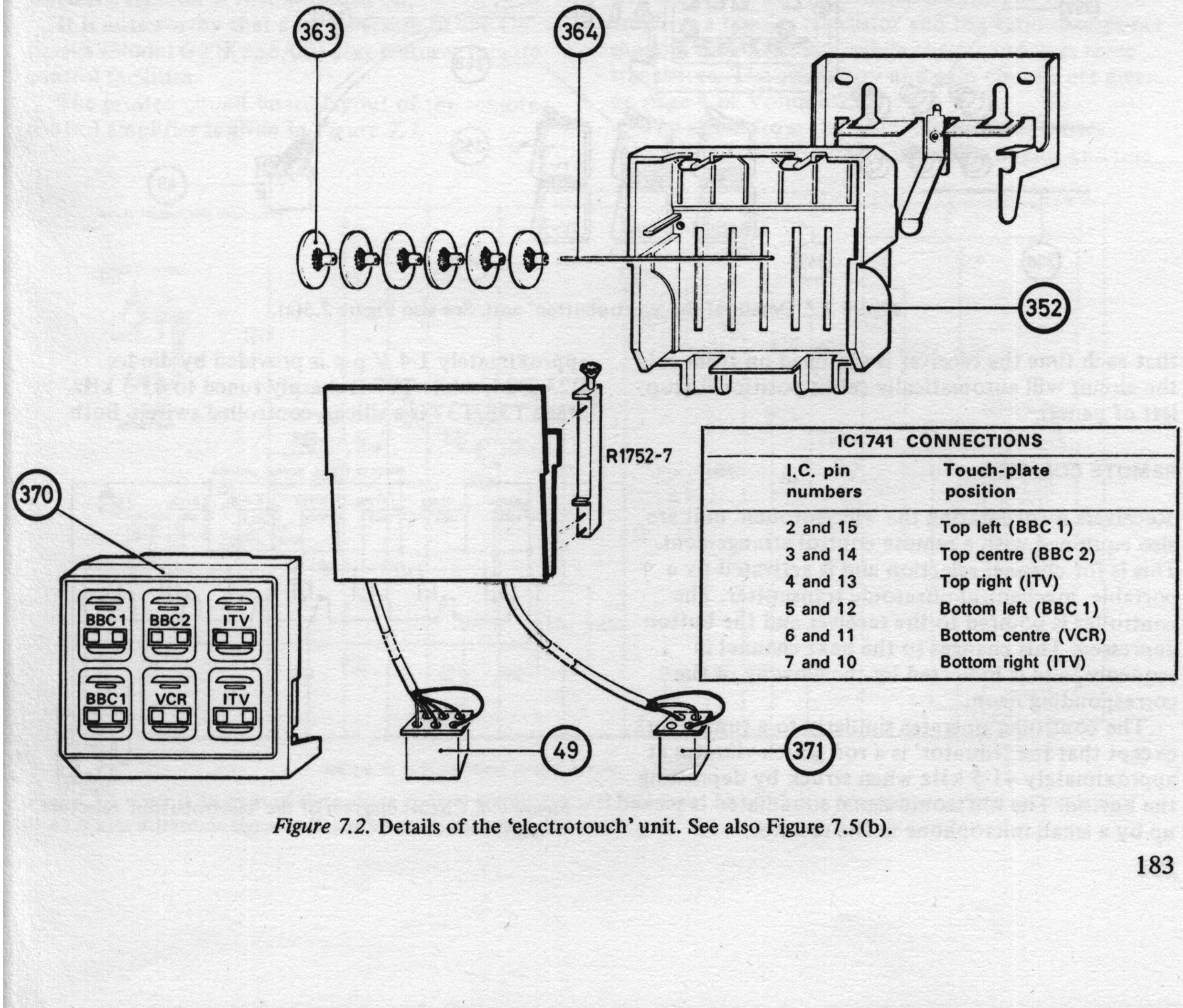
VARIATIONS

There are some variations to *Figure 7.1* circuit as follows. In some units C1744 is 2μ2F and a 1N4148 diode is added across R1739.

Mechanical details of the unit are given in *Figures 7.2* and *7.3*, while the wiring to the 'electrobuttons' is given in *Figure 7.4*.

There are two versions of buttons. One called 'electrobuttons', shown in *Figure 7.5a*, and the other called 'electrotouch', shown in *Figure 7.5b* and *Figure 7.2*. The diagrams in *Figure 7.5* show how the two versions are hinged down for tuning. In both cases the a.f.c. is automatically muted when the units are hinged down. With the 'electrobutton' version the required programme is selected by rotating the appropriate thumbwheel while a button is depressed. An approximate indication of the channel selected is by a pointer visible through a clear scale adjacent to the thumbwheel.

Tuning the 'electrotouch' version is similar. A neon will glow when a pair of contacts on the touchplate is activated by a finger. When this is done a station to



IC1741 CONNECTIONS

I.C. pin numbers	Touch-plate position
2 and 15	Top left (BBC 1)
3 and 14	Top centre (BBC 2)
4 and 13	Top right (ITV)
5 and 12	Bottom left (BBC 1)
6 and 11	Bottom centre (VCR)
7 and 10	Bottom right (ITV)

Figure 7.2. Details of the 'electrotouch' unit. See also Figure 7.5(b).

correspond with that 'button' is tuned by the appropriate thumbwheel, the channel being indicated as in the 'electrobutton' version. It should be noted

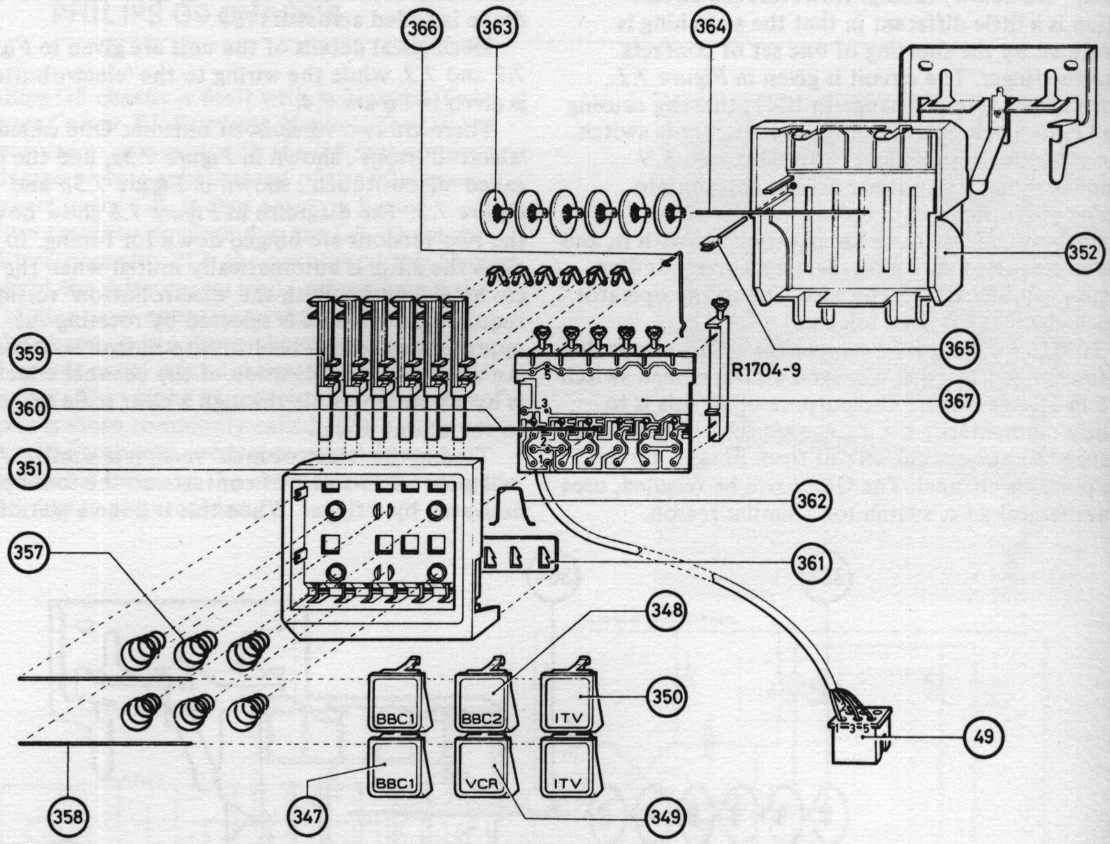


Figure 7.3. Details of the 'electrobutton' unit. See also Figure 7.5(a).

that each time the receiver is switched on from cold the circuit will automatically select position 1 (top left of panel).

REMOTE CONTROL

Receivers incorporating the 'electrotouch' unit are also equipped with a remote control arrangement. This is for channel selection and is activated by a portable, mechanical ultrasonic transmitter. The controller is pointed to the receiver and the button depressed. This changes to the next channel in sequence, and is indicated by the glowing of the corresponding neon.

The controller operates similarly to a tuning fork, except that the 'vibrator' is a rod which vibrates at approximately 41·5 kHz when struck by depressing the button. The ultrasonic signal so radiated is picked up by a small microphone in the receiver.

The circuit of the remote control panel is given in *Figure 7.6.* The microphone signal is conventionally amplified by T3/T6/T16. Amplitude limiting at approximately 1·4 V p-p is provided by diodes D23/D24, while T27 is sharply tuned to 41·5 kHz. Stage T38/T37 is a silicon-controlled switch. Both

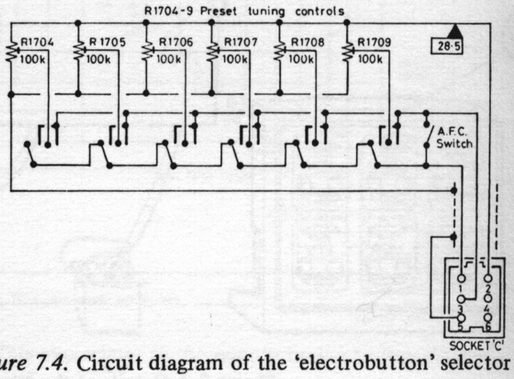


Figure 7.4. Circuit diagram of the 'electrobutton' selector unit.

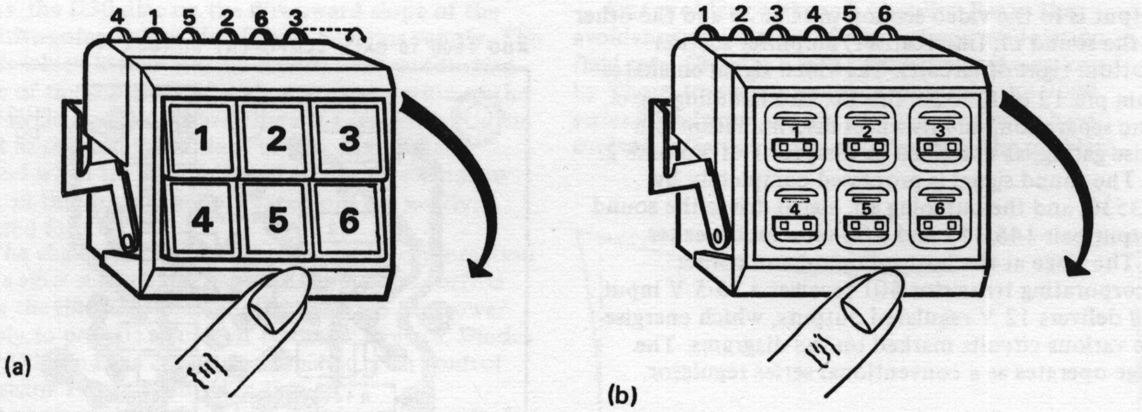


Figure 7.5. Comparing the 'electrobutton' and 'electrotouch' versions (see text for details of adjustment).

devices conduct for a limited period and produce negative pulses to the i.c. in the tuning head (*Figure 7.1*). The pulses cause the channels to change consecutively (i.e., 1-2-3-4-5-6), and then back to 1. R39/R40 ensure that channel 1 is always selected when the receiver is first switched on.

It is noteworthy that a later version of the G8 chassis (Model G22K556/09) also features remote control facilities.

The printed circuit board layout of the remote control amplifier is given in *Figure 7.7*.

SIGNAL PANEL (FRONT-END)

The circuit diagram of the front part of the 'signal' panel is given in *Figure 7.8*. I.F. signal from the tuner is passed first through the 'selectivity' department and thence to the 'gain' department. The first employs a bipolar transistor and the various response shaping tuned circuits, while the second uses three transistors. The selectivity and gain circuits are given on page 4 of Volume 2.

The signal from the 'gain' department passes through the 'sound selectivity' department, and one

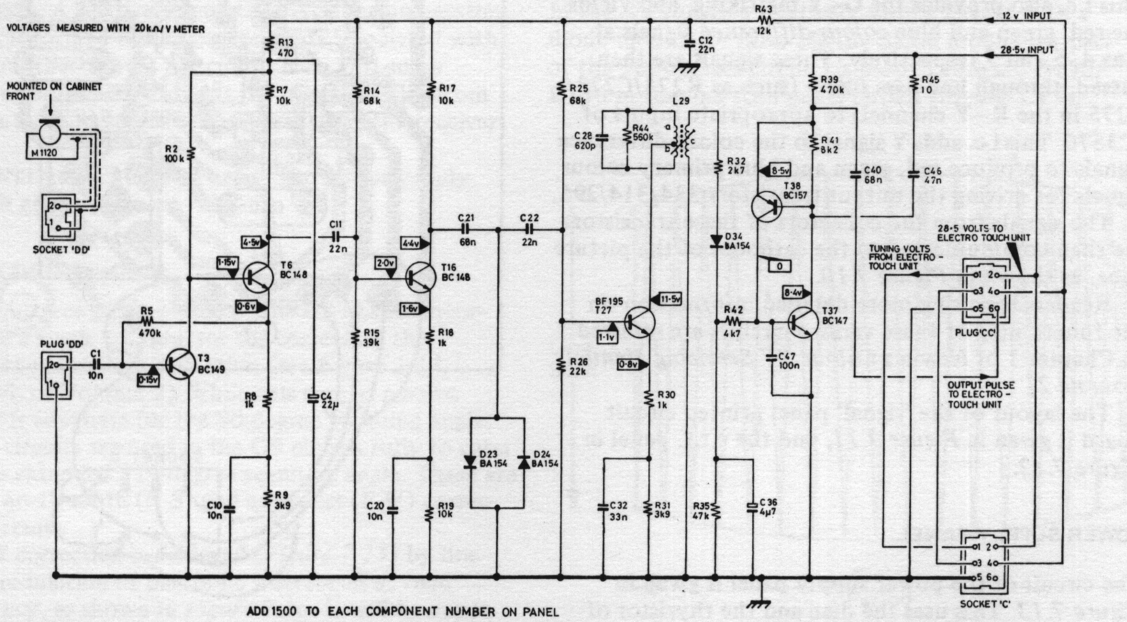


Figure 7.6. Circuit diagram of the remote control amplifier panel, the input of which is a microphone which responds to a 41.5 kHz ultrasonic signal radiated by the 'controller'. See text.

output is to the video section in IC3520 and the other to the sound i.f. (intercarrier) amplifier section (bottom right of circuit). The video signal emanates from pin 12 of IC3520, this i.c. also handling a.g.c., sync separation, line flywheel discrimination and noise gating, as described in Chapter 1 of Volume 2.

The sound signal is processed completely by IC3530, and the outgoing a.f. signal drives the sound output pair 146/152 and a 70 ohm loudspeaker.

The stage at the bottom right-hand corner incorporating transistor 401 receives a 23·5 V input and delivers 12 V regulated outputs, which energise the various circuits marked on the diagrams. The stage operates as a conventional series regulator.

SIGNAL PANEL (DECODER)

The back-end of the signal panel circuit is given in *Figure 7.9*. The video goes in at the top left-hand corner of the circuit, where it is processed by IC3540, after first passing through the Y delay line 183. This i.c. also incorporates the chroma amplifiers and a.c.c. amplifier.

The colouring signals are partly processed by IC3550, this one providing the ident, colour killer, reference oscillator (with crystal 363), reference signal amplitude control and reference signal phasing.

After processing by the PAL delay line U3248, the resulting V and U signals are demodulated (by the R–Y and B–Y demodulators respectively) in IC3560. This i.c. also provides the G–Y matrixing, and yields the red, green and blue *colour-difference* signals at pins 4, 5 and 7 respectively. These signals are then passed, through low-pass filters (such as R274/C273/C275 in the R–Y channel) to appropriate inputs of IC3570. This i.c. adds Y signal to the colour-difference signals to produce red, green and blue primary colour signals for driving the output transistors 334/314/294.

The signals from the collectors of these transistors are then communicated to the cathodes of the picture tube, as shown in *Figure 7.10*.

Readers requiring more detailed information on the functioning of these various circuits are referred to Chapter 1 of *Newnes Colour TV Servicing Manual, Volume 2*.

The layout of the 'signal' panel printed circuit board is given in *Figure 7.11*, and the c.r.t. panel in *Figure 7.12*.

POWER SUPPLY PANEL

The circuit of the power supply panel is given in *Figure 7.13*. This uses the diac and the thyristor of the G8 in a stabilised control arrangement. It will be recalled that a phase delay network is adopted which

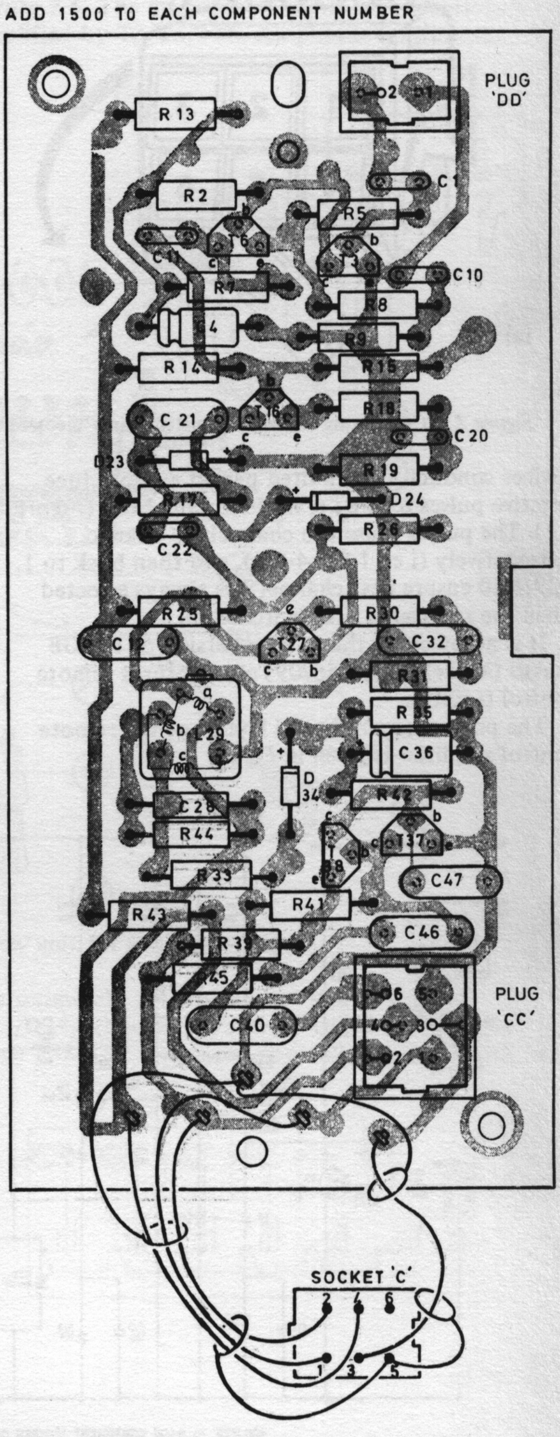


Figure 7.7. Printed circuit board layout of the remote control amplifier.

'fires' the D30 diac on the downward slope of the positive-going half cycle of the a.c. mains supply. The pulse which is thus created controls the conducting time of the thyristor SCR37. A greater period of the half-cycle is utilised when there is a tendency for the load to rise and the voltage to fall, and a smaller period when the load falls and the voltage tends to rise. In this manner supply variations are neatly catered for.

The changes in the G9 include overload protection and a slow start circuit. A 45 V supply line derived from the line output stage is fed back to the power supply to provide a form of feedback control. Diodes D25/D26 and the circuitry associated with control transistor T7 are involved in this.

Variations in the 45 V line, which could result, for example, from trouble in the line output stage, will precipitate conduction of T7 and hence activate the protection circuit. It is as well to remember, then, that the 45 V line is a key factor when investigating certain fault conditions. It is possible to tell whether changes in the 45 V line are responsible by temporarily disconnecting D25/D26. Fault-finding techniques similar to those used with the G8 chassis can be adopted, of course, but in that chassis diode D1398 is the diode to disconnect to isolate the over-voltage control circuit.

The slow start circuit is arranged to delay the 'firing' point of the diac on switch-on. The control is similar to the over-voltage, but is active for only about 1·5 seconds, the circuit then resuming normal operation. A relatively long time constant integrating circuit is formed by the components associated with T20. In other words, the circuit is an anti-surge arrangement which protects the power supply from 'raw' a.c. mains surges on first switching the receiver on.

The printed circuit layout of the power supply panel is given in *Figure 7.14*.

SCAN CORRECTION

The 90-degree picture tube of the G8 chassis incorporates a single transductor for correcting the inherent pincushion distortion (see *Figure 1.13*, page 14, of Volume 2). While this sort of passive circuit is adequate for the 90-degree scanning angle, active circuits are used in the G9 chassis fully to cater for the extended 110-degree scanning angle. These are called north-south (N-S) and east-west (E-W) correction circuits.

E-W correction is achieved (*Figure 7.15*) by line scan modulation of parabolic waveforms at field frequency, as shown in *Figure 7.16*. It will be appreciated that this technique compensates for the distortion at the start and finish of each field.

One problem with such circuitry lies in the avoidance of e.h.t. and focus voltage modulation at field rate. Chapter 6 reveals the method employed by Thorn to overcome this problem in the 9000 series 110-degree chassis. Various designers have evolved different schemes for solving the problem.

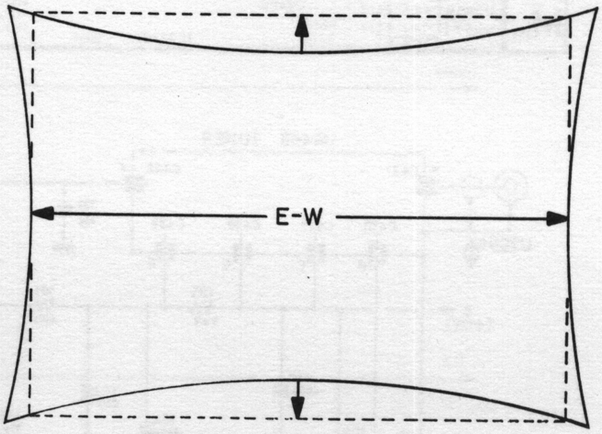


Figure 7.15. E-W distortion correction requirements.

In the G9 chassis a relatively simple circuit with a diode modulator (also see the diode modulator part of the 9000 series circuit) is used. These are D150/ D156 in the line scan panel circuit (*Figure 7.17*).

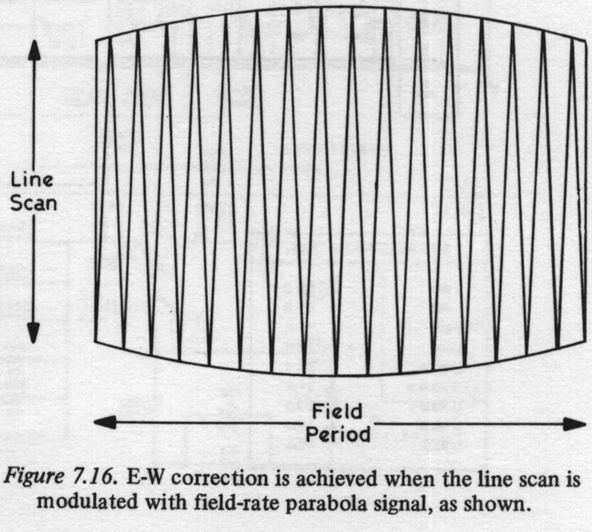
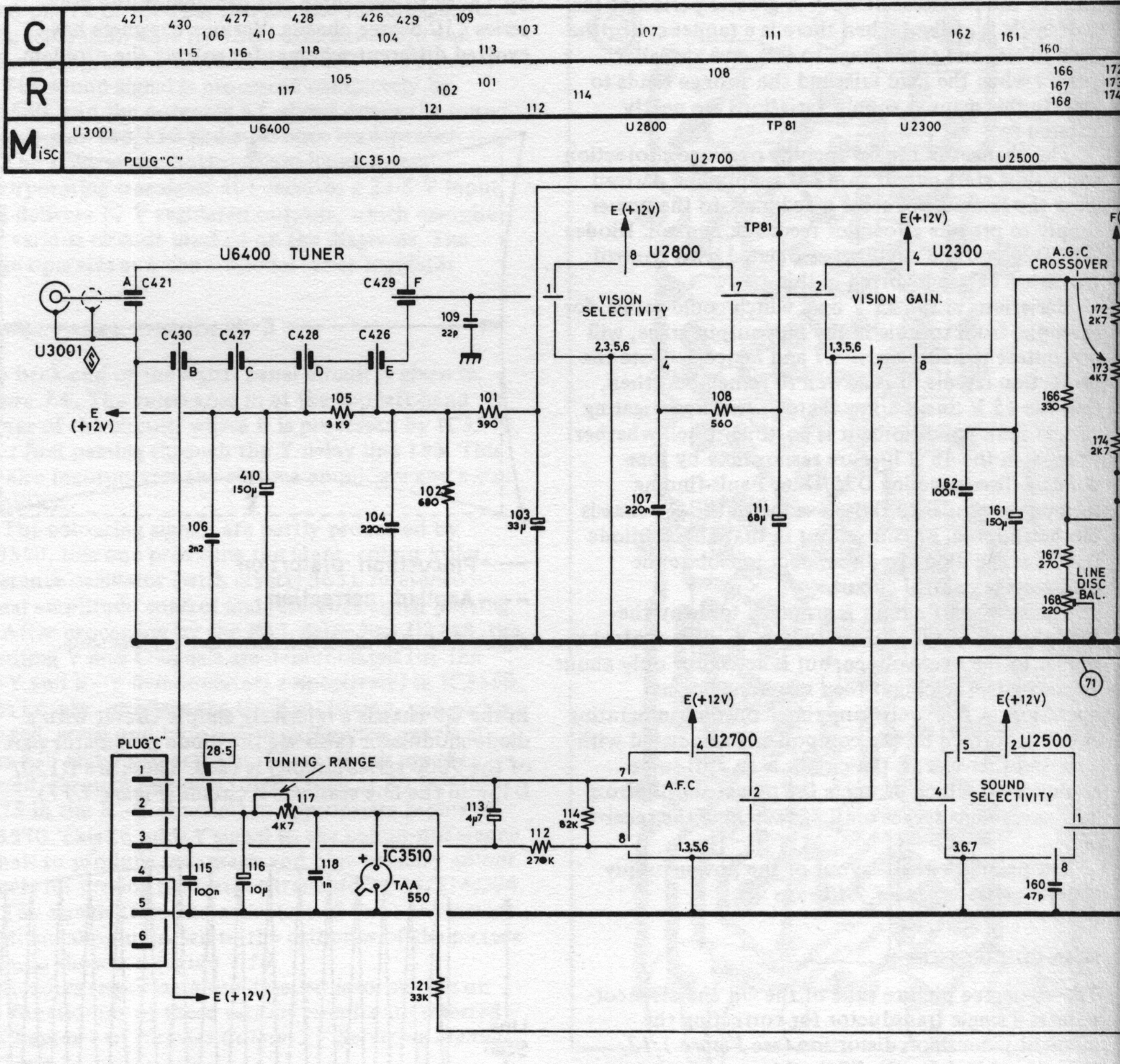


Figure 7.16. E-W correction is achieved when the line scan is modulated with field-rate parabola signal, as shown.



COIL RESISTANCES >1Ω	
L 183	196 Ω
L 403	2·7 Ω
L 404	2·7 Ω
L 405	2·7 Ω
U 3008 c	3·5 Ω
U 3006 b	3·7 Ω
U 3006 f	2·3 Ω
U 3009	1·9 Ω
U 3010	1·2 Ω

NOTES

Add 3000 to each component number except those prefixed 'U'.

Voltages

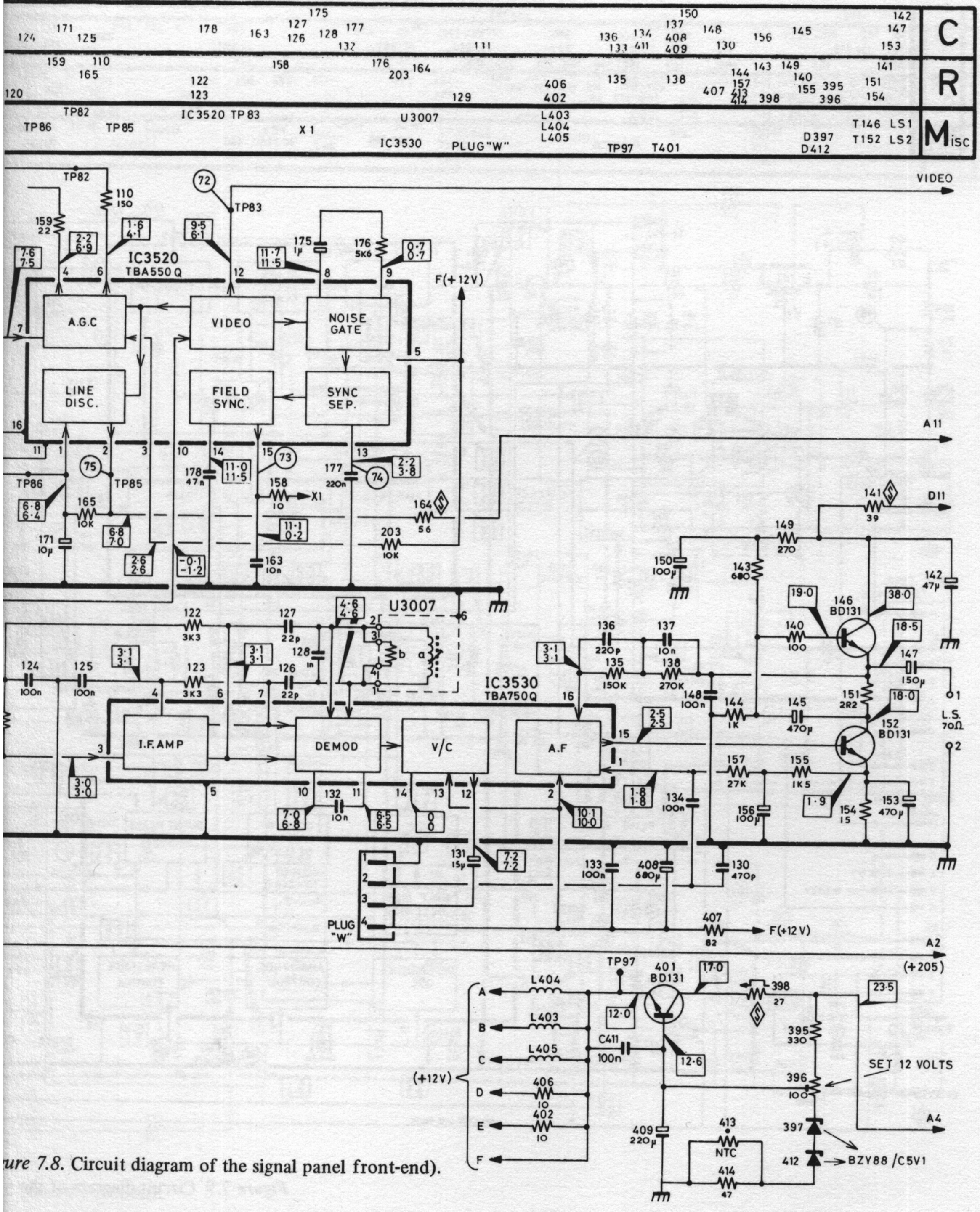
1·7 = No signal input, all customer controls set to minimum
3·4 = Colour bar signal, controls set for normal picture.

All voltages measured with 20kΩ/V meter.

(90) Denotes waveform.

= Thermal fuse.

= Special safety component. Refer to servicing notes before replacing.



ure 7.8. Circuit diagram of the signal panel front-end).

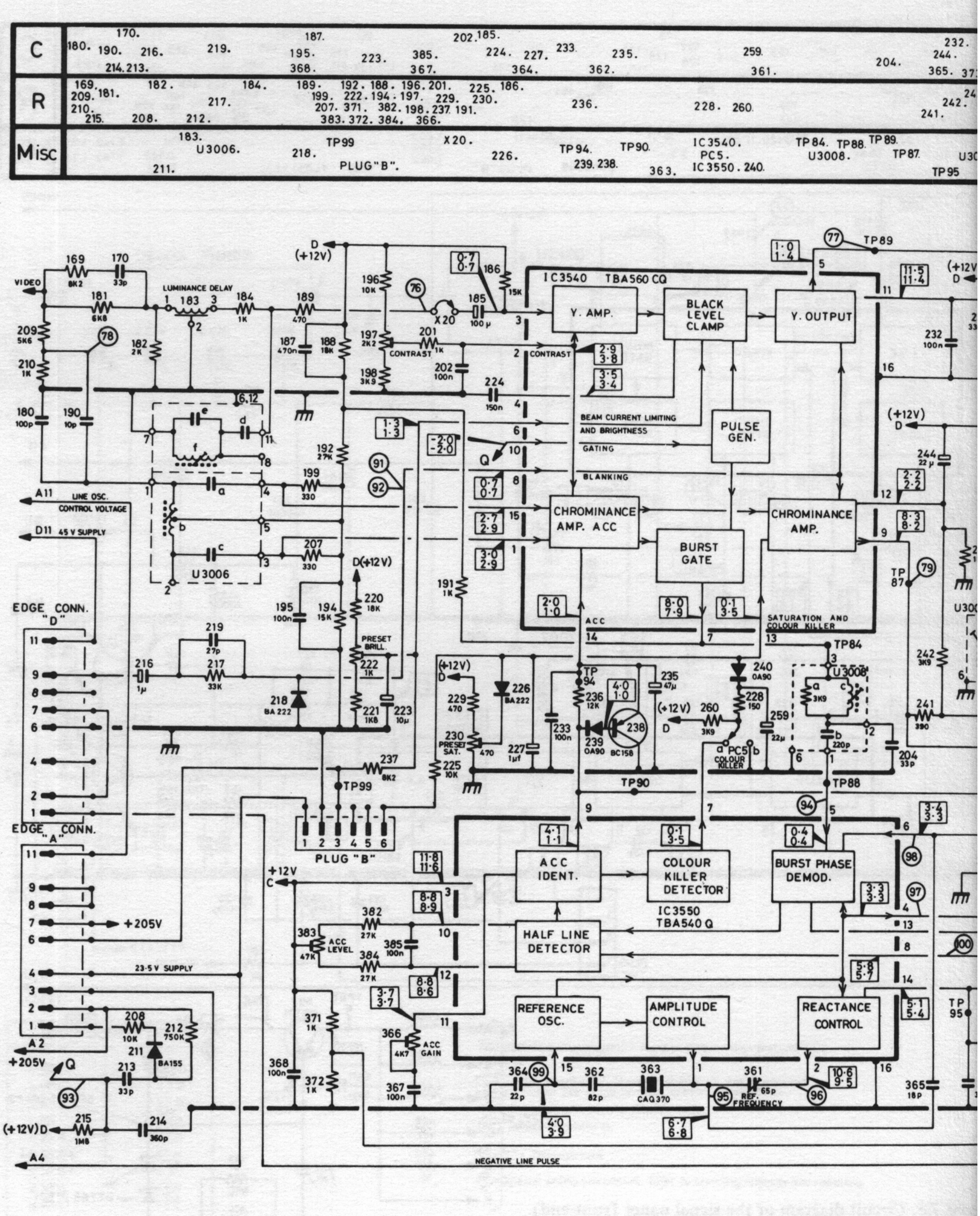
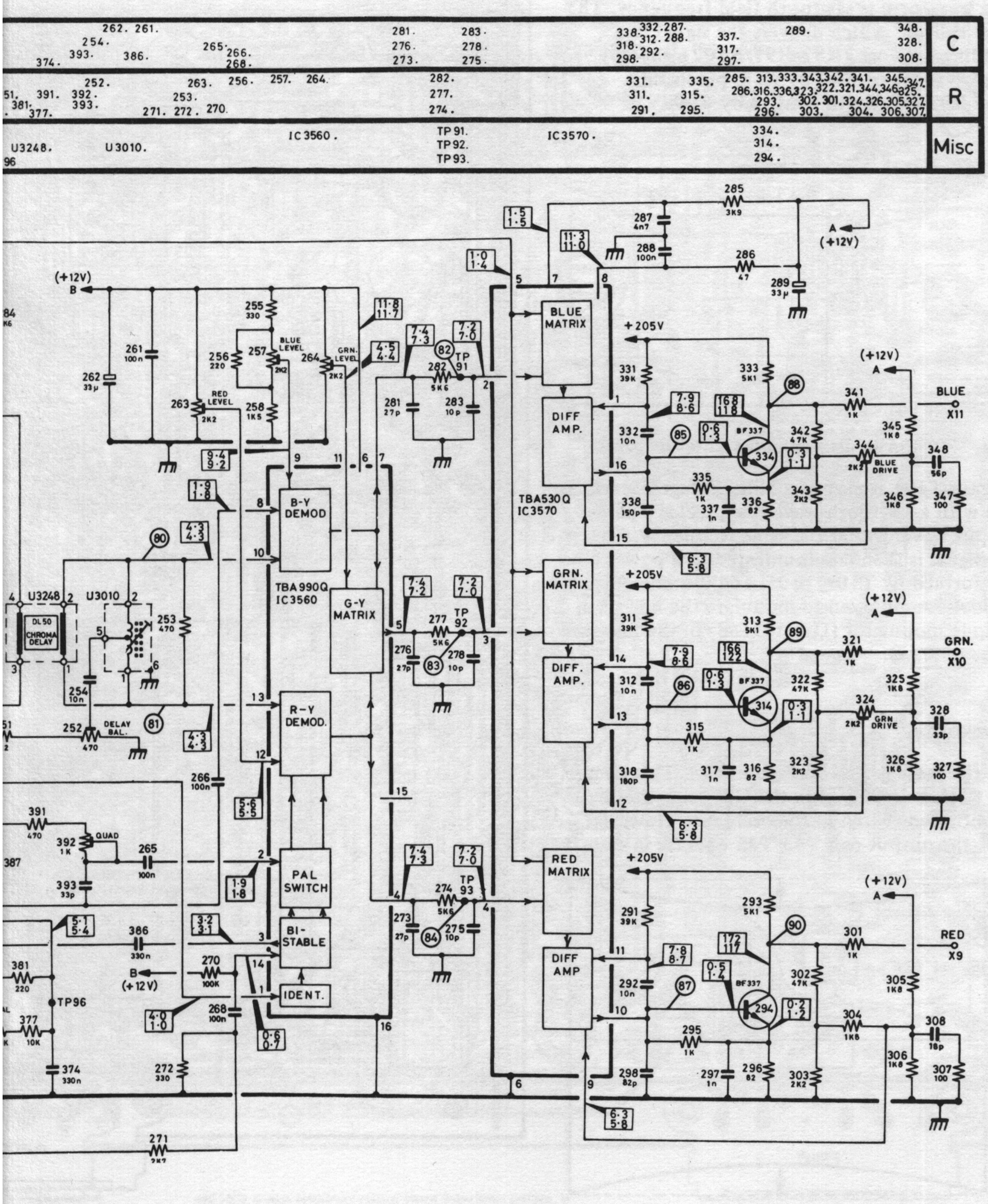


Figure 7.9. Circuit diagram of the si



el (decoder section).

The parabolic field waveform is obtained from the timebase panel circuit (*Figure 7.18*). Here it will be seen that T85 base is fed from the field output stage, where the waveform is sawtooth field frequency. T85 serves as a 'splitter' which delivers the signal to a matrix adding network (R81/R97/R102), thereby providing keystone control by R88, pincushion control by R92 and width control by R99.

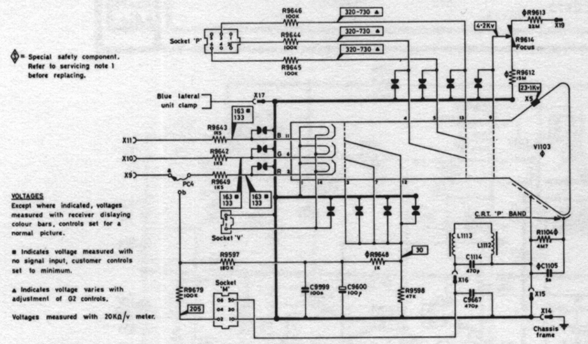


Figure 7.10. Circuit diagram of the c.r.t. base panel.

Transistor T101 is part of a Miller integrator which, when fed with a sawtooth waveform, yields a parabolic output waveform at the same frequency. The resultant signal is then communicated to a power amplifier formed by T104/T105, and it is the output of this which is employed to modulate the line scan, via the diode modulator (D150/D156) in the line scan panel (*Figure 7.17*).

FIELD TIMEBASE

The field timebase is also on *Figure 7.18.* This circuit is similar to that employed in the G8, using the silicon-controlled switch in the oscillator. However, in the G9, the output pair T43/T45 operate in class B,

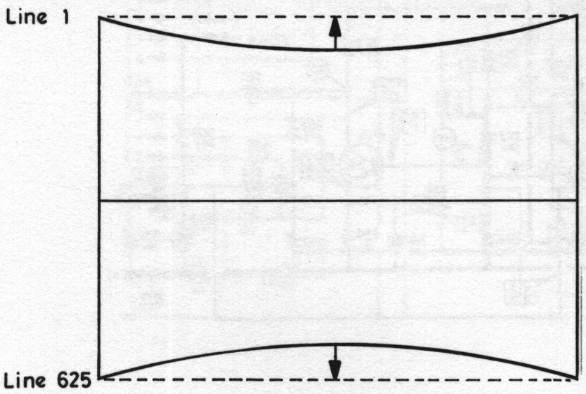


Figure 7.19. N-S raster correction (see text).

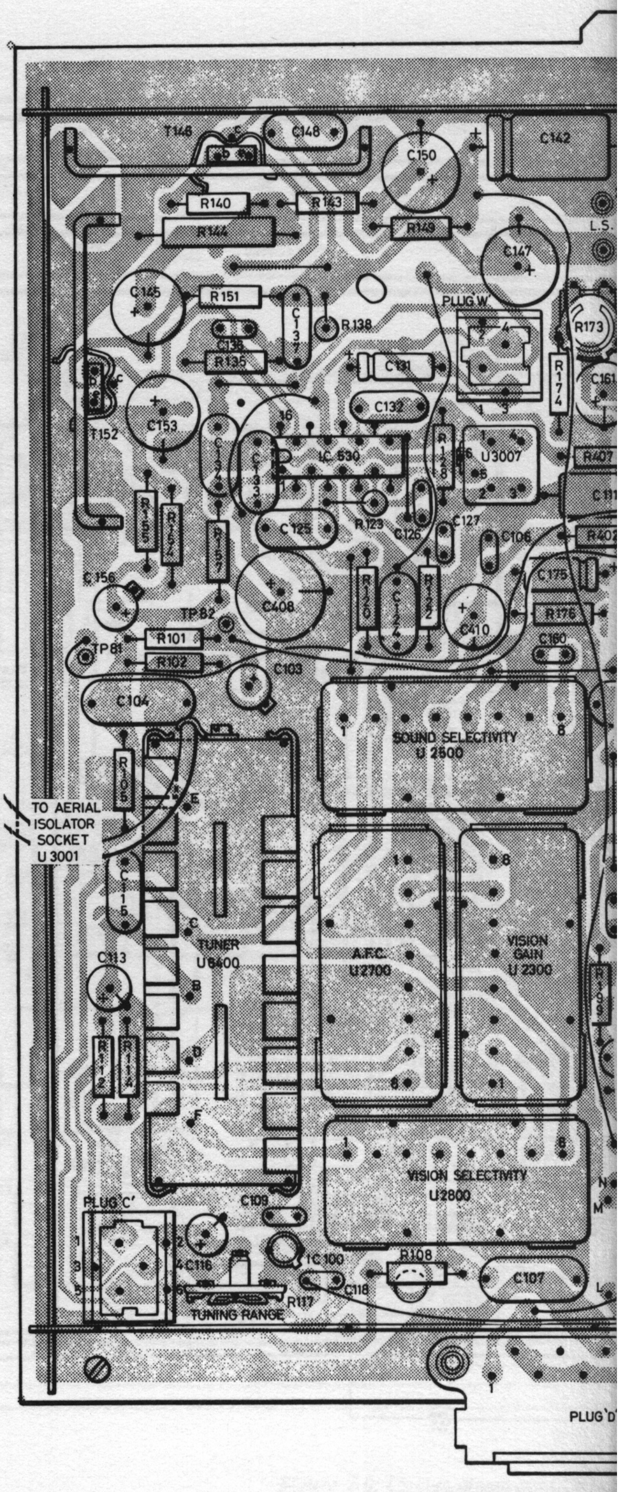
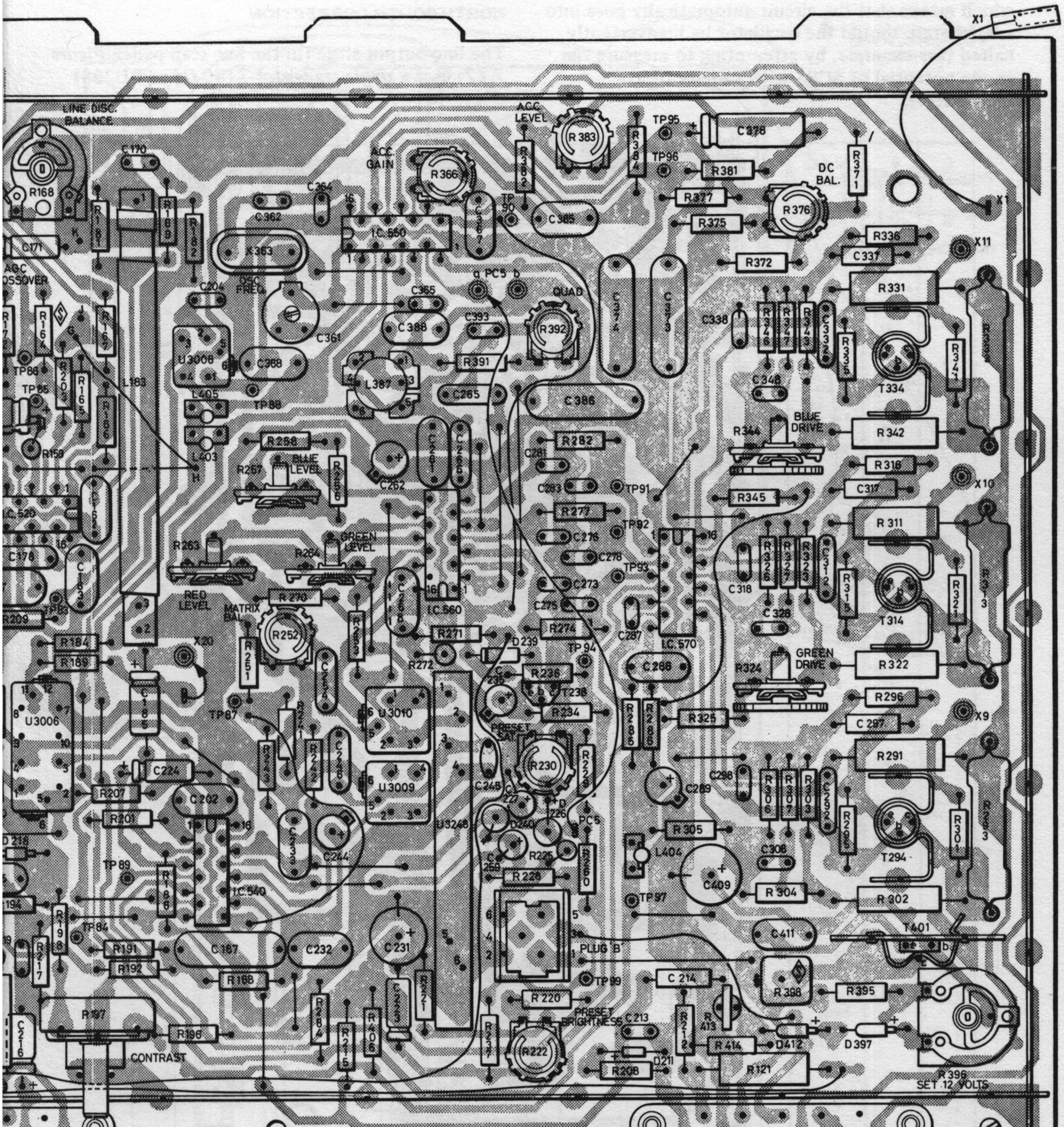


Figure 7.11. Printed circuit layout of the complete signal panel.



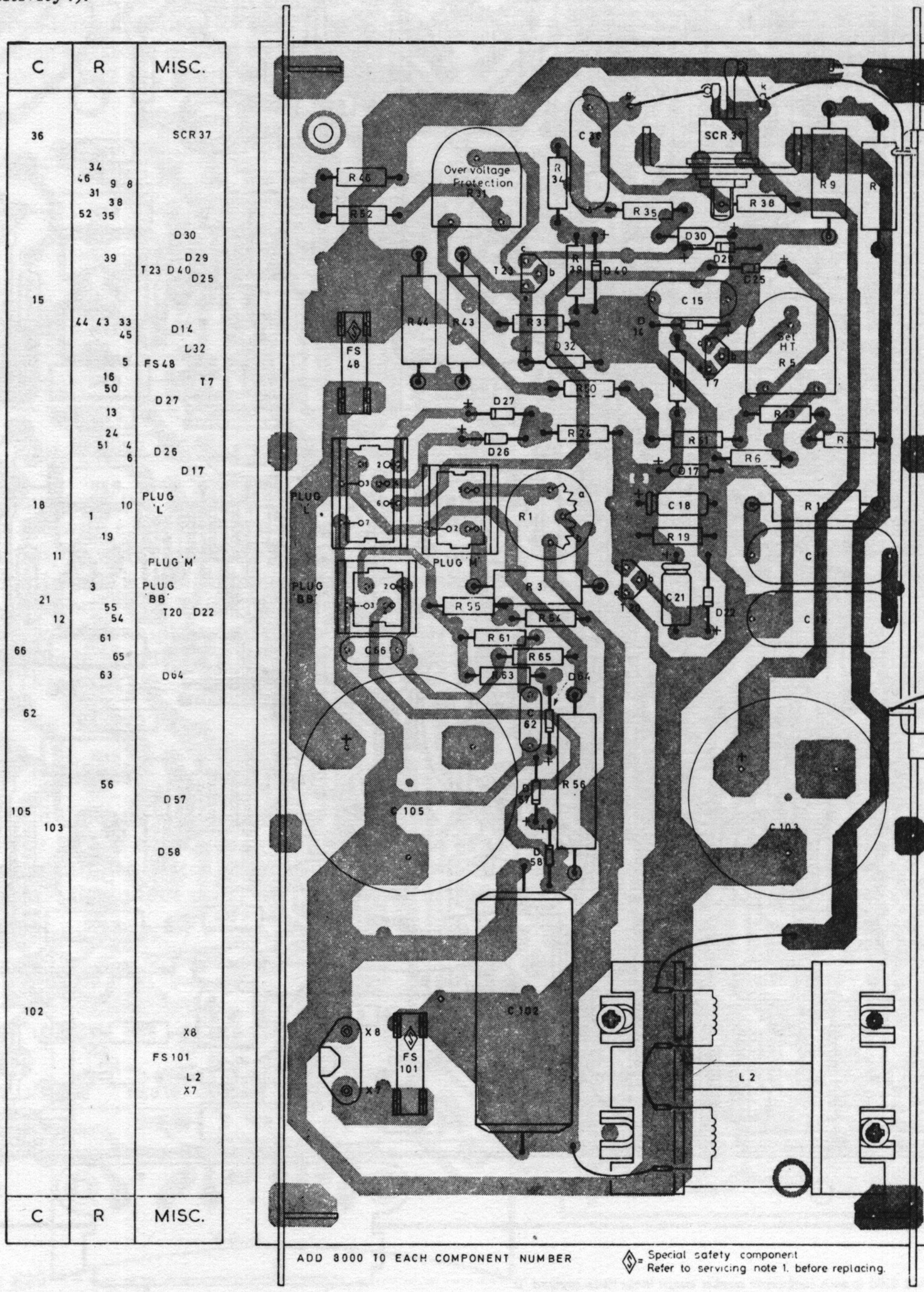
Add 3000 to each component number except those items prefixed 'U'

ote that this is the same as that used in the G8, the two being interchangeable.

which means that the circuit automatically goes into a 'safe' state should the oscillator be inadvertently halted (for example, by attempting to measure the anode potential of SCS5 with a meter of low sensitivity!).

NORTH-SOUTH CORRECTION

The line output stage (in the line scan panel, *Figure 7.17*) uses a *single* transistor T130 (type BU208)



Corrections:
D27 is not fitted. For "R24" read "D24"
R63 is replaced by a wire link

Figure 7.14. Printed circuit layout of the power supply panel.

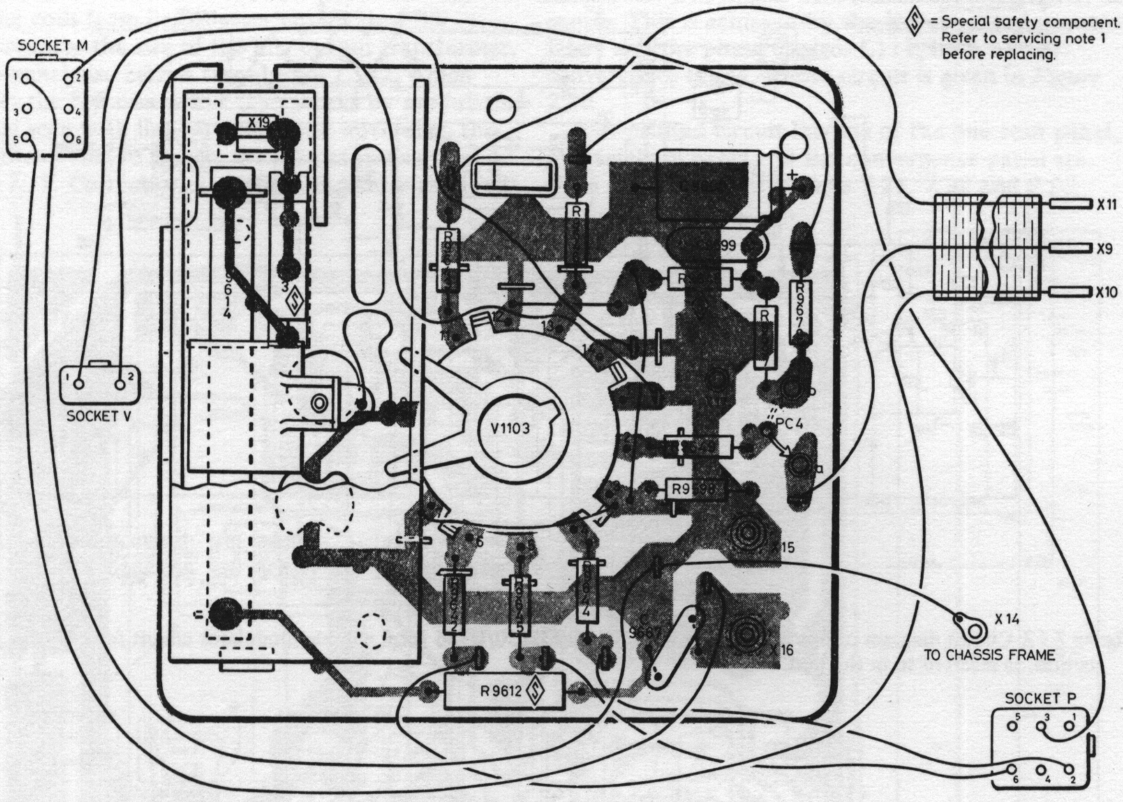


Figure 7.12. Printed circuit layout of the C.R.T. base panel.

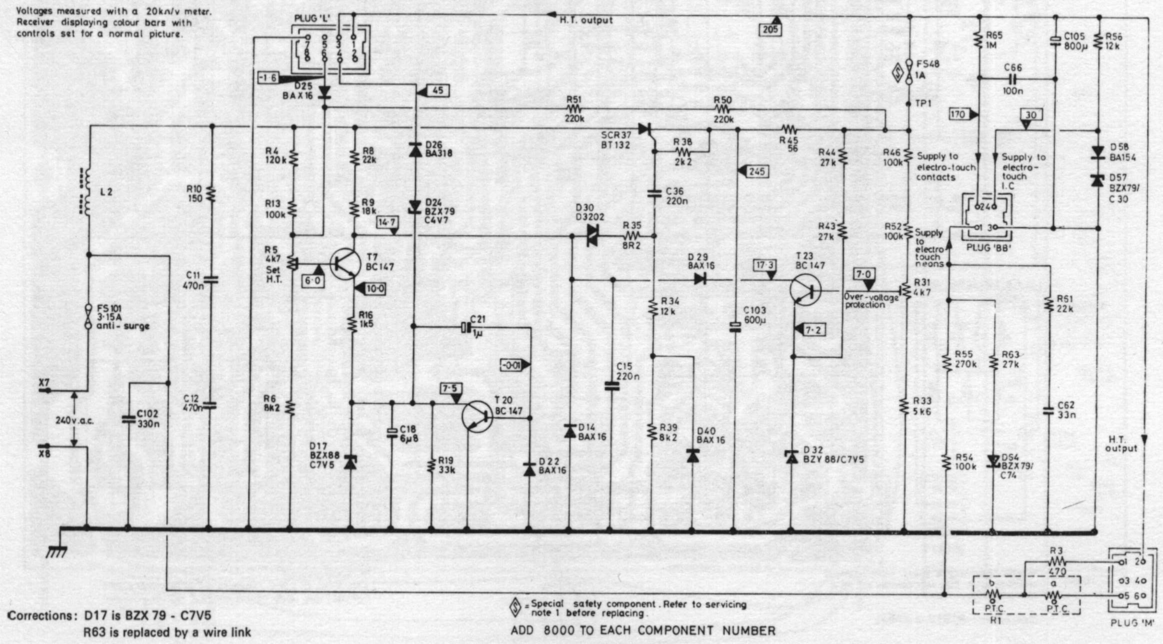


Figure 7.13. Circuit diagram of the power supply panel.

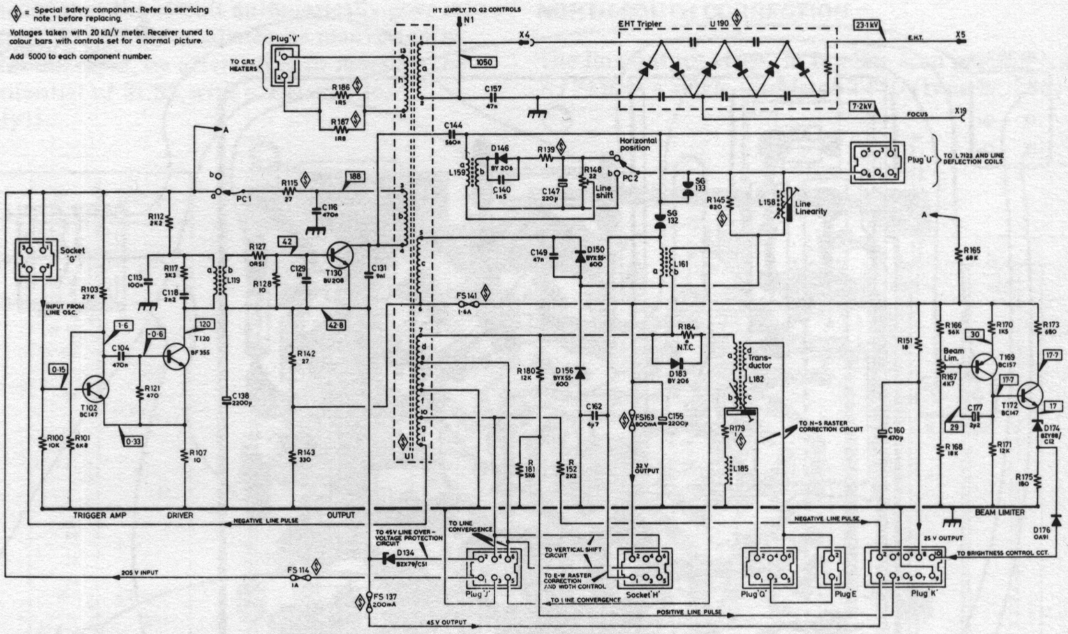


Figure 7.17. **Circuit diagram of line scan panel, where diodes D150/D156 form a diode modulator circuit for E-W scan correction, as referred to in the text.**

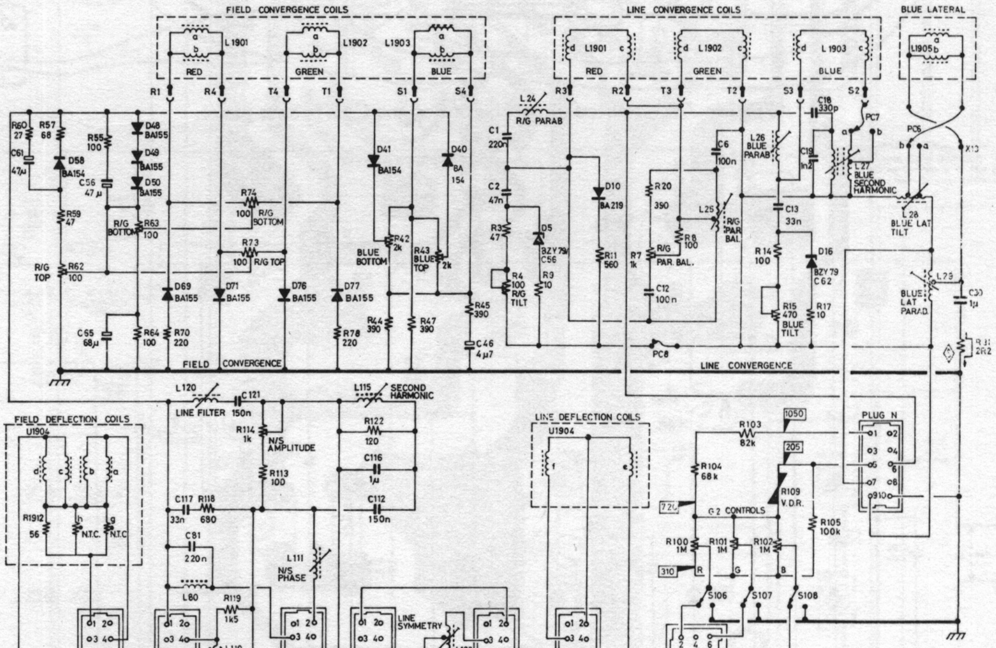


Figure 7.20. **Circuit diagram of convergence panel, which includes the preset controls for scan correction.**

mounted on a substantial heat sink. This feeds the scanning coils from its collector circuit, and the design reduces the size of the line output transformer.

The panel also carries transductor L182, which provides the N-S correction. This works by modulating the field scan with line rate parabolic waveform, the effect then being to change the scan as shown in *Figure 7.19*. Correction, therefore, is mostly required at the start and finish, with the least correction at the centre. This is achieved by the N-S amplitude control R114 and the phase control L111, both on the convergence board, whose circuit is given in *Figure 7.20*.

The printed circuit layouts of the line scan panel, the timebase panel and the convergence panel are given respectively in *Figures 7.21, 7.22* and *7.23*.

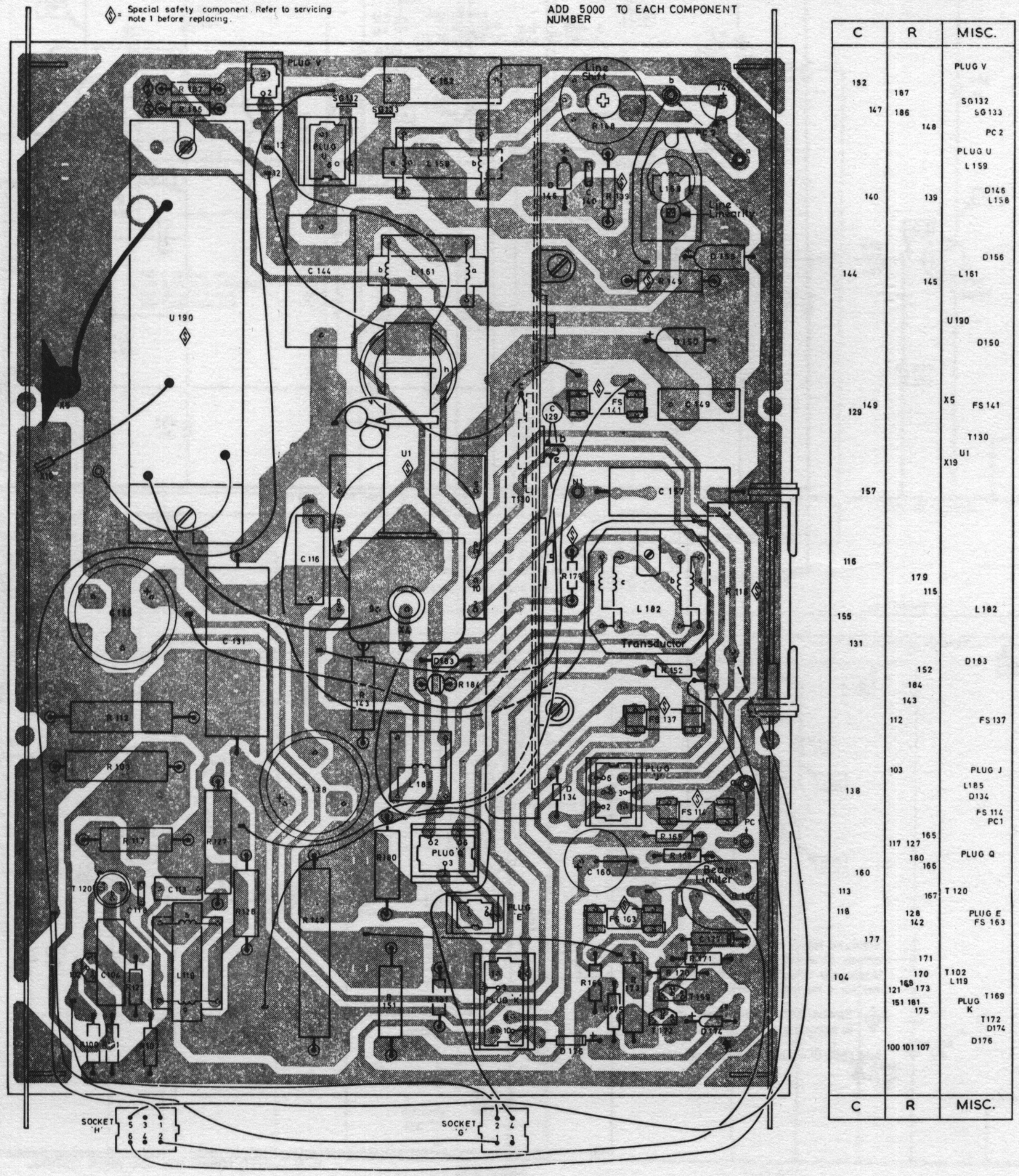


Figure 7.21. Printed circuit layout of the line scan panel.

C	6. 78. 10. 20. 22. 89. 12. 90. 94. 35. 38. 103. 93. 51. 46. 48.
R	1. 2. 3. 4. 9. 79. 80. 16. 15. 14. 86. 87. 17. 18. 88. 23. 25. 24. 91. 31. 30. 13. 29. 13. 92. 81. 32. 95. 37. 36. 33. 100. 102. 47. 97. 96. 99. 98.
Misc.	X1. L11. SCS 5 D7. D19. T85. T21. T34. T101. T43. D44. T45.

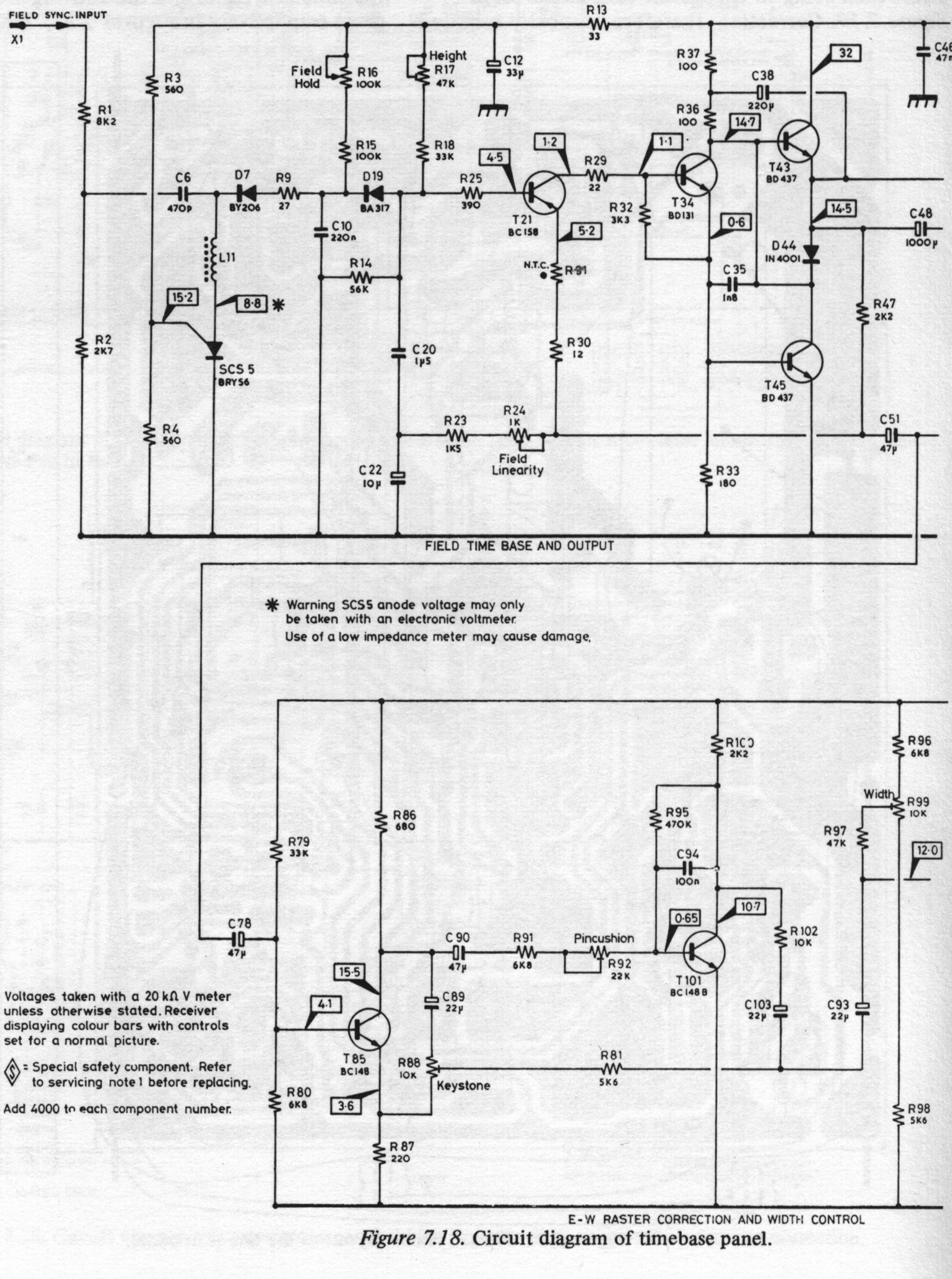
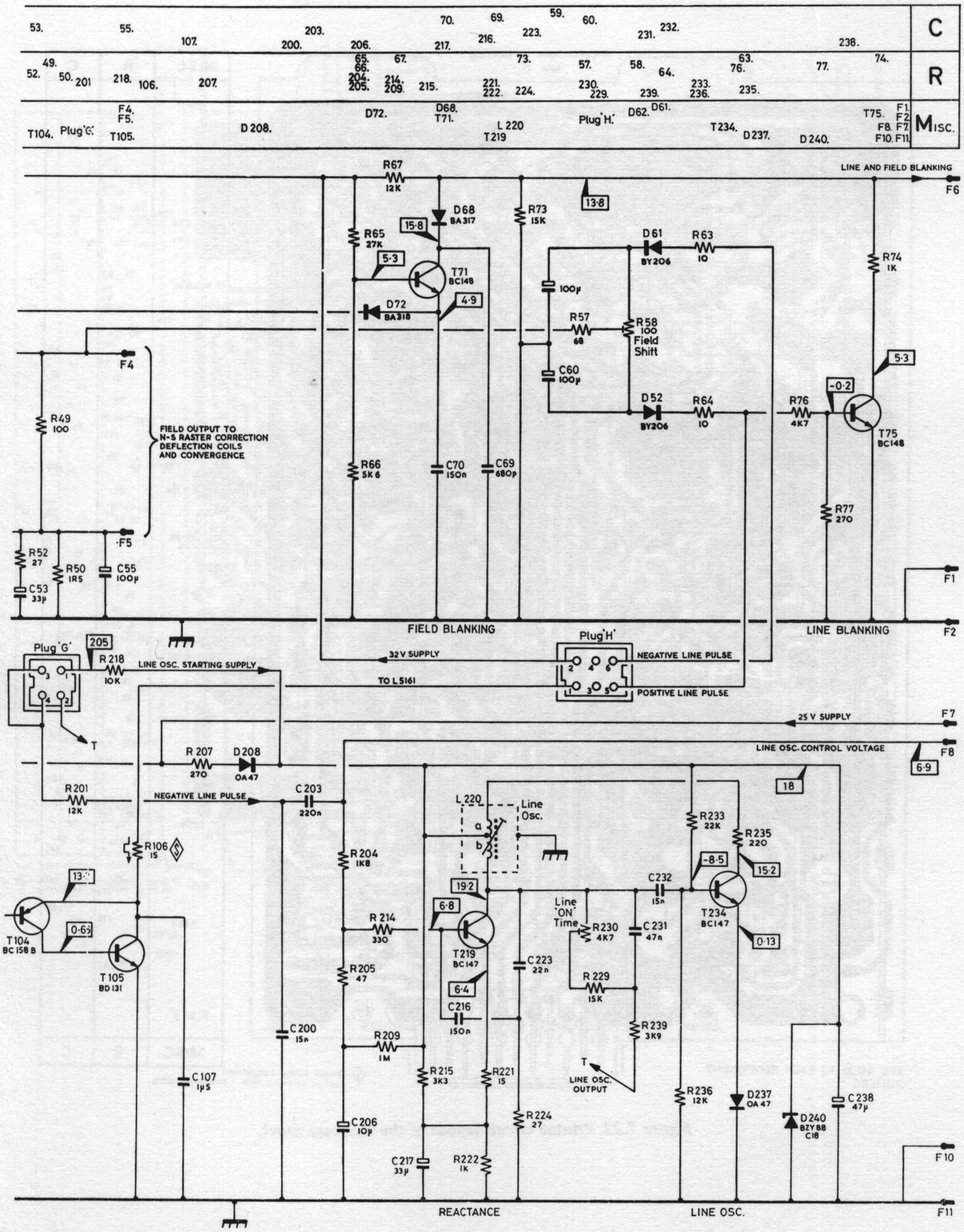


Figure 7.18. **Circuit diagram of timebase panel.**


C
R
MISC.
53.
55.
107.
200.
203.
206.
217.
70.
216.
69.
223.
59.
60.
231.
232.
238.
52.
49.
50.
201
218.
106.
207.
65.
66.
204.
205.
67.
214.
209.
215.
221.
222.
73.
224.
57.
230.
229.
58.
239.
64.
233.
236.
63.
76.
235.
77.
74.
T104.
Plug 'G'.
F4.
F5.
T105.
D 208.
D72.
D68.
T71.
L 220
T219
Plug 'H'.
D62.
D61.
T234.
D 237.
D 240.
T75.
F1.
F2.
F8.
F7.
F10.
F11.
R67
12K
D68
BA317
15·8
R65
27K
5·3
T71
BC148
D72
BA318
4·9
R73
15K
13·8
D61
BY206
R63
10
100μ
R57
68
R58
100
Field
Shift
C60
100μ
D52
BY206
R64
10
R76
4K7
-0·2
T75
BC148
5·3
R74
1K
R77
270
LINE AND FIELD BLANKING
F6
F4
R49
100
FIELD OUTPUT TO
N-S RASTER CORRECTION
DEFLECTION COILS
AND CONVERGENCE
R66
5K6
C70
150n
C69
680p
F5
R52
27
C53
33μ
R50
1R5
C55
100p
FIELD BLANKING
LINE BLANKING
F1
F2
Plug 'G'
205
R 218
10K
LINE OSC. STARTING SUPPLY
32 V SUPPLY
TO L S161
Plug 'H'
NEGATIVE LINE PULSE
POSITIVE LINE PULSE
25 V SUPPLY
F7
LINE OSC. CONTROL VOLTAGE
F8
6·9
18
T
R 207
270
D 208
OA47
R201
12K
NEGATIVE LINE PULSE
C 203
220n
L 220
Line
Osc.
a
b
R 204
1K8
R106
15
13·
0·65
T104
BC 158 B
T 105
BD 131
19·2
6·8
R 214
330
T219
BC147
6·4
C216
150n
R205
47
C 223
22n
Line
'ON'
Time
R230
4K7
C232
15n
C231
47n
R229
15K
R239
3K9
R233
22K
R235
220
-8·5
15·2
T234
BC147
0·13
C 200
15n
R209
1M
R215
3K3
R221
15
T
LINE OSC.
OUTPUT
C 107
1μ5
R224
27
C 206
10μ
C217
33μ
R222
1K
R236
12K
D237
OA 47
D240
BZY88
C18
C 238
47μ
F10
F11
REACTANCE
LINE OSC.

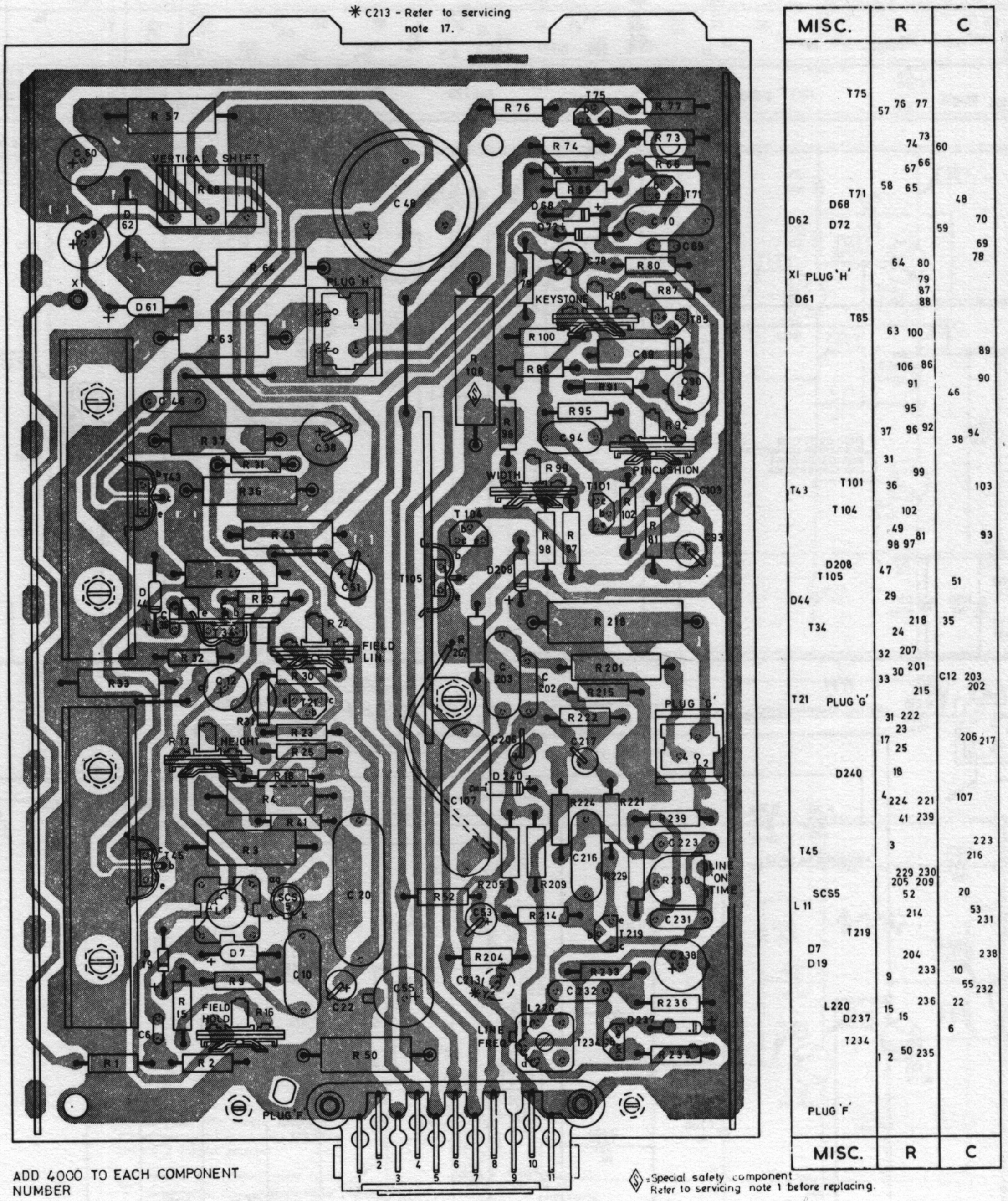


Figure 7.22. Printed circuit layout of the timebase panel.

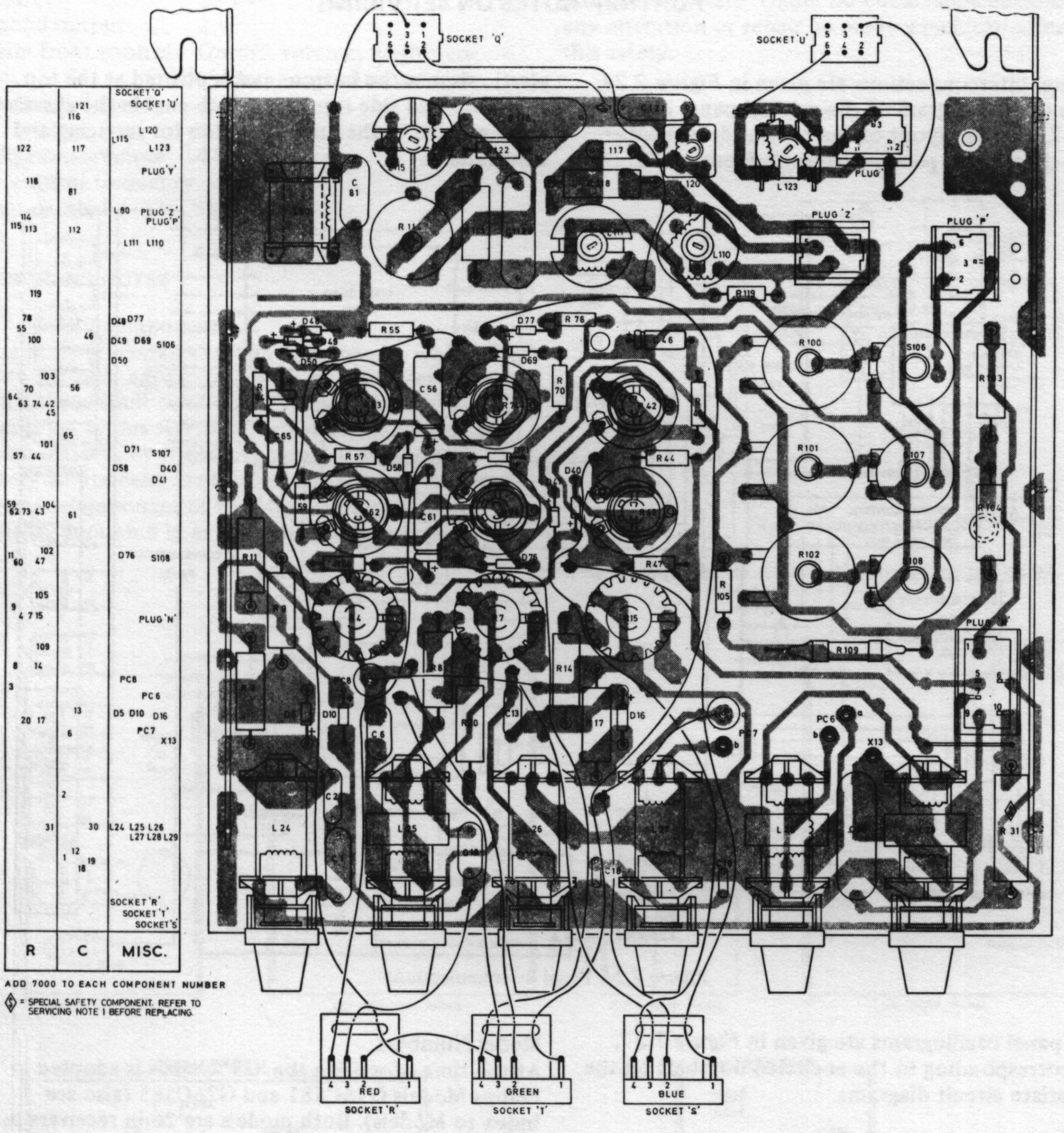


Figure 7.23. **Printed circuit layout of the convergence panel.**

FURTHER NOTES ON SERVICING

The panel interconnections are given in *Figure 7.24*, and the circuit diagram of the control panel in *Figure 7.25*. The layout of the preset adjustments, etc. on the various panels is given in *Figure 7.26*.

plastic slips at the bottom and is pivoted at the top. There are also side supports which enable the chassis to be secured in the raised position for servicing and adjustments.

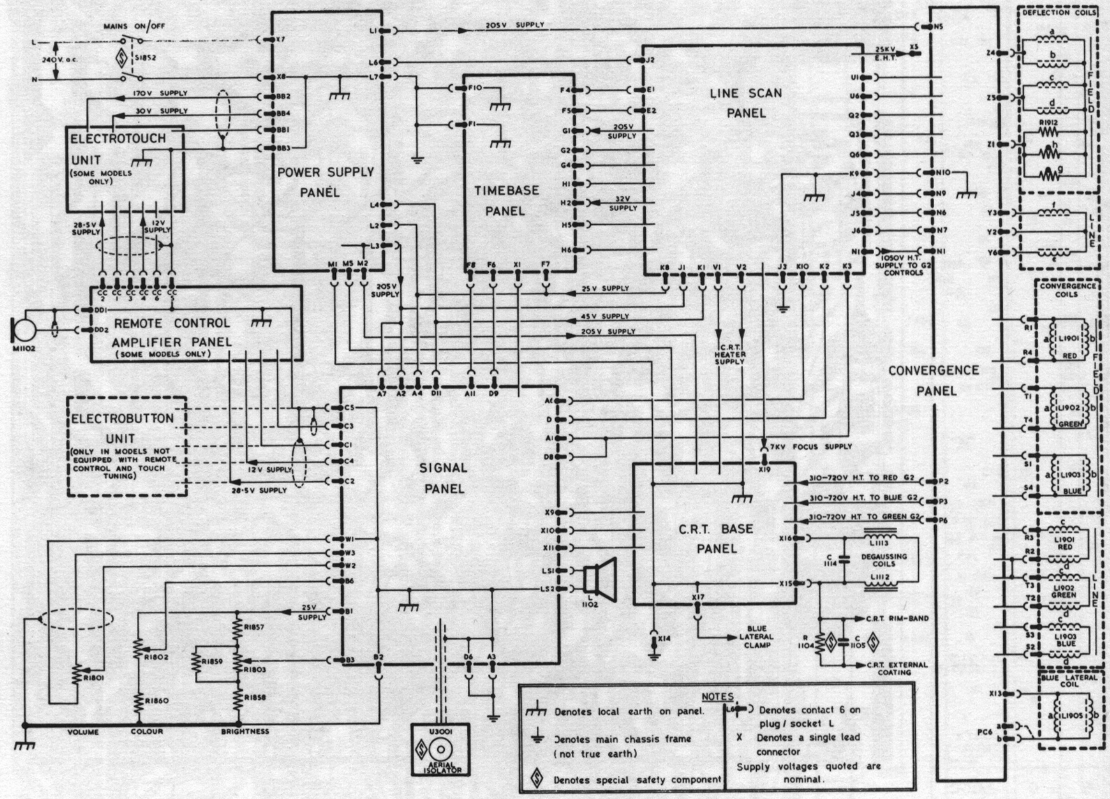


Figure 7.24. Panel interconnections.

Signal panel oscillograms are given in *Figure 7.27*, these corresponding to the encircled numbers on the appropriate circuit diagrams.

General Details

The G8 chassis is all solid state and utilises a 110-degree scanning angle picture tube with a 'quick vision' gun assembly, such that a legible picture becomes available within a few seconds of switching on.

The chassis employs five printed circuit panels mounted on a pivoting frame. Each panel can be removed easily merely by removing or loosening the securing screws and unplugging the associated connecting cables. The chassis proper is retained by

Model Numbers

At the time of writing the 'G9' chassis is adopted in Philips Models G26C581 and G26C585 (also see Index to Models). Both models are 26 in receivers in teak cabinets and supplied with a stand equipped with castors, but the latter has a black surround to the tube screen and front control moulding (see heading photo), in addition to being equipped with the 'electrotouch' channel selector and 'sit and switch' remote control programme change, activated by a hand-held ultrasonic transmitter unit.

Specification

Mains supply	240 V 50 Hz a.c. only
Consumption	220 W

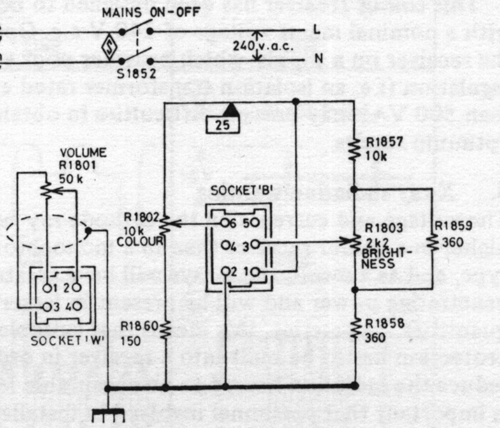
System	625 lines u.h.f. PAL colour
E.H.T.	25 kV
Sound output	2 W
Main front controls	On/off; volume; brightness, colour, programme selection
Occasional rear control	contrast
Ultrasonic remote control frequency (not on Model G26C581)	41·5 kHz

SERVICING NOTES

1. Safety components

The receiver contains certain components which have been specially chosen to ensure safety under both normal and fault conditions. These components are identified in this service information and also in the receiver itself, by the safety symbol ◈. Should a safety component need to be replaced it is essential to use a component of the identical type which must be mounted in exactly the same manner.

The receiver is designed to be electrically and mechanically safe. Under no circumstances should any alteration or repair be made which can effect this safety.



Note: In some sets R1801 is 47kΩ.

Figure 7.25. Circuit diagram of control panel.

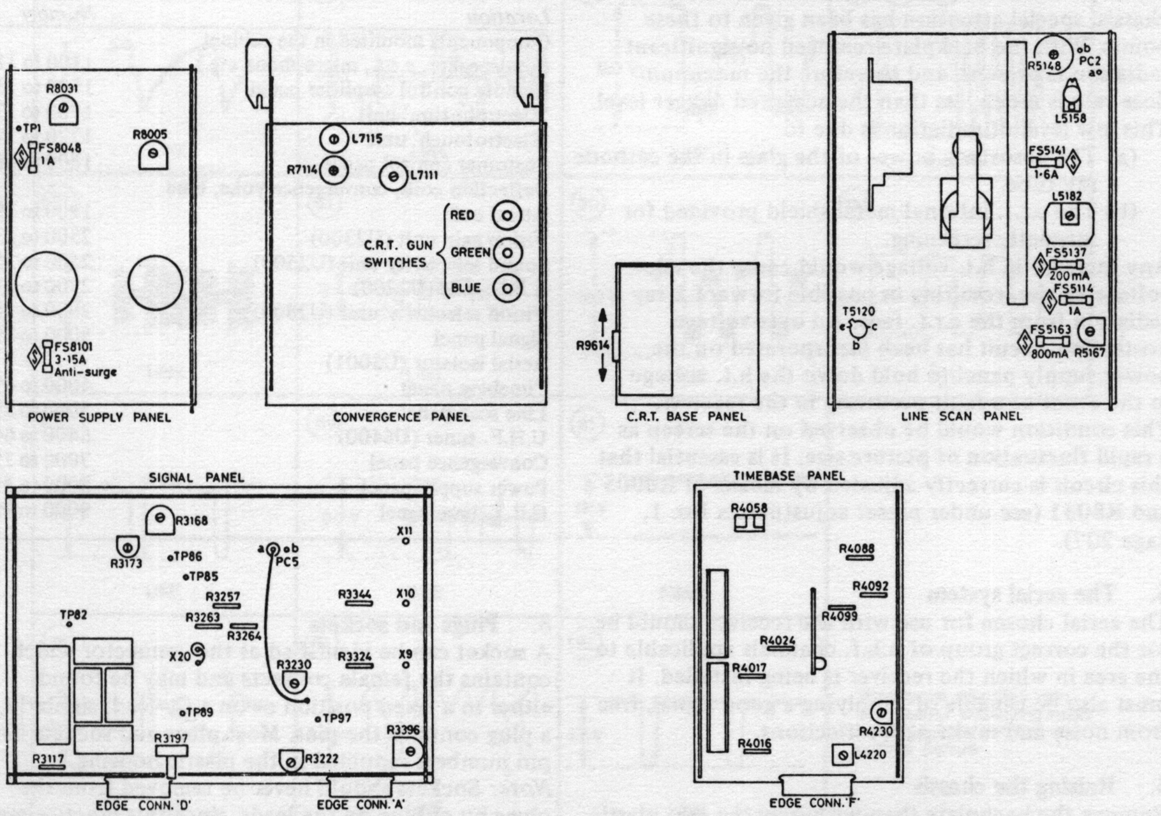


Figure 7.26. Showing the positions of the various preset adjustments on the panels.

2. Mains supply voltage

WARNING LIVE CHASSIS: Check that the chassis is connected to the neutral side of the mains supply before operating the receiver with the backplate removed.

This colour receiver has been designed to be used with a nominal mains voltage of 240 V a.c. Operating the receiver on a supply which provides poor voltage regulation (i.e. an isolation transformer rated at less than 500 VA) may present difficulties in obtaining optimum results.

3. X-ray radiation warning

The voltage and currents on the cathode ray tube are higher in a colour receiver than in a monochrome type, and as a result, the x-rays will have greater penetrating power and will be present in larger quantities. In practice, this means that suitable protection has to be built into a receiver in order to reduce the radiation hazard to an acceptable level. It is important that personnel involved in installation and servicing should be well aware of any possible dangers. The radiation problems are confined to x-rays generated by the cathode ray tube. During development of the G9 series colour television chassis, special attention has been given to these points. With the backplate removed no significant radiation is present, and therefore the maximum dose rate is much less than the accepted danger level. This low level of radiation is due to:

(a) The absorbing power of the glass in the cathode ray tube.
(b) The c.r.t. internal metal shield provided for magnetic screening.

Any increase in h.t. voltage would cause the e.h.t. voltage to rise, resulting in possible forward x-ray radiation from the c.r.t. face. An over-voltage protection circuit has been incorporated on the power supply panel to hold down the h.t. voltage in the event of a fault occurring in the receiver. This condition would be observed on the screen as a rapid fluctuation of picture size. It is essential that this circuit is correctly adjusted by means of R8005 and R8031 (see under preset adjustments No. 1, page 207).

4. The aerial system

The aerial chosen for use with the receiver should be for the correct group of u.h.f. channels applicable to the area in which the receiver is being installed. It must also be capable of supplying a good signal, free from noise and multi-path reflections.

5. Raising the chassis

Remove the backplate then withdraw the two plastic retaining clips from the bottom of the chassis. The chassis may then be hinged away from the cabinet and held in the raised position with two side support struts (clipped to the sides of the chassis).

6. Access to convergence panel

Slacken the two screws securing the panel to the chassis frame. The panel supporting brackets may then be disengaged from the screws and temporarily inserted into the slots provided in the wooden rail inside the top of the cabinet, thus enabling adjustments to be performed from in front of the receiver whilst viewing the screen.

7. The component numbering system

In order to identify a particular component in the circuit with its position in the receiver, a coding system for component numbers is used. For instance, any component with a 3000 number is located on the signal panel, and a component with a 5000 number will be found on the line scan panel.

The complete coding system is given in *Table 7.1.*

TABLE 7.1

Location	*Number*
Components mounted in the cabinet (loudspeaker, c.r.t., microphone etc.)	1100 to 1199
Remote control amplifier panel	1500 to 1599
'Electrobutton' unit	1700 to 1719
'Electrotouch' unit	1720 to 1799
Customer control panel	1800 to 1899
Deflection coils, convergence yoke, blue lateral coil	1900 to 1999
Vision gain unit (U2300)	2300 to 2399
Sound selectivity unit (U2500)	2500 to 2599
A.F.C. unit (U2700)	2700 to 2799
Vision selectivity unit (U2800)	2800 to 2899
Signal panel	3000 to 3999
Aerial isolator (U3001)	–
Timebase panel	4000 to 4999
Line scan panel	5000 to 5999
U.H.F. tuner (U6400)	6400 to 6499
Convergence panel	7000 to 7999
Power supply panel	8000 to 8999
C.R.T. base panel	9000 to 9999

8. Plugs and sockets

A socket can be identified as the connector which contains the female contacts and may be found either in a fixed position or on a fly-lead; similarly, a plug contains the pins. Most plugs and sockets have pin numbers moulded in the plastic housing.

Note: Sockets should never be removed from the plugs by pulling on the leads, since this practice may result in the connections being damaged.

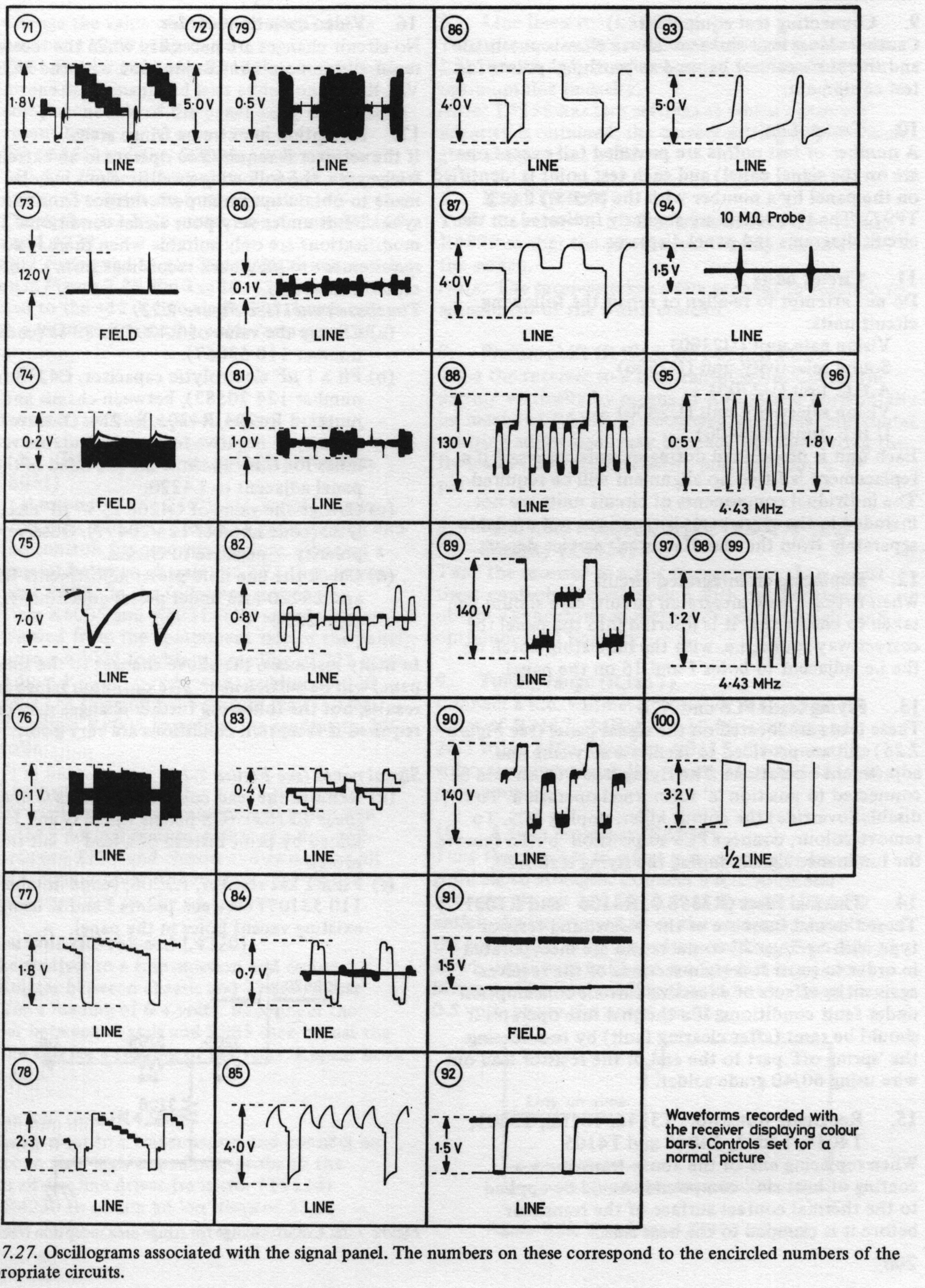


Figure 7.27. **Oscillograms associated with the signal panel. The numbers on these correspond to the encircled numbers of the appropriate circuits.**

9. Connecting test equipment
Caution: Most heat sinks are above chassis potential and therefore cannot be used as 'earthing' points for test equipment.

10. Test points
A number of test points are provided (all except one are on the signal panel) and each test point is identified on the panel by a number with the prefix TP (e.g. TP97). The test points are similarly indicated on the circuit diagrams and panel diagrams.

11. Circuit units
Do not attempt to re-align or repair the following circuit units:

Vision gain unit (U2300)
Sound selectivity unit (U2500)
A.F.C. unit (U2700)
Vision selectivity unit (U2800)
U.H.F. tuner (U6400)

Each unit is pre-aligned during manufacture and if a replacement is fitted no alignment will be required. The individual components of circuit units are not included in the spare parts list, and are not available separately from the manufacturer's service depots.

12. Replacing an integrated circuit
When fitting a new integrated circuit, care should be taken to ensure that it is inserted into the panel the correct way round, i.e. with the indicating notch on the i.c. adjacent to holes 1 and 16 on the panel.

13. Flying leads PC5 and X20
These leads are located on the signal panel (see *Figure 7.26*) and are provided to facilitate servicing and adjustment operations. The flying lead PC5 should be connected to position 'a' for normal operation. To disable (override) the colour killer, unplug PC5. To remove colour, connect PC5 to position 'b'. To remove the luminance signal, unplug the flying lead X20.

14. Thermal fuses (R3398 ◊, R4106 and R7031)
These thermal fuses are of the wirewound resistor type with 'spring-off' contacts and are incorporated in order to protect certain sections of the receiver against the effects of excessive current consumption under fault conditions. If a thermal fuse operates it should be reset (after clearing fault) by re-soldering the 'spring-off' part to the end of the resistor lead-out wire using 60/40 grade solder.

15. Replacing transistors T3146, T3152, T3401, T4034, T4043, T4045 and T4105
When replacing any of the above transistors, a coating of heat sink compound should be applied to the thermal contact surface of the transistor before it is clamped to the heat sink.

16. Video cassette recorder
No circuit changes are necessary when the receiver is required to operate in conjunction with the Philips V.C.R.

17. Reception in extreme fringe areas
If the receiver is required to operate in an extreme fringe area, the following modifications may be made to obtain optimum performance from the line sync circuit under very poor signal conditions. These modifications are only suitable when there is no requirement to play back recordings from a video cassette recorder.

Timebase panel (see Figure 7.22)

(a) Change the value of R4205 to 33 Ω (code number 110 53067).
(b) Fit a 1 μF electrolytic capacitor, C4213 (code number 124 20583), between chassis and the junction R4204/R4205/R4214. Observe polarity – negative to chassis. Suitable vacant holes for this capacitor are provided in the panel adjacent to L4220.
(c) Change the value of C4206 to 47 μF electrolytic (code number 124 20477). Observe polarity – negative to chassis.
(d) Check the line hold preset adjustments R3168 and L4220 (see under preset adjustments, page 207).

In many instances, the above changes to the timebase panel will be sufficient to give optimum fringe area results, but the following further changes may be required if reception conditions are very poor.

Signal panel (see Figure 7.11)

(e) Remove the lead connecting points G and H (near L3183). (On panels where G and H are joined by print instead of a lead – cut the print).
(f) Fit a 1 kΩ resistor, R3206, (code number 110 53107) between points J and K using the existing vacant holes in the panel.

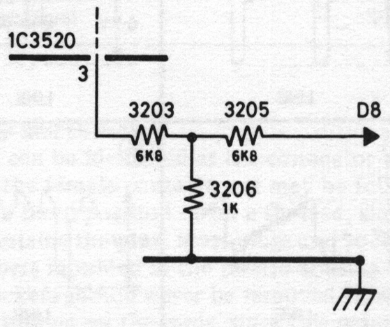


Figure 7.28. Circuit change for fringe area reception (see text).

(g) Change the value of R3203 to 6k8Ω (code number 110 63129).
(h) Connect point N (near R3141) to point G by means of an insulated lead added on the component side of the panel using the existing vacant holes.
(j) Fit a 6k8Ω resistor, R3205, (code number 110 63129) between points L and M using the existing vacant holes in the panel.
(k) Check the line hold preset adjustments R3168 and L4220.

The circuit connected to pin 3 of IC3520 will now be as shown in *Figure 7.28*. Pin 3 of IC3520 was originally connected to the +12 V line via R3203, but is now fed with a positive line gating pulse from pin 8 of plug D.

PRESET ADJUSTMENTS *(refer to Figure 7.26)*

1. Set h.t. (R8005) and over-voltage protection (R8031)

Connect the receiver to a 240 V a.c. supply having a rating of at least 100 VA. Tune to a transmission and adjust the controls for a normal picture. Connect a d.c. voltmeter between chassis and TP1 then adjust R8005 and R8031 in the following sequence.

(a) Turn R8005 and R8031 fully anticlockwise (viewed from the component side of the panel).
(b) Adjust R8005 to obtain a reading of 225 volts.
(c) Adjust R8031 to reduce the reading to 220 volts (At this point the picture may flutter).
(d) Re-adjust R8005 to reduce the reading to 205 volts.

2. 12 volt supply (R3396)

Tune the receiver to a transmission and adjust the controls for a normal picture. Connect a d.c. voltmeter between TP97 and chassis and switch off all three c.r.t. guns. Adjust R3396 for a reading of 12 volts then switch on the c.r.t. guns.

3. Line hold (R3168 and L4220)

Tune the receiver to a transmission and connect a d.c. voltmeter between chassis and TP86. Adjust R3168 for a reading of 6·4 volts. Reconnect the voltmeter between chassis and TP85 then adjust the core of L4220 for a reading of 6·9 volts. Repeat both adjustments.

4. Line 'on' time (R4230)

Tune the receiver to a transmission and connect an oscilloscope via a high impedance probe to the collector of the line driver transistor (T5120). Adjust R4230 to obtain an 'on' time of 27 µs (see *Figure 7.29*).

5. Line linearity (L5158)

Tune the receiver to a test transmission then adjust L5158 with a $\frac{3}{32}$ in square-ended insulated tool for optimum line linearity.

Note: L5158 has two settings at which optimum linearity is obtained; the correct setting is that which gives the greatest width.

6. Width (R4099)

Tune the receiver to a test transmission then adjust R4099 so that the picture just overlaps the side of the screen.

Note: The receiver takes a few seconds to respond to adjustment of the width control.

7. Picture shift (R4058, R5148 and PC2)

Tune the receiver to a test transmission. Centre the picture vertically by means of R4058 and horizontally by means of R5148. If necessary, a 'coarse' horizontal centring adjustment may be made by transferring the fly-lead PC2 to its alternative position (pin 'a' or pin 'b').

8. Field hold (R4016), height (R4017), field linearity (R4024)

Tune the receiver to a test transmission then adjust these controls in conjunction with one another to obtain a synchronised picture of correct height and optimum field linearity.

9. Tuning range (R3117)

Connect a d.c. voltmeter between chassis and the slider of R3117. Adjust R3117 for a reading of 28·5 volts. After adjusting R3117, disconnect the voltmeter then check the tuning of each individual programme.

10. A.G.C. crossover (R3173)

Tune the receiver to a test transmission of known good signal strength. Connect a d.c. voltmeter between chassis and TP82, then turn R3173 fully anticlockwise (viewed from the component side of the panel) and note the voltage reading. Turn R3173 slowly clockwise until the reading just begins to increase. The final reading should not be more than 0·5 volts above the noted reading.

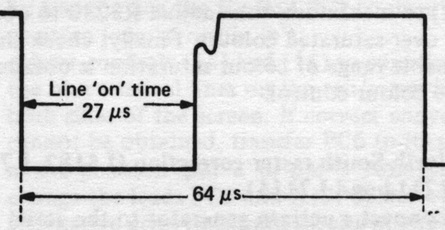


Figure 7.29. Waveform at T5120 collector.

11. Focus (R9614)
Tune the receiver to a test transmission, then adjust the slider control R9614 for optimum definition over the whole screen.

12. Preset brightness (R3222)
Tune the receiver to a transmission. Remove colour by connecting the fly-lead to pin 'b' and remove the luminance signal by unplugging the fly-lead X20. Connect a d.c. voltmeter between chassis and pin 6 of edge connector 'A' then adjust the brightness control (R1803) for a reading of 1·2 volts. Switch off all three c.r.t. guns and connect an oscilloscope to TP89. With the 'scope set to line frequency, adjust R3222 to obtain a line pulse waveform of 1·5 volts peak-to-peak amplitude. Finally, switch on all c.r.t. guns, reconnect X20 and reconnect PC5 to pin 'a'.

13. Colour difference output d.c. levels (R3257, R3264 and R3263)
(a) Tune the receiver to a transmission and set the contrast control (R3197) to minimum.
(b) Remove colour by connecting the fly-lead PC5 to pin 'b' and remove the luminance signal by unplugging the fly-lead X20. Switch off all three c.r.t. guns.
(c) Connect a d.c. voltmeter between chassis and pin 6 of edge connector 'A' then adjust the brightness control for a reading of 1·2 volts.
(d) Reconnect the voltmeter (250 volts d.c. range) to X11 and adjust R3257 for a reading of 145 volts.
(e) Reconnect the voltmeter to X10 and adjust R3264 for a reading of 145 volts.
(f) Reconnect the voltmeter to X10 and adjust R3263 for a reading of 145 volts.
(g) Repeat steps (d), (e) and (f) then reconnect X20, reconnect PC5 to pin 'a' and switch on all c.r.t. guns.

14. Preset saturation (R3230)
Note: This adjustment should only be carried out when the decoder is correctly aligned. Tune the receiver to a colour test transmission (test card F is suitable). Set the contrast and brightness controls (R3197 and R1803) for a normal picture. Set the colour control (R1802) to maximum, then adjust R3230 to obtain slightly over-saturated colours. Finally, check that a reasonable range of colour saturation is obtainable with the colour control.

15. North-South raster correction (L5182, L7111, R7114 and L7115)
(a) Connect a pattern generator to the aerial socket and display a 'cross-hatch' pattern. Switch off the red and blue guns of the c.r.t.
(b) Turn R7114 fully anticlockwise (viewed from the component side of the panel). Position the core of L7115 level with the top of the former, then turn the core in five complete turns clockwise.
(c) Adjust L5182 to straighten the horizontal lines across the centre of the screen.
(d) Adjust the core of L7111 so that the lowest point of the top horizontal line is positioned above the centre of the screen.
(e) Adjust the core of L7115 in conjunction with R7114 to straighten the horizontal line at the top of the screen.
(f) If necessary, repeat steps (d) and (e) to obtain optimum results. Finally, switch on the red and blue guns.

16. East-West raster correction (R4092 and R4088)
(a) Connect a pattern generator to the aerial socket and display a 'cross-hatch' pattern. Switch off the red and blue guns of the c.r.t.
(b) Adjust the R4092 to straighten the vertical lines at the sides of the screen.
(c) Adjust R4088 to minimise tilting of the vertical lines at the sides of the screen (i.e. to make the left-hand verticals parallel with the right-hand verticals).
(d) If necessary, repeat the adjustments to obtain optimum results. Finally, switch on the red and blue guns.

17. Beam current limiter (R5167)
Before adjusting R5167, check the grey scale tracking, operations 1 to 6.
(a) Turn R5167 fully anticlockwise (viewed from the component side of the panel).
(b) Tune the receiver to a stationary picture of average modulation (test card F is ideal).
(c) Remove colour by connecting the fly-lead PC5 to pin 'b'.
(d) Connect a d.c. voltmeter between chassis and pin 6 of edge connector 'A' then adjust the brightness control (R1803) for a reading of 1·2 volts.
Caution: Leave the brightness control undisturbed during operations (e) and (f).
(e) Disconnect the voltmeter from A6 and chassis and reconnect it across R9649 (c.r.t. red cathode resistor). Adjust the contrast control (R3197) to obtain a reading of 0·75 volts.
(f) Adjust R5167 to reduce the reading to 0·6 volts, then disconnect the meter and reconnect PC5 to pin 'a'.

CONVERGENCE

General

Before attempting any adjustments of convergence, the receiver must be allowed to warm up for at least 20 minutes, and all normal adjustments of height, width, linearity and raster correction must be completed.

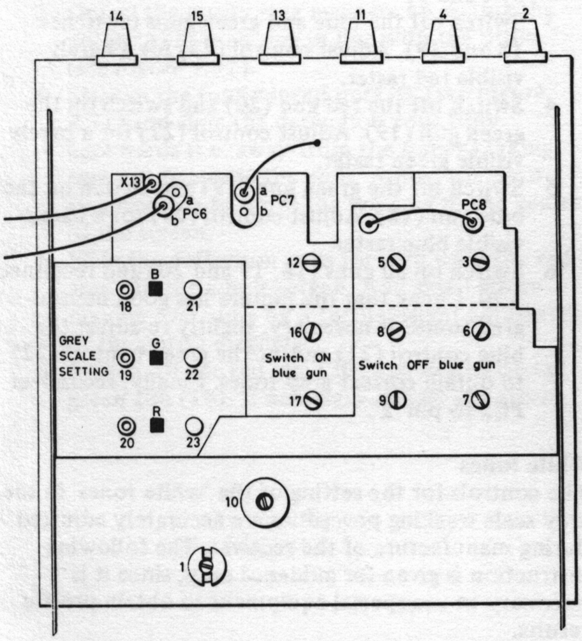


Figure 7.30. Convergence panel adjustments.

In the following notes on purity, static and dynamic convergence, the numbering of the controls relates to *Figure 7.30.* The diagram attached to the convergence panel may be employed in conjunction with these instructions, using the waveforms to help explain the function of each control.

Notes

1. When adjusting the purity ring magnets, care should be taken that no undue force is exerted on the rings since this may damage the plastic retaining clips.
2. In common with normal servicing practice, the receiver should not be switched off and on again in rapid succession. This may not only adversely affect transistors etc., but it is possible that static convergence errors may occur.
3. All purity, convergence and grey scale adjustments should be carried out under subdued lighting conditions.

Static Convergence

1 Connect a 'cross-hatch' generator to the aerial socket, adjusting the tuning of the generator and/or the receiver to obtain sharp clearly defined vertical lines.

2 Switch off the blue gun (switch **18**) and, keeping the brightness level fairly low, adjust the red and green static shift magnets (see *Figure 7.31*) to superimpose the red and green lines at the centre of the screen only.

3 Switch on the blue gun (switch **18**) and adjust the blue vertical static shift magnet to superimpose the blue horizontal lines on the red/green lines at the centre of the screen only.

4 Adjust the blue lateral static shift magnet to superimpose the blue vertical lines on the red/green lines at the centre of the screen only.

5 Re-check the red purity. If it has been affected, the purity and static convergence adjustments must be repeated.

Dynamic convergence

During dynamic convergence re-adjust the static convergence as necessary to superimpose parallel lines.

1 Unplug the fly-lead PC8 and switch off the blue gun (18). Adjust the core of coil (1) for minimum crossover of the red and green centre horizontal lines then reconnect PC8.

2 Adjust controls (2) and (3) to superimpose the red and green vertical lines at both sides of the screen.

3 Adjust controls (4) and (5) to superimpose the red and green centre horizontal lines.

4 Adjust controls (6) and (7) to superimpose the red and green centre vertical lines.

5 Adjust controls (8) and (9) to superimpose the red and green horizontal lines at the top and bottom of the screen.

6 Adjust the core of coil (10) for minimum crossover of the red and green horizontal lines at the top of the screen.

7 Switch on the blue gun (18). Adjust controls (11), (12) and (13) to superimpose the blue centre horizontal lines on the red/green lines. If necessary, a 'coarse' adjustment may be made by transferring the fly-lead PC7 to its alternative position (pin 'a' or pin 'b').

8 Adjust controls (14) and (15) to superimpose the blue vertical lines on the red/green lines at both sides of the screen. If correct convergence cannot be obtained, transfer PC6 to its alternative position (pin 'a' or pin 'b') and/or interchange the leads PC6 and X13. Select whichever alternative gives optimum results in conjunction with control adjustment.

9 Adjust controls (16) and (17) to superimpose the blue horizontal lines on the red/green lines at the top and bottom of the screen.

Note: If the adjustments described in step 8 do not give satisfactory blue lateral convergence proceed as follows. (This further adjustment will normally only be required if the c.r.t., deflection coils or convergence yoke have been changed.)

(a) Temporarily unplug the lead X13 and slacken the convergence yoke securing screw C (see *Figure 7.31*).

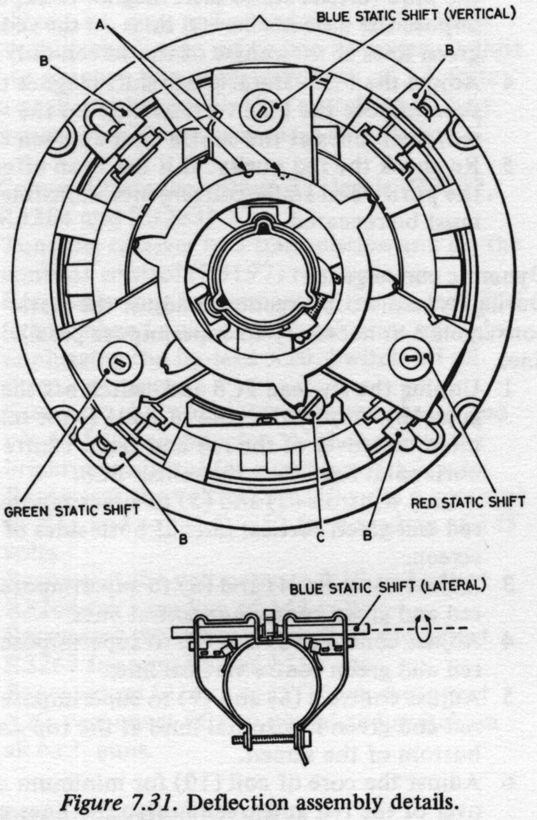


Figure 7.31. Deflection assembly details.

(b) Slightly rotate the convergence yoke with respect to the deflection coils until the blue lateral convergence errors are equal at both sides of the screen.

(c) Reconnect the lead X13, tighten the convergence yoke securing screw C and repeat step 8. It may also be necessary to repeat the red/green dynamic convergence procedure, steps 1 to 7.

GREY-SCALE TRACKING

Dark grey tones

1 Display a stationary picture, preferably a stepped 'staircase' pattern containing shades of grey. Connect the fly-lead PC5 to pin 'b' to remove any colour. Unplug the fly-lead X20 to remove the luminance signal.

2 Set the contrast control (R3197) to minimum. Connect a d.c. voltmeter between chassis and pin 6 of edge connector 'A' and adjust the brightness control (R1803) for a reading of 1·2 volts. The brightness control should then be left undisturbed during the following steps 3, 4 and 5.

3 Switch off the blue and green guns (switches 18 and 19). Adjust control (23) for a barely visible red raster.

4 Switch off the red gun (20) and switch on the green gun (19). Adjust control (22) for a barely visible green raster.

5 Switch off the green gun (19) and switch on th blue gun (18). Adjust control (21) for a barely visible blue raster.

6 Switch on all guns (18, 19 and 20) and reconne X20. Check that the picture has good neutral grey tones. If necessary, slightly re-adjust the blue control (21) and/or the green control (22) to obtain correct grey tones. Finally, reconnect PC5 to pin 'a'.

White tones

The controls for the setting of the 'white tones' in th grey scale tracking procedure are accurately adjusted during manufacture of the receiver. The following instruction is given for guidance only, since it is necessary to use special equipment to obtain precise results.

7 Connect a pattern generator to the aerial socke and display a test pattern containing a large are of white. (Alternatively tune to a transmission containing a large area of white, e.g. test card F). Adjust R3324 (green drive) and/or R3344 (blue drive) for a neutral white.

DEGAUSSING

The receiver is fitted with an automatic degaussing circuit which operates each time the receiver is switched on from cold. However, in cases where c.r.t. and/or associated metal parts have been subjected to extra strong magnetic fields, it may be necessary to pass an external degaussing coil across the c.r.t. face and in each corner before purity/ convergence adjustments are carried out.

At no time whilst using an external degaussing coil should it be allowed to come closer to the face of the c.r.t. than is necessary for complete degaussing, otherwise permanent damage may be caused to the shadowmask plate inside the tube.

PURITY

1 Tune the receiver to a transmission. Remove colour by connecting the fly-lead PC5 to pin 'b'. Remove the luminance signal by unplugging the fly-lead X20 (see *Figure 7.26*).
2 Switch off the blue and green guns (switches **18** and **19**). Adjust the brightness control and, if necessary, the red G2 control (**23**) for a reasonable brightness level of the red raster.
3 Cancel the purity ring magnets by setting the notch 'A' in each ring in line with the other (see *Figure 7.31*).
4 Slacken the four winged nuts 'B' (see *Figure 7.31*) and slide the deflection coils fully backwards (i.e. away from the screen) taking care not to rotate the coils. Adjust the purity ring magnets to move the red area to the centre of the screen.
5 Slide the deflection coils forward until the red area fills the whole screen. Any small errors may be overcome by a further slight adjustment of the purity magnets.
6 Switch off the red gun (**20**) and switch on the green gun (**19**). If necessary, adjust the green G2 control (**22**) for a reasonable brightness level. Check that the whole of the screen is green.
7 Switch off the green gun (**19**) and switch on the blue gun (**18**). If necessary, adjust the blue G2 control (**21**) for a reasonable brightness level. Check that the whole of the screen is blue.
8 Tighten the four winged nuts 'B', switch on all guns (**18, 19** and **20**), reconnect X20 and reconnect PC5 to pin 'a'. If the setting of any of the G2 controls was altered during purity adjustment, it will now be necessary to adjust the grey scale tracking.

COLOUR FAULTS (REF. TEST POINT 90)

1 No colour. 1 V at TP90 (normal). Suspect IC3540 (TBA560CQ).
2 No bursts. 4 V at TP90 (abnormal). Suspect IC3550 (TBA540Q).
3 Incorrect ident. 10 V at TP90 (abnormal). Suspect IC3560 (TBA990Q).
4 No bistable. 0 V at TP90 (abnormal). Suspect IC3560 (TBA990Q).